

International Web Conference on

# INNOVATIVE AND CURRENT ADVANCES IN AGRICULTURE AND ALLIED SCIENCES

19-21 JULY 2021

## Souvenir & Conference Book (ICAAAS-2021)



**Chief Editor**  
**Dr. S.P. Singh**

**Organized By**

**Society for Scientific Development in Agriculture and Technology**  
**MEERUT (U.P.) INDIA**

**In Collaboration with**



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Meerut (UP) INDIA

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International Web Conference on

# **Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**

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MEERUT (U.P.) INDIA**

**In Collaboration with**

Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.) INDIA

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# **SOUVENIR & CONFERENCE BOOK**

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**Dr. S.P. Singh**

*Scientist Plant Breeding, CSAUAT-ARS, Kalai, Aligarh (U.P.) India*

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नरेन्द्र सिंह तोमर  
NARENDRA SINGH TOMAR

कृषि एवं किसान कल्याण,  
ग्रामीण विकास और पंचायती राज मंत्री  
भारत सरकार  
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MINISTER OF AGRICULTURE & FARMERS WELFARE  
RURAL DEVELOPMENT & PANCHAYATI RAJ  
GOVERNMENT OF INDIA  
KRISHI BHAWAN, NEW DELHI



### MESSAGE

It gives me immense pleasure that the **Society for Scientific Development in Agriculture and Technology**, Meerut (U.P.) India is organizing a three days International Web Conference on “**Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**” in Collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur; Chhattisgarh; UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut (UP) India, during 19-21 July 2021.

I hope the issues pertaining to various aspects of science and technology and their dissemination to the end user will be deliberated and discussed by the delegates, at length, during the conference in order to come out with certain adoptable low-cost, location specific recommendations for the benefit of the people at global level.

I convey my best wishes for great success of the conference and complement to organizers.

  
[Narender Singh Tomar]



कृष्ण पाल गुर्जर  
Krishan Pal Gurjar



सामाजिक न्याय और अधिकारिता राज्य मंत्री  
भारत सरकार  
MINISTER OF STATE FOR  
SOCIAL JUSTICE & EMPOWERMENT  
GOVERNMENT OF INDIA



### MESSAGE

It is a great to welcome you all to the International Web Conference on **Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)** which is being held during 19-21 July 2021 Organized by **Society for Scientific Development in Agriculture and Technology**, Meerut in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh; UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut (UP) India.

India has undergone a series of ups and down in agriculture production and food security playing havoc in the year of abnormality. Food Security in India can be achieved by playing higher attention to such as climate change, integrated water management, use the advanced agricultural techniques and pricing etc. New technologies will be make it possible for sustainable agriculture.

I express my sincere thanks to the organizers for organize such kinds of International Web Conference to exchange the idea for the growth of Agriculture.

**Krishan Pal Gurjar**



# M S Swaminathan Research Foundation

Center for Research on Sustainable Agriculture and Rural Development

Third Cross Street, Taramani Institutional Area, Chennai - 600 113



## M S Swaminathan

Former Member of Parliament (Rajya Sabha)  
Emeritus Chairman, M S Swaminathan  
Research Foundation

### MESSAGE

I am glad to know that **Society for Scientific Development in Agriculture and Technology**, Meerut in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh, UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut (UP) India are organizing a three days International Web Conference on “**Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**” during 19-21 July 2021.

The subject chosen is very relevant and timely to address the current agricultural scenario in the country and state as well. I hope that this conference will come out with viable researches for farming community.

I wish the conference all success.

sd-

**M S Swaminathan**



त्रिलोचन महापात्र, पी.एच.डी.  
एफ एन ए, एफ एन सी, एफ एन ए ए एस  
**TRILOCHAND MOHAPATRA, Ph.D**  
FNA, FNASc, FNAAS  
SECRETARY & DIRECTOR GENERAL

भारत सरकार  
कृषि अनुसंधान और शिक्षा विभाग एवं  
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## MESSAGE

Fighting rural poverty has become the overriding priority in the new millennium. Our agricultural scientists and technologists have to work for doubling the productivity of the available land under cultivation. While doing so, utmost care would have to be taken for various environmental and people related aspects leading to sustainable development.

I am glad to know that the **Society for Scientific Development in Agriculture and Technology, Meerut** in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh, UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut (UP) India are organizing a three days International Web Conference on **“Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)”** during 19-21 July 2021. This is an unique event organized exclusively for systematic review of the factors responsible for decrease in availability of natural resources, degradation of land and water resources, loss of plant bio-diversity, increase in environmental pollution, climatic changes, decline in factor productivity and operational holdings and widening gap between rich and poor responsible for threatening our food security and health. The aim of International Conference will definitely promote the interest of Policy makers, Experts, Research scientists, Executors, Representatives from all over the country. I am sure that the outcome of the Conference will not only help in achieving the economic access to food but also give ecological access to food for future planning.

I convey my greetings and best wishes to organizers, participants and sponsors for their joint venture for the success of this three days International Web Conference.

**TRILOCHAND MOHAPATRA, Ph.D**

डा. अशोक कुमार सिंह

उपमहानिदेशक (कृषि प्रसार)

**Dr. A.K. Singh**

Deputy Director General (Agricultural Extension)



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## MESSAGE

It is a matter of great pleasure to know that **Society for Scientific Development in Agriculture and Technology**, Meerut in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh, UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut (U.P.) India are organizing a three days International Web Conference on **“Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)”** during 19-21 July 2021.

Farming is now being judged on parameters like profitability and sustainability. To excel on these parameters, farming has to be technology driven with a clear cut focus on reducing cost of cultivation and enhancing productivity and quality of produce. It requires a multi-pronged approach including management of natural resource, enhanced productivity, linking the production system to storage, processing & value addition and marketing in order to make the entire system vibrant, income generating and employment oriented.

I am sure the learned delegates will deliberate on the issues and challenges faced by the farming community with emphasis on small and marginal farmers and come out with tangible suggestions. I hope that the outcome of the Conference will help in developing strategies and an action oriented road map to promote sustainable and profitable agriculture.

I wish the conference a grand success and congratulate the organizers for making this kind of academic interface.

**Dr. A.K. Singh**





# National Academy of Agricultural Sciences

**Prof. Anil Kumar Singh**  
**Vice-President**



## MESSAGE

It is a matter of great pleasure to know that **Society for Scientific Development in Agriculture and Technology**, Meerut in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh, UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut are organizing a three days International Web Conference on “**Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**” during 19–21 July 2021.

Agriculture is no longer an activity for subsistence only it has to be considered as a commercial enterprise in which profitability and sustainability are both equally vital. Farming has to be technology driven with a clear cut focus on reducing cost of cultivation and enhancing productivity and quality of produce. It has to be knowledge based. Without application of science and technology in agriculture and allied fields, the sustainability would remain uncertain considering the challenges being faced by the Agriculture sector worsen by the climate change impacts. It requires a multi- pronged approach to manage natural resources sustainably, enhanced productivity link the production system to storage, processing & value addition and marketing in order to make the entire system, vibrant and employment oriented. I feel that in this conference, the learned delegates will deliberate on burning issues and challenges facing the farming community with emphasis on small and marginal farmers and come out with tangible suggestions. I hope that the outcome of the Conference will help in developing strategies and an action oriented road map to promote sustainable and profitable agriculture.

I wish the conference a grand success and congratulate the organizers for their judicious planning and hard work in making this kind of academic interface.



(A.K. Singh)



# इंदिरा गांधी कृषि विश्वविद्यालय

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डॉ. एस.के. पाटील  
कुलपति  
Dr. S.K. Patil  
Vice Chancellor



## MESSAGE

Agriculture in India is highly diversified and crops are grown in diversified environments viz., water logged to rainfed uplands, hills to deep water, high humid to arid temperatures and flood prone to drylands. Soils are so extraordinarily varied that there is hardly any type or texture of soils on which cultivation cannot be done viz. acid peaty soils of Kerala (pH3), highly alkaline soils (pH 8.5 and above) of Punjab, Haryana and Uttar Pradesh. Increasing use of inputs together with improved cultures and irrigation has contributed substantially to overall growth in crop production. However, recent concerns regarding decreasing conjunctive use of organic manures, imbalanced use of fertilizers and blanket fertilizer recommendations over large domains without considering variability in soil fertility have all contributed to discouraging impacts on crop production and on soil health, particularly in intensive crop systems. Furthermore, frequent occurrence of abiotic stresses such as drought and submergence has been identified as the key to the low productivity of rainfed ecosystems.

It is a matter of great pleasure to know that **Scientific Development in Agriculture and Technology**, Meerut in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh, UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Society for Astha Foundation, Meerut are organizing a three days International Web Conference on “**Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**” during 19–21 July 2021.

I wish the International Conference a grand success.



(S.K. Patil)



# ಕೃಷಿ ಮತ್ತು ತೋಟಗಾರಿಕೆ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಶಿವಮೊಗ್ಗ UNIVERSITY OF AGRICULTURAL AND HORTICULTURAL SCIENCES, SHIVAMOGGA

Dr. M.K. Naik,

Ph.D. (Horticulture), FRCI (USA), FPSI (NAAS)

VICE CHANCELLOR

Savabanga Road, Shivamogga-577204  
Karnataka, India



## MESSAGE

It is a matter of great pleasure to know that **Society for Scientific Development in Agriculture and Technology**, Meerut in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh, UAHs, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut are organizing a three days International Web Conference on **“Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)”** during 19–21 July 2021.

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M.K. Naik  
Vice Chancellor



उत्तमा वृत्तिस्तु कृषिकर्मैव

प्रो. आर. पी. सिंह

कुलपति

Prof. R. P. Singh

Vice-Chancellor

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## Message

Crop yield and growth has reached a plateau and no significant increase is being realized in productivity levels. With reduced land availability and increased demand for food production, crop production is being intensified through higher fertilizer inputs and cropping. Keeping in view the annual average population growth rate of ~1.5% and estimated per capita consumption of about 450 g per day, the demand for cereal crops is expected to increase to 40% by 2025. This projected demand can be met only if there is a steady increase in productivity and production. Further, the increase in production has to be achieved under conditions of declining and deteriorating land, soil and water resources and at the same time preserving the environmental quality. It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. Emerging challenges are plenty and new frontiers of combating these imposed challenges have to be identified to meet crop production and productivity targets so that the novel variability can be created and harnessed across the species and kingdoms.

It is in this context, the three days International Web Conference on “**Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**” during 19–21 July 2021. Being organized by the **Society for Scientific Development in Agriculture and Technology**, Meerut in collaboration with CSAUAT, Kanpur, U.P.; IGKV, Raipur, Chhattisgarh, UAHS, Shivamogga, Karnataka; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan and Astha Foundation, Meerut. The conference will provide a common platform for all the stake holders to share their Innovations/experiences and expertise to better understand the challenges posed by emerging problems in agriculture and to fine-tune future strategies/approaches for addressing such stresses in different areas of agriculture and allied sciences. I convey my greetings and best wishes to organizers, delegates and sponsors for their joint venture for the success of this International Conference.

  
(R.P. Singh)



# बिरसा कृषि विश्वविद्यालय BIRSA AGRICULTURAL UNIVERSITY

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डॉ. ओंकार नाथ सिंह  
Dr. Onkar Nath Singh  
कुलपति  
Vice-Chancellor



Ref. No. : .....

Date : .....

## MESSAGE

Innovations can only have the answers to plateauing yield stagnation in crop productivity levels. With Challenges in several fronts as reduced land availability and increased demand for food production, crop production is being intensified through higher fertilizer inputs and cropping. The increase in production has to be achieved under conditions of declining and deteriorating land, soil and water resources and at the same time preserving the environmental quality. It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. To address the emerging challenges opportunities have to be identified to meet crop production and productivity targets so that the novel variability can be created and harnessed across the species and kingdoms. It is in this context, the three days International Web Conference on “**Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**” during 19–21 July 2021 organized by **Society for Scientific Development in Agriculture and Technology**, Meerut (U.P.) in collaboration with CSAUAT, Kanpur, U.P.; BAU, Ranchi, Jharkhand; IGKV, Raipur, Chhattisgarh, SKRAU, Bikaner, Rajasthan; UAHS, Shivamogga and Astha Foundation, Meerut (U.P.) during 19–21 July 2021.

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(O.N.Singh)

डॉ रणधीर सिंह

सहायक महानिदेशक कृषि परिसर

**Dr. Randhir Singh**

Asstt. Director General (Agricultural Extension)



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## MESSAGE

Investing in agriculture is one of the most effective ways of promoting agricultural productivity, reducing poverty and enhancing environmental sustainability. Making the transition to sustainable agriculture will not be possible without significant investment to protect and enhance the efficiency of natural resource use and to reduce waste at all stages of production, processing, marketing and consumption. However, rather than just advocating more government and donor funding, this conference calls for new strategies that puts agricultural producers at its centre and focuses public resources at all levels on the provision of public goods and the creation of an enabling environment for investment by farmers. We need to motivate farmers to make investments and also achieve public investments to make this world well fed and hunger free through appropriate resource management.

I hope that this conference, **ICAAAS-2021** will be successful in stimulating the global community to put agricultural producers at the centre of investment strategies for agriculture and allied sectors.

Warm wishes for new year and good luck

(Randhir Singh)





# Astha Foundation®

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## MESSAGE

Our earth provide the basis for food production. The interaction of different enterprises with different cultures in different climates results in the need for unique approaches to sustainable agricultural systems in each situation. The transition to systems that are both sustainable and sufficiently intense to support the increasing density of human population will be faster or slower depending on the resources available. The renewed recognition of the sustainable resource management for assuring food security and the fundamental role in climate change adaptation and mitigation has triggered numerous projects, initiatives and actions on a global scale. But fertile soils are limited and are increasingly under pressure by competing land uses for cropping, forestry, and pasture/rangeland but also for energy production, settlement and infrastructure, raw materials extraction, etc. Sustaining and feeding the growing population of the world and meeting their needs for biomass (energy), fibre, fodder and other products will be the guiding principles and drivers of future research thrusts on a global scale.

Agriculture in India is highly diversified and crops are grown in diversified environments viz., water logged to rainfed uplands, jhums to deep water, high humid to arid temperatures and flood prone to dry lands. Frequent occurrence of abiotic stresses such as drought and submergence has been identified as the key to the low productivity of rainfed ecosystems. Value addition is the key coupled with rapid technological interventions will upscale the productivity of the small and marginal farmer's of India. It is not recent, significant changes are already happening even in the parched, hungry, degraded lands. The **Astha Foundation, Meerut, UP**, has played significant role in providing suitable forum for exchange of ideas, encouraging research and disseminating knowledge of sustainable agriculture and allied sciences to researchers.

Climate regulation as well as biodiversity conservation and other cultural services, increasing land use changes are threatening this resource and urgent action is needed to reverse this trend if we want to assure the necessary food production for future generations.

International Web Conference on “**Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2021)**” during 19–21 July 2021. The thematic areas chosen for the conference will be very useful for the researchers, development agencies and farmers of the country to understand the practical problems in the agricultural development of our country. Scientists have been at the forefront of our agricultural development in past. They are required to play still more critical role in ensuring sustainable agriculture development. I am sure that conference will address various aspects related to increasing productivity and food & nutritional security. Technologies have helped wipe out malnutrition and hunger and reinvigorating the innovations will spearhead path. I am sure that the outcome of this conference would be very meaningful and will be of immense use for scientists, extension workers and farmers.

**S.P. SINGH**  
Organizing Chairman  
GRISAAS-2020



## ABOUT ICAAAS

Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS) is a brain child of **Society for Scientific Development in Agriculture and Technology** to bring scientists, researchers, academicians and all stake holders from throughout the globe for the betterment of humanity with the involvement of all the branches of sciences and related field. The eleven different themes of sessions were planned for the ICAAAS and these themes itself explains the vision of ICAAAS. These themes of sessions are :

1. Innovative technology for crop improvement, biotechnology and genetic engineering
2. Biodiversity and IPRs : issues and challenges
3. Global climate change : scenario and food security
4. New frontiers in disease and pest management
5. Food processing, value addition and post harvest technology
6. Policies and economics of profitable agriculture
7. Cropping system and indigenous technical knowledge
8. Integrated approaches in physical, chemical and biological sciences
9. Soil health management and practices: key factor for crop productivity
10. Animal health, animal husbandry and dairy technology
11. Social sciences, library, information science and humanities

The **first ICAAAS** conference was organized in collaboration with Professor Jayashankar Telangana State Agriculture University, Rajendranagar, Hyderabad (Telangana); Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.) and Astha Foundation, Meerut. It held during 10-11<sup>th</sup> December, 2016 at Professor Jayashankar Telangana State Agriculture University, Rajendranagar, Hyderabad (Telangana). During the conference, 29 lead papers were presented along with 630 oral and poster presentation in eleven different themes. It received overwhelming response with the registration of more than 700 participants. All the lead cum invited papers and abstracts of oral and poster presentations were compiled in souvenir and conference book and published with ISBN number. The lead papers in the conference covered almost all the important areas of agriculture and related fields starting from global research initiatives for sustainable agriculture, plant molecular farming status, opportunities and challenges, association mapping in plants, forages as an alternative for diversification of agriculture to backyard poultry farming, strategies for enhancing organic farming profitability, molecular detection of animal diseases, yield gap analysis, newer approaches for weed management and livestock based integrated farming system. Many new emerging topics were also delivered during the conference like nano-fertilizers, bio pest management, genome mapping, heavy metal tolerance and clearance, advancement in food processing technologies etc. Overall it was a great fusion of traditional to latest knowledge for the betterment of society.

The **second ICAAAS** International Conference was organized during 27 January to 01 February, 2020. It was organized by Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.) and Astha Foundation, Meerut at Hotel Ramada D'Ma, 1091/388 New Petchburi Road 33, Bangkok 10400 Thailand. This conference was bestowed with 09 lead papers and 90 oral and poster presentations in eleven themes with more than 100 registrations in the conference. All the lead cum invited papers and abstracts of oral and poster presentations were compiled in souvenir and conference book and published with ISBN number. This conference



was poured with the knowledge and experience of scientific stalwarts and focused on the doubling the farmers income: a vision of new government of India. It had invited paper on “doubling farmers income through innovative agricultural and allied technology” and related topics like financial inclusion for developing nations, intellectual property rights on biodiversity conservation, advances in post harvest technologies and their applications, various strategies for the disease control in animals and vaccine developments with new generation diagnostics. Many of the crops like rapeseed, cowpea, maize and millets were on the focus of experts and duly addressed. The issues of breeding management for quality seed production, market security in contract farming, nutritional management of soil for optimum output of crops and better management of natural resources e also discussed by the experts during their deliberations and accordingly recommendations were prepared and submitted to respective agencies.

The **third ICAAAS** International Conference is being organized during 19-21<sup>st</sup> Jult, 2021 from the headquarter of Society for Scientific Development in Agriculture and Technology (SSDAT). Considering the post pandemic effect and travel restrictions, it is being organized in collaboration with Astha foundation, Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Indira Gandhi Krishi Vishwavidhyalay, Raipur (Chattisgarh); University of Agriculture and Horticulture, Shivamoga (Karnataka), Bihar Agricultural University, Ranchi, Jharkhand and Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan on online mode. In spite of corona pandemic it has received overwhelming response with more than 1000 registrations and presentation of more than 450 oral and posters during three days conference, As usual 11 themes will have lead cum invited papers of experts of national and International reputes in respective themes during the conference. All the lead cum invited papers and abstracts of oral and poster presentations have been compiled in souvenir and conference book and being published with ISBN number. This time it will be also available on online mode at society website [www.ssdattmeerut.in](http://www.ssdattmeerut.in). This conference is going to address the current scenario on farmers bills and doubts of farming community on these bills. Many of the experts including some foreign experts are expected to deliver invited papers in different themes of conference. The presence of stalwarts from the different part of country is going to have excellent deliberations and outcomes to be recommended to responsible agencies for the betterment of farmers and dairy sectors.



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# Lead Papers/ Invited Papers

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## **INNOVATIVE AND CURRENT ADVANCES IN AGRICULTURE AND ALLIED SCIENCES (ICAAAS-2021)**

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Agriculture plays a pivotal role in the Indian economy with over 58 per cent of rural households depending on agriculture as their prime means of livelihood. We are the country with more than 50 per cent of our population still dependent on agriculture. Human population of India has increased to 1210.2 million at a growth rate of 1.76 per cent in 2011 over 2001 (1028.7 million) and is estimated to increase further to 1530 million by 2030 (Census of India, 2011). On the other hand, our national food grain production for past 3-4 years is hovering around 234 million tonnes. This means, per capita food grain production is only about 193 kg per year. India is facing the challenge to achieve sustainable food security with shrinking land resources by producing an additional 50 million tonnes of food to meet the requirement of the prognosticated population of 1,000 million in the country.

Present and anticipated global food demands necessitate a significant increase in crop productivity in marginal farmlands. Biotic and abiotic stresses are major limiting factors for plant growth, development and crop productivity. Although every plant has some degree of innate tolerance and/or resistance to such stresses but for a successful crop there is need to improve the resistance levels of these crop plants to keep pace with the future food demands. Before the introduction of fertilizer responsive high yielding varieties (HYVs) in mid sixties, indigenous varieties of wheat, rice and maize were grown as rainfed or partially irrigated and generally with little fertilizer input. The low level of yields resulted in persistent food shortages in the country. Intensive agriculture, which implies harnessing of soil and water resources, genetic potential of plant and other inputs in a large measures, that has taken firm roots in the irrigated areas of India has no doubt succeeded in getting the country out of the “food trap”. A ‘ship to mouth’ existence of the early fifties has been transformed into one of “farm to ship” reality. The country is now boasting of an enviable buffer stock of 50 million tonnes food grains and quantum jumps in productivity and production of wheat and rice. The input intensive modern agriculture, which has succeeded in ushering in an era of self-sufficiency in food grain production, has also brought in several environmental problems.

There are ample evidences available that relatively low productivity in our agriculture is due to suboptimal performance related to management aspects rather than low potential. Therefore, the developing countries like us, having optimal potential in the field of technology and services will take strong steps towards second green revolution. Global climate change with predicted 1.5 - 3.8°C increases in temperature by 2100 has to cause heat stress to create threats to agricultural production through high temperature and other abiotic stresses are clearly limiting factors for crops cultivated on marginal lands, crop productivity far and wide is often at the mercy of random environmental fluctuation. The unfavourable effects of heat stress can be mitigated by developing crop plants with improved thermo-tolerance using an assortment of genetic approaches. Acquiring thermo-tolerance is a lively progression by which considerable amount of plants resources are diverted to structural and functional maintenance to escape damaged caused by heat stress.

Investing in agriculture is one of the most effective ways of promoting agricultural productivity, reducing poverty and enhancing environmental sustainability. Making the transition to sustainable agriculture will not be possible without significant new investment to protect and enhance the efficiency of natural resource use and to reduce waste at all stages of production, processing and consumption. Fighting rural poverty has become the overriding priority in the new millennium. Our agricultural scientists and technologists have to work for doubling the productivity of the available land under cultivation. While doing so, utmost care would have to be taken for various environmental and people related aspects leading to sustainable development. In recent years, enormous progress has been made in developing agriculture technology, cultivation and trade throughout the world. India is one of the richest countries in the world known for its biodiversity and natural resources. The green revolution helped in enhancement of crop quality and increases in production to a great extent. With the rapid industrialization and urbanization due to increase in population, the burden on natural resources is increasing apart from



the environmental pollution. It is a matter of pride the scientific fraternity is taking initiatives to meet the challenges of degradation of land and water resources, loss of plant diversity due to the climatic changes and environmental pollution through continuous innovation, research and development.

Innovations can only have the answers to plateauing yield stagnation in crop productivity levels. With Challenges in several fronts as reduced land availability and increased demand for food production, crop production is being intensified through higher fertilizer inputs and cropping. The increase in production has to be achieved under conditions of declining and deteriorating land, soil and water resources and at the same time preserving the environmental quality. It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. To address the emerging challenges opportunities have to be identified to meet crop production and productivity targets so that the novel variability can be created and harnessed across the species and kingdoms. Agriculture plays an important role to meet food and development needs of the Indian population and also as a source of increasing national economy through trade. New Technologies are anticipated to play a major role in meeting nation's food security and in achieving Sustainable Development Goals of UN7 (for example- Goal 2: End Hunger, Achieve Food Security and Improve Nutrition, and Promote Sustainable Agriculture).

### **Innovations led development-Innovation-decision definition**

**Innovations** – It is an idea, which is new one supposed to be adopted by the intended clientele. It may not always hold objectivity due to lapse of time since its discovery. According to Rogers (1983, 1995) the innovation – decision process is the process through which an individual or any decision making unit passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision. This process consists of a series of actions and choices over time through which an individual or an organization evaluates a new idea and decides whether or not to incorporate the new idea into the ongoing system. This behaviour consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative to those previously in existence. The perceived newness of an innovation, and the uncertainty associated with this newness, is a distinctive aspect of innovation-decision making, compared to other types of decision making.

### **Innovation – decision process conceptualized to have five stages.**

*1. Knowledge    2. Persuasion    3. Decision    4. Implementation    5. Confirmation*

Re-invention is defined as the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation. Re-invention often is beneficial to the adopters of an innovation. Flexibility in the process of adopting an innovation may reduce mistakes and encourage customization of the innovation to fit it more appropriately to local situations or changing conditions. As a result of reinvention, an innovation may be more appropriate in matching an adopter's pre-existing problems and more responsive to new problems that arise during the innovation-decision process. Recognition of the existence of Re-invention brings into focus a different view of adoption behaviour – instead of simply accepting or rejecting an innovation as a fixed idea, potential adopters on many occasions are active participants in the adoption and diffusion process, to give their own unique meaning to the innovation as it is applied in their local context. Adoption of an innovation is thus a process of social construction.

In a very short span of time, Genome Editing (GE) Technology has demonstrated its potential applications in a wide range of sectors covering human and animal health, food, agriculture, microbial biotechnology, bio-economy, etc. These potential applications include, but are not limited to, improved crop protection and livestock breeding, improved animal welfare, modification of animal donors for xenotransplantation, products of microbial biotechnology, gene- and cell-based therapies to control diseases and prevent the inheritance of disease traits, control of vector-borne diseases such as Malaria, Dengue, Chikungunya, etc, biofuels, pharmaceuticals, and other high-value chemicals. Like with all new technologies, GE technologies have dual-use potential and therefore involve both safety & security issues. Biotechnology offers safe and sustainable solutions to many environmental challenges. It is, therefore, envisioned that genome editing holds many promises to improve environmental quality as well as the quality of life and related services. The genome editing technologies offer solutions to address several issues related to Human & Animal Welfare and Protection of Environment. The Genome Editing Technology offers to increase yield and productivity of agricultural crops to meet constantly increasing demand for food and food security optimally by protecting them from various biotic and abiotic stresses and various other traits. India is a fisheries giant with a total catch of about 3 million metric tons annually placing India among the world's top 10 fishing nations. India's livestock sector is also one of the largest in the world including broad spectrum of native breeds of cattle, buffalo, goats, sheep, swine, equine, camel and poultry with merits of adaptability to climate and nutrition, and resistance to diseases and stress. The national targets for production of livestock and poultry products are 61% for milk, 76% for meat, 91% for fish, and 169% for eggs by the year 2020 over the base year 1999. The production potential in livestock is not realized fully because of constraints



related to feeding, breeding, health, etc. Frequent outbreaks of diseases like FMD, BQ, PPR, Brucellosis, Swine fever, and Avian Influenza, etc. continue to reduce productivity and production.

Nutritional genomics is a new and promising science area which can broadly be defined as the application of high throughput genomics (transcriptomics, proteomics, metabolomics/metabonomics) and functional genomic technologies to the study of nutritional sciences and food technology. The combination of genomics and molecular biology has created a new way for scientists to generate plant varieties, one that offers wider functional scope and greater precision than conventional plant breeding methods.

Multiple biotic and abiotic environmental stress factors affect negatively various aspects of plant growth, development, and crop productivity. Plants, as sessile organisms, have developed, in the course of their evolution, efficient strategies of response to avoid, tolerate, or adapt to different types of stress situations. The diverse stress factors that plants have to face often activate similar cell signalling pathways and cellular responses, such as the production of stress proteins, up regulation of the antioxidant machinery, and accumulation of compatible solutes. Stress can be understood as a stimulus or influence that is outside the normal range of homeostatic control in a given organism: if a stress tolerance is exceeded, mechanisms are activated at molecular, biochemical, physiological, and morphological levels; once stress is controlled, a new physiological state is established, and homeostasis is re-established. When the stress is retired, the plant may return to the original state or to a new physiological situation.

Abiotic stresses remain the greatest constraint to crop production. Worldwide, it has been estimated that approximately 70% of yield reduction is the direct result of abiotic stresses. Transgenic approaches are one of the many tools available for modern plant improvement programs. Gene discovery and functional genomics projects have revealed multitudinous mechanisms and gene families, which confer improved productivity and adaptation to abiotic stresses. These gene families can be manipulated into novel combinations, expressed ectopically, or transferred to species in which they do not naturally occur or vary. Hence, the ability to transform the major crop species with genes from any biological source is an extremely powerful tool for molecular plant breeding. Transgenic plants can be used as sources of new cultivars and they are also extremely useful as proof-of-concept tools to dissect and characterize the activity and interplay of gene networks for abiotic stress resistance.

Swaminathan D. (1998) stated that technology, capacity building, and application for sustainable rural development could be more fruitful, if the exercise is undertaken through a partnership effort among the universities, engineering institution, rural and development labs, national institutions, agricultural research centres, NGOs, government departments and industries. The actual partnership may be determined by the local situations. The corporate sector can play an effective role in discharging its social responsibility in this partnership. This role is in addition to its industrial activity in the rural areas. Similarly, the professional and scientific expertise of the professional bodies and scientific academics could be fully utilised for the rural development activity.

This is where the mobile technology which over the year have become the integral part of business world and have multiplied the working efficiency in terms of real time communication, information and data sharing, having virtual presence and reach. The fact that with minimum infrastructure availability at the individual level mobile phones have the capability to connect any individual with the entire world on a click of button makes it a powerful tool to have access to desired information. In the 21st century, Information, Communication and Technology (ICT) are the most powerful 'enabler' to provide a variety of inputs for rapid development of rural areas. The ICT could be effective tools for rural extension by the government and non-governmental organizations to effectively disseminate Information Resource. For the development, Information Resource [IR] is the vital input as that could increase the accessibility of any other resources - like financial, human, physical, technology and etc. The sustainable rural development can make a powerful contribution to fulfil - the poverty reduction, growth with equity, food security and effective natural resource management. There is a growing emphasis on development of rural economy for enhancing the livelihood of the rural people.

A systematic review of the factors responsible for decrease in availability of the natural resources, loss of bio diversity, increase in environmental pollution, climatic changes, decline in factor productivity and operational holdings and widening gap between rich and poor are threatening our food security and health. In recent years, enormous progress has been made in developing agriculture technologies, cultivation and trade through out the world. Making the transition from sustainable agriculture to sustainable empowerment will not be possible without significant new investment in protecting and enhancing the efficiency of production, processing and marketing personnel to embrace and share a diverse range of basic studies, techniques and experiences. In this context, deliberations in the international conference by eminent and galaxy of speakers of several innovative and current advances in agriculture and allied sciences will open new vistas in addressing all the issues.



## STATUS OF AQUACULTURE PRODUCTION AND BIODIVERSITY STATUS, AND IMPACT OF COVID 19 ON AQUACULTURE AND FISHERIES

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### Abstract

The fisheries sector contributes 3.52% to the national GDP, 26.37% to the agricultural GDP and more than 1.35% to the total export earnings. The total production was 4.552 m.mt fish in 2019-2020. Fisheries sector contributes significantly 62.58 g/day/capita of animal protein in daily dietary requirement. Aquaculture and fisheries sector of country is severely affected by pandemic corona virus (COVID-19). Data and information sources was used a mixed-method including online questionnaire surveys, direct and telephonic interviews, key informant interviews (KII), focus group discussions (FGD) and questionnaire survey during June 2020 to May 2021 and secondary data collected publication of the Department of Fisheries (DoF) and online grey literature. This study exposes a positive impact on ecosystem and increased fish stock in open water and coastal area due to stop of industrial influents and decrease fishing pressure. The demand of spawn production decreased at the rate of 33 percent and number nursery practice was also decreased at 34 percent and demand of food fish decreased at 33 percent. Finally, about (28-34)% fish farmer are not continued fish culture practice due to less demand and lower price of fish. All export and import based business is slowdown globally and nationwide lockdown situation imposed the supply chain, and processing and exporting of shrimp, crab and exportable other fish item hampered due to pandemic situation. Out of 12%, about (20-25)% fisheries people somehow directly or indirectly related with fisheries sector are going to workless due to pandemic and a negative impact resulted a worsened livelihood. So, a long-term policy and action plan is needed to recover aquaculture sector from the pandemic considering enhance production, economic, social and environmental sustainability.

**Keywords :** *Pandemic, COVID 19, Aquaculture, Spawn, Nursery, Livelihood, Supply chain.*

### INTRODUCTION

Bangladesh has an inland water area of about 45,000 km<sup>2</sup> and about 710 km long coastal belt. Bangladesh has vast inland freshwater resources including floodplains, ponds, rivers, oxbow lakes, large depressions (locally known as haor and beel), estuaries and a large coastal area with a sea. The open freshwater body of Bangladesh inhabits 260 fish species, 12 exotic fish species and 24 prawn species and marine fisheries is with 475 finfish species and 25 shrimp species (Rahman, 1989). Fisheries sector contributes significantly about 60% (62.58 g/day/capita) of animal protein in daily dietary requirement.

### MATERIALS AND METHODS

Data of the study collected through direct interviews, key informant interviews (KII), focus group discussions (FGD) and questionnaire survey. This study focuses on the aquaculture and fisheries of entire Bangladesh as all the 8 divisions of the country are being affected by the pandemic. The data were analyzed through one way ANOVA using MSTAT followed by Duncan's Multiple Range Test to find out whether any significant difference existed among treatment means (Duncan, 1955; Zar, 1984). Standard deviation in each parameter was calculated and expressed as mean  $\pm$  S.D.

### RESULTS AND DISCUSSION

The fisheries sector contributes 3.52% to the national GDP, 26.37% to the agricultural GDP. The total production was 4.552 m.mt fish in 2019-2020 (Fig.-1). The pandemic has created mostly negative impacts on the aquaculture sector. In 2021, the demand of spawn, fry and food fish including shrimp in this sector is decreased at the rate of 33%, 34% and 33%. On the otherhand, the price of spawn, fry and food fish is decreased at 33%, 34% and 33%, respectively (Fig.-2).

The negative impacts are mainly due to an increase in inputs and transport costs and reduction of demand for/and price of fish. Due to the restrictions on transport and less availability of manpower as well as difficulty in production operation, the fish feed companies have incorporated approximately 10-12% increased feed price reported (Aura et al., 2020) and the price of the cultured fish has decreased due to low demand in the markets due to the loss of jobs and disruption of cash flow since the start of the pandemic. This study exposes a positive impact on ecosystem and increased fish stock in open water and coastal area due to stop of industrial influents and decrease fishing pressure.



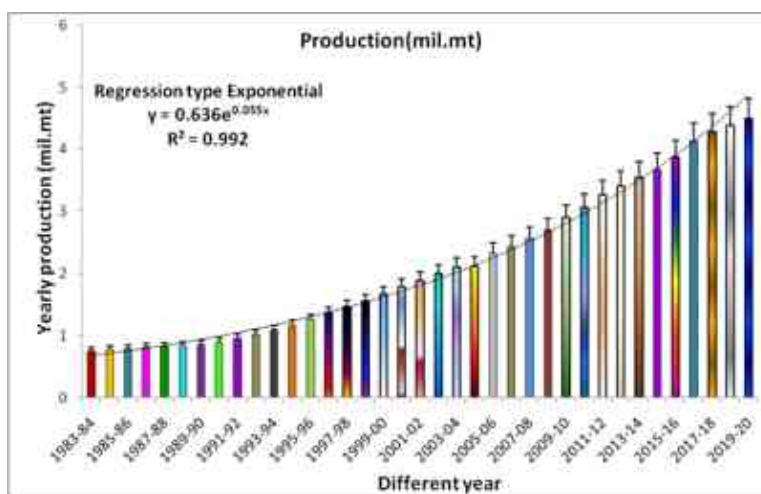


Fig.-1 : Total fish production (mil.mt) in different sector of Bangladesh.

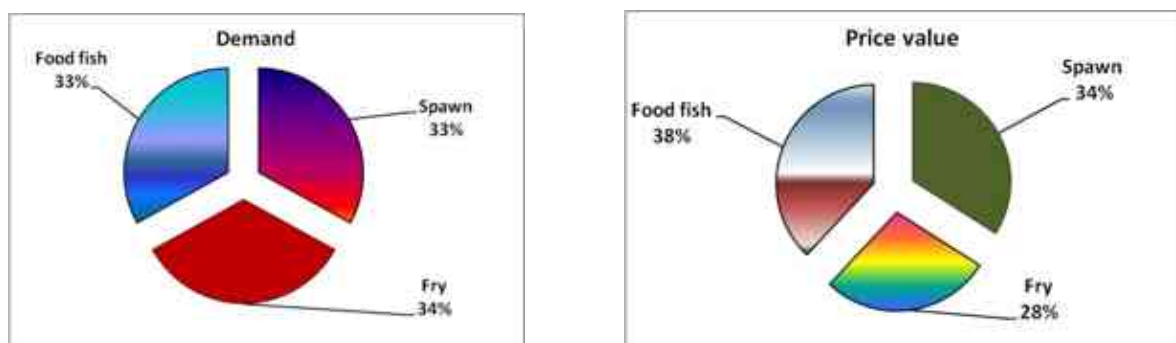


Fig.-2 : Decreasing demand and price of spawn, fry and food fish in Bangladesh.

There are overall positive impacts on river, floodplain and off-shore marine ecosystem and fish capture due to stop of industrial influents and decrease fishing pressure (Chanrachkij et al. 2020). Out of 12%, about (20-25)% fisheries people somehow directly or indirectly related with fisheries sector are going to workless due to pandemic and a negative impact resulted a worsened livelihood.

Overcome the pandemic COVID 19 situation to continue fish production to avoid disruptions to the fish supply chain, keep international trade open and protect domestic fish supply chain, allow movement of seasonal workers and transport operators across domestic and international borders, arrange collection centers closer to producers, allow to open local markets to maintain strict physical distance, interest free financial assistance for aquaculture to be ensured, Import tariffs to minimize, temporarily reduce VAT and other taxes and technical service for aquaculture should be confirm due to nationwide lockdown.

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## **CLIMATE CHANGE AND ITS IMPACTS ON AQUACULTURE IN NEPAL**

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### **Abstract**

Climate change is an alteration in the normal distribution of weather over periods of time that range from decades to millions of years. In general, climate change may be limited to a specific region or may occur across the world. Climate change is affecting the biological processes in an aquatic system and the productivity of fish species. Earlier evidences suggest that the global climate is now changing as a result of human activities—most importantly, those which cause the release of greenhouse gases from fossil fuels. The rising of global temperature is going on and patterns of precipitations have also changed: arid and semiarid regions are becoming drier, while other areas, especially mid-to-high latitudes, are becoming wetter. Where precipitation has increased, there has been a disproportionate increase in the frequency of the heaviest precipitation events. The consequences for sustainability of aquaculture and the people that depend on them, are uncertain.

It is now generally accepted that warming of the climate system is unequivocal, as evidenced from global increases in: average air and ocean temperatures; melting of snow and ice; and average sea levels. The impacts on different sectors will have considerable implications on water security, food security, energy security, human health, etc., and are subsequently likely to jeopardise many of the strategic development additions. Current climate variability is already impacting these sectors, particularly where policies are irrelevant or unsustainable development practices are prevalent. Unless sound risk management policies, as well as timely, coordinated, and sustainable measures are implemented the world is likely to experience considerable economic loss, humanitarian stresses, and environmental degradation as a result of climate-related disasters, exacerbated by climate change.

## **AGRICULTURE AND FOOD SECURITY**

The agriculture sector is one of the most important components of the world and Asian economy. Agriculture can help reduce poverty, raise incomes and improve food security for 80% of the world's poor, who live in rural areas. Also agriculture boost shared prosperity and feed a projected 9.7 billion people by 2050. The extreme weather events and climate-related disasters, higher temperatures, and a decrease in summer rainfall, resulting in drought, desertification, soil erosion, and salinization are having marked effects on grain productivity, with potentially severe economic consequences. These impacts are likely to increase into the future, under a changing climate, particularly in the absence of any adaptation and disaster reduction measures. Not only the agricultural land but land for growing pasture is also affected and there is a risk of desertification due to higher temperatures and decreasing rainfall, which will directly impact livestock productivity. Furthermore, it impacts on flock structure and poor pasture management, grazing schedules, and overgrazing deteriorate not only the natural vegetation but also the quality of forages in pastures. Mishandling of watering points causes waterlogging and secondary salinization of the pastures. Many forest areas are open to unregulated livestock grazing and the uncontrolled felling of trees. Mudflows and landslides (Tuncok -2021).

For the mitigation, farmers can improve pasture management by growing self-regenerating leguminous crops to improve soil fertility, surface cover, and livestock feeding. The agroforestry initiatives may have a remarkable recovery of degraded soils and provided livestock feed. Improvement and protection of community hayfields, the establishment of hay and fodder funds, and preparation of additional fodder for the winter are imperative. Agriculture provides livelihoods for 68 percent of Nepal's population, accounting for about 27 percent of the GDP. Nevertheless, Nepal struggles to produce an adequate supply of food for its citizens.

## **WATER SECURITY**

The availability of good quality of water is very essential for the maintenance of proper life. Between now and 2040, global demand for fresh water will increase, but the supply of fresh water will not keep pace with demand absent more effective management of water resources. A major international study finds that annual global water requirements will reach 6,900 billion cubic meters (bcm) in 2030, 40 percent above current sustainable water supplies. Climate change will cause water shortages in many areas of the world. Water is already a scarce and conflict-prone natural resource in Asia. Its availability limits the productivity of ecosystems and agriculture, energy supplies, and overall socio-economic development. Climate change impacts, particularly increased temperatures, changes in rainfall patterns and glacial melting, are anticipated to drastically alter the hydrological cycle and in so doing, exacerbate existing water scarcity, drought impacts and water-related





conflicts. This will also, likely, aggravate energy and food insecurities across the world and Asian region. Furthermore, climate variability and change, combined with human activities, is likely to further influence the water levels of the aquatic systems, with consequences for water supply, agriculture, and human health in the surrounding areas (Tuncok -2021).

Population increases, migration, and changing human consumption patterns resulting from economic growth will be key drivers of rising fresh water demand. The developing world, with its rapidly expanding urban centres, will see the biggest increases in water demand, as its population grows larger and more affluent. Migrations to cities will drive major increases in water demand for personal consumption, sanitation and industry. Urban and sub-urban populations will demand greater quantities of water-intensive products with diets that contain more meats and fewer grains.

## **ENERGY SECURITY AND NEPAL**

The energy in the form hydroelectricity is at risk from climate change-related impacts, namely increasing temperatures, glacial melting and changing rainfall patterns, and associated drought cycles. Glacial melting is likely to increase water flow in the basins used for hydropower generation in the short term. Hydropower development is the top priority action of global energy leaders such as Latin America, followed in priority for those in Asia and Africa who perceive the issue with similar low uncertainty but a relatively low degree of impact. Nepal has endowed high potential of water resources, covering 395,000 ha (48%) area within 45,000 km in length of 6000 rivers with 170 billion m<sup>3</sup> annual runoff and 45,610 MW feasible hydroelectricity generation. Most of the rivers of Nepal flowing from Himalayas covers 818,500 ha land area equivalent to 5%, out of the total surface area of the country (Sriskanthan, & Funge-Smith, 2011; CFPCC, 2019). All countries have energy efficiency priority in policy objectives bearing in mind its multiples benefits including prominent role on climate change issues. The projected climate change scenarios for Nepal average mean temperature will increase by 1.2 and 3°C as projected by 2050 and 2100. This trend is significantly dangerous for glacier retreat and glacial lakes expansion, making them more vulnerable. There may be significant impacts on hydropower, rural livelihoods, and agriculture and storages dams anticipated a climate change impacts which poses environmental conflicts for sustainable hydropower development in future.

## **RECENT FLOODS IN NEPAL**

Nepal is mostly vulnerable due to its fragile ecosystem and jagged topography. Abrupt changes in the environment create exposure with floods, drought and landslides which directly impacts the economy of the nation and the livelihood of the people. The beginning of monsoon has brought havoc like never before. There was massive devastation across the country. Major rivers and streams have swollen up dangerously, raising fears among communities living nearby. Most of the areas are inundated and in some places floodwater has gushed into the settlements and displaced many peoples. Several Rainbow trout farms in the Helambu area have been swept away by floods. The integrated ecosystem management approach may be beneficial to reduce the risk of disaster.

## **CONCLUSION**

It is now generally accepted that warming of the climate system is unequivocal, as evidenced from global increases in: average air and ocean temperatures; melting of snow and ice; and average sea levels. There is a need for a collaborative approach among different nations to cope with climate-related disasters. Availability of the proper amount of water may create problems in the near future. The fluctuation of minimum downstream release is found as the major cause for declining fish diversity. More anthropogenic disturbances and project structures are found creating impact on extinction of wildlife and protected species like birds and mammals. Furthermore, hydropower development has negative environmental and social consequences, although it does not emit air pollution or greenhouse gas emissions. In near future global hydroelectric capacity is going to be doubled and dam blocking of rivers degrading water quality, disturbance of aquatic and riparian habitat, migratory fish route blockage, economic impacts on fishery, and displacement of local communities.

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## **WOMEN IN SCIENCE**

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In early times women were directly engaged in science and technology. The involvement of women in science dates back to 2700 BC. Merit Ptah described in an inscription as “chief physician” is the earliest known female scientist named in the history of science (Micheal et al 2013). Since then until the 21st century it has been reported a fundamental contributions of women to science. Nevertheless the women’s contribution for science was rarely acknowledged early days compared to the present day. They were less paid or unpaid and in position they lacked the status and respect deserved. Currently, the imbalance is gradually being redressed (Hill et al 2010). As we see there are many Nobel prizes won by women scientist.

At the present day, 30% of the world’s researchers are women (Report, Workplace Gender Equality Agency 2018). There has been substantial progress towards gender equality in education and employment over the last few decades. Women have gained access to the same educational and career opportunities as men, and are well-represented in many fields. However, progress in science, technology, engineering and mathematics (STEM) has been slow. The women in STEM fields publish less, are paid less for their research and do not progress as far as men in their careers. However, there is very little data at the international or even country level showing the extent of these disparities.

When considering the drivers and barriers mainly family decisions, financial considerations, workplace cultures and discrimination can shape the respective careers in STEM (Pajares, F. 2005, Simard, C 2008). Although women in STEM fields tend to have higher salaries than women in non-STEM fields, there still exists a gender pay gap in STEM professions.

We need to break the gender barrier and inspire more and more young females to pursue careers in science. In many ways, of course, the climate has become more welcoming to young women who want to study and work in STEM.

As well as encouraging young female scientists, we must also address the significant obstacles that drive women out of the STEM workforce. STEM workplaces should be intentionally inclusive, family-friendly and safe for people of all genders (Heilman et al 2004). There should be options developed for flexible/part-time work at senior management and leadership levels. Further more, adopting clear criteria for success is critically important. A transparent evaluation processes, can further help counteract unconscious bias in assessing women’s performance. We are all responsible and we need to take necessary actions that will remove the obstacles those women in STEM face. Laying all this in place goes a long way to building a gender equal workplace where people of all genders can thrive.

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## **USE OF BIOTECHNOLOGY AND GENE EDITING IN CROP IMPROVEMENT AND WHERE WE ARE IN INDIA**

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### **Introduction**

Climate change and ballooning population worldwide is demanding a continued improvement in the productivity. Agriculture researched has made their effort and use the science very effectively and made continue sturdy growth in food production. In spite of these great efforts, September 2015 Global Citizen has highlighted -795 million people still suffer from hunger. They regularly do not get enough nutritious food to eat each day. Inadequate nutrition is an underlying cause of 45% of preventable child deaths (2.8 million) each year, and the majority of these deaths occur outside of humanitarian crises. Children suffering from acute malnutrition are 2.5 times more likely to die than children without malnutrition are; and those with severe acute malnutrition are 9 times more likely to die than a properly nourished child. 66 million primary school children go to school hungry. 23 million of those children are in Africa. Inadequately nourished children may suffer from difficulty concentrating or lowered immunity. These facts need to be taken seriously and food security needs to be rewritten. "Food security, as defined by the United Nations' Committee on world food security, means that all the people, at all the times, have physical, social and economic access to sufficient, safe, and nutritious food that meet their food preferences and dietary need for an active and healthy life"

Conventional breeding approaches have helped breeding community to develop the product for the farmer and they can produce enough food grain not only for current consumption but also for buffer stock. In this article we have considered. 1) this new definition of the food security need carefully and work out the limitation of the conventional mode of plant breeding. 2) To search the scope to use the advance tools of plant breeding such as Biotechnology and gene editing for managing the breeding funnel more efficiently and improve the selection efficiency, to manage the difficult & complex traits, selection precision and speed in product development.

### **Historical Facts**

Importance of the quality seed and conventional approach of plant breeding were started when a man had started tilling the land and start producing his food requirement. Gregor Mendel has helped to explore the power of recombination and independent assortment and segregation for creating the new genetic variability as source population and select the plant, which has the combination of more desirable traits together. With the rediscovery of Mendel's laws in 1900, with the discovery of Mendel's long forgotten paper "Versuche Ueber Pflanzen Hybriden" and the monumental work of East (1911-1915), East and Hayes (1912) and Shull (1904 -1914), the scientific concept of heterosis phenomenon emerged. This concept of heterosis is one of the most commercially exploitable and impactful discovery. Plant breeders worldwide have used and are using to develop the new cultivar, which more efficiently can produce more economical yield in the given environment. A century ago in 1920 corn (maize) was the 1<sup>st</sup> crop where hybrids breeding started and still holding a leading crop where hybrid technology is one of the major drivers for improving the productivity worldwide.

Later on Cytoplasmic male sterility (CMS) sources in pearl millet were identified in populations of crosses involving genetically diverse parents, for example, A<sub>1</sub> (Burton, 1958), A<sub>3</sub> CMS (Athwal, 1966). This discovery of male sterility (cytoplasmic male sterility and genetic male sterility) has opened a window to use heterosis in more cross-pollinated, often cross-pollinated and even in self-pollinated crops. In conventional breeding, breeders are creating desirable genetic variability through hybridization, make selection and fixing and make line homogeneous / homozygote and use them in hybrids breeding or release as pure line or use in hybrid breeding this a common breeding approach.

In the 1970s, a series of complementary advances in the field of molecular biology provided scientists with the ability to readily move DNA between more distantly related organisms. The Recombinant DNA technology emerged a very powerful tool which enables the scientists can take a piece of DNA containing one or more specific genes from nearly any organism, including plants, animals, bacteria, or viruses, and introduce it into a specific crop species. The application of this recombinant DNA technology frequently been referred to as genetic engineering. An organism/plant that has been modified, or transformed, using modern techniques of genetic exchange is commonly referred to as a genetically-modified organism (GMO). On the other hand, the offspring of any traditional cross between two organisms also are "genetically modified" relative to the genotype of either of the contributing parents. Plants that have been genetically modified using recombinant DNA technology to introduce a gene or set of genes from either the same or a different species also are known as transgenic plants and the specific gene transferred is known as a transgene. Not all GMOs involve the use of cross-species genetic



exchange; recombinant DNA technology also can be used to transfer a gene between different varieties of the same species or to modify the expression of one or more of a given plant's own genes, e.g., to amplify the expression of a gene for disease resistance. Today there two clear stream.

### **Why Agricultural Biotechnology Products Being Developed?**

When we try to understand the acceptance of new technology in any field including agriculture there two clear main point of attraction 1) Efficacy with high degree of the repeatability in varying environments and 2) Capacity / potential to create the commercial value for the technology developers and users. Reducing the cost of cultivation and mismanaging the losses cause by biotic and a biotic stress what one of the maizor changes before the agricultural community and the use of Biotechnological open a possibility and opportunity to make plant more efficient to produce more in lesser inputs. That is where the new developments in agricultural biotechnology being used to increase the productivity of crops, primarily by reducing the costs of production by decreasing the needs for inputs of pesticides. After two decades of intensive and expensive research and development in agricultural biotechnology, the commercial cultivation of transgenic plant varieties has commenced over in 1986. The power of technology has supervised to developer and users and in 1999, it was estimated that approximately 40 million hectares of land were planted with transgenic varieties of over 20 plant species, the most commercially important of which were cotton, corn, soybean, and rapeseed (International Service for the Acquisition of Agricultural Biotechnology [ISAAA], 1999). The traits these new varieties contain are most commonly insect resistance (cotton, corn), herbicide resistance (soybean), and delayed fruit ripening (tomato). The benefits of these initial transgenic crops are better weed and insect control, higher productivity, and more flexible crop management. The countries include several of the world's major producers and exporters of agricultural commodities: Argentina, Australia, Canada, China, France, Mexico, South Africa, Spain, and the United States. Approximately 15% of the area is in emerging economies. The value of the global market in transgenic crops grew from US\$75 million in 1995 to US\$1.64 billion in 1998. GMO crops has been approved for commercial cultivation in more the 50 country and covering more than 170 million ha, Most dominated one are here in pic1

As per ISAAA report, In 2019, the 24th year of commercialization of biotech crops, 190.4 million hectares of biotech crops were planted by up to 17 million farmers in 29 countries. From the initial planting of 1.7 million hectares in 1996 when the first biotech crop was commercialized, the 2019 planting indicates ~112-fold increase. Thus, biotech crops are considered as the fastest adopted crop technology in the history of modern agriculture. This coverage is more than 10% of the total arable area worldwide. Also very significant spread in diffract crop and GMO Corn grown in 17 country, cotton grown in 15 countries, Soybean in 11 countries, Rape seed in 4 countries, Papaya in USA and China, Sugar bet in USA and Canada, Potato, Squash/pumpkin, and Alfa-Alfa in USA. in USA and egg plant in Bangladesh.

### **Non-GMO application of Biotechnology**

Germplasm improvement by created the new genetic variability and make the selection in this new variability in order to accumulate the desirable alleles exhibit the traits of interest is common never ending process in plant breeding. Breeder can manage the simple traits easily as they have high heritability and express with involvement of one or few know genes. Improving the complex traits, which are polygenic in nature and have very high genotype environment interaction, is very challenging for breeding group ever since and even today.

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## IMPACT OF *PARTHENIUM HYSTEROPHORUS* (GAJARGHAS) WEED ON THE BIODIVERSITY OF LOCAL FLORA IN BUNDELKHAND REGION AND ITS ECOFRIENDLY CONTROL BY *ZYGOGRAMMA BICOLORATA*

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### ABSTRACT

Weeds are a major biotic constraint in agricultural production systems worldwide. Besides reducing crop yield and quality, these unwanted plants adversely affect biodiversity, animal health and environmental security. In fact the problem of weeds is as old as the agriculture itself as almost all crop plants have been domesticated from their wild relatives only. Weeds interfere with normal plant growth by competing for available nutrients, light and water. Uncontrolled weeds reduce the grain yield by 96% in direct-seeded rice and 61% in wetseeded rice. Realizing the growing weed infestations in the cropped and non-cropped lands, agricultural scientists of the world have been undertaking research and sharing their findings at various platforms. One such initiative was taken way back in 1967 when weed scientists of 22 countries of the Asian-Pacific region met at the Hawaiian Island of Kauai to establish linkages and discuss what should be done in weed science in this part of the world. The genus *Parthenium* contains 15 species and native range in the subtropical regions of South and North America. *P. hysterophorus* was firstly introduced in Pune (Maharashtra, India) during 1955 and in the present time this weed has ability to release toxic chemicals such as Parthenin, which is an allelopathic chemical against other herbs and its high growth rate allows it to colonize very fast and extensively in new areas.

About 750 species, 445 genera and 111 families of flowering plants (excluding cultivated and ornamental plants) found in Chitrakoot. *Cyperus* is the dominant genus having 20 species followed by *Indigofera* and *Ipomoea*-11 species each. *Ficus* has 10, *Cassia* 9, *Euphorbia* and *Fimbristylis* 8 each, *Grewia*, *Crotalaria*, and *Blumea* 7 each, *Alysicarpus*, *Justicia*, *Phyllanthus*, *Eragrostis* 6 each, *Sida*, *Corchorus*, *Desmodium*, *Tephrosia*, *Acacia*, *Dioscorea* and *Commelina* 5 each. Besides 6 Genera have 4 species, 27 have 3 species each, 68 have 2 species each and remaining 343 genus representing single species (Sikarwar, 2011).

### Parthenium

*Parthenium hysterophorus* L. is an aggressive Mexican weed, native of tropical America. Within last century it has been reported from more than 54 countries including India and become a very serious problem in our country (Adkin & Shabbir, 2014). About 35 million hectares land is infested with *Parthenium hysterophorus*. *Parthenium hysterophorus* (Gajarghas) is very dangerous weed belongs to aster family, Asteraceae. *Parthenium* weed is a dominant, aggressive and exotic weed and commonly called 'Gajarghas', 'Carrot grass', (Tower and Rao, 1992), Santa-Maria, whitetop, star weed, false ragweed, ramphool and bitter weed (Adkins and Navie, 2006; Paudel, 2009; Dahiya and Jakhar, 2015). Its allelopathic chemical suppress crop and pasture plants and its allergens affect humans and livestock. Parthenin component is a factor of radical growth inhibitor and germination of other common herbs and plants. It also affects the function of nitrogen fixation on nitrifying bacteria, *Azospirillum*, *Rhizobium*, *Azotobacter* and *Actinomyces*.

It has spread all over India covering most of the vacant and marginal lands. *P. hysterophorus* is known to suppress local vegetation by release of growth inhibitors through leaching, exudation of roots, decay of residues etc. It not only covers wasteland but also invades cultivated fields and poses a threat to crops such as cereals, vegetables, fruits, oil seeds, etc. Seedlings of all species were significantly inhibited by the presence of small amounts of dried leaf material of *Parthenium* weed indicating a strong allelopathic activity. The root growth of all species was inhibited more than the shoot growth indicating a greater sensitivity of the roots. Its seeds can spread long distances through water, wind, animals and other agents due to very light weight. It is an aggressive weed which invades wasteland, roadsides, railway tracks and residential areas.

The weed suppresses growth of local vegetation and has been reported as a health hazard for farm labourers by causing dermatitis, eczema, allergic rhinitis, burning and blister around eyes and asthma. *P. hysterophorus* also cause diarrhoea; allergic bronchitis. The pollen deposition is reported to inhibit fruit of seed setting in crops like tomato, brinjal, beans, capsicum and maize. The Importance value of weeds is a good indicator of the flora distribution in the area. Stem is highly branched and green in color. The juvenile phase is rosette with dark green, a much reduced stem pinnetisect, radical and large sized leaves. Leaves of carrot grass do not allow growth of any vegetation under it and flowering is not found in this phase but in the adult stage plant is erect and much branched, up to one meter or more in length and flowers are present. The surface of leaf and stem is covered with whitish trichomes (Rodriguez *et al.*, 1976). This weed has enormous biotic potential which is





facing very little environmental resistance, wastelands, road side, railway track, water channels and crop lands (Joshi 1991). *P. hysterothorus*, a drought resistant plant can germinate in different types of soil, but is particularly successful on vertisols (Towers, 1992 and Karim, 2012).

Flowers of *Parthenium* are creamy-white in colour with green small sepals and white trichomes. Flowering stage starts about a month after germination. Each flower of *Parthenium* contains five seeds, wedge-shaped. *P. hysterothorus* produces huge numbers of pollens an average 624 million/plant, which are dispersed on the floral parts and vegetative, and reducing the growth of different common plants and their fruits like brinjal, tomato, capsicum, beans and maize. Single well matured and large plant produces up to 150,000 seeds in whole life cycle. Fruit type is cypsela. Seeds of *Parthenium* weed are capable for germinating anywhere in the soil when moisture is available and the germination rates are highest at 12<sup>o</sup> to 27<sup>o</sup>C. *P. hysterothorus* shows two different phases in their life, first is juvenile, rosette or the mature (reproductive) stage.

*Parthenium* weed colonizes and disturbed every infested site very aggressively due to allelopathic effect. Adkins and Shabbir, (2014) reported that *P. hysterothorus* is an invasive weed plant which has spread almost the world. The workers reported that *Parthenium* weed became the major noxious weed for the last 25 years in Australia and India, respectively. It is an exotic weed and was firstly introduced in India along with food grain under PL 480 scheme. The *Parthenium* invasion also reported from Bangladesh (Mahadevappa, 1997). *Parthenium* is a worldwide weed. It has been distributed to many countries in the pacific, Asia, Africa, and now has become a very dangerous weed in India and Australia.

### Control

The control of *Parthenium* is being done by several means i.e. Uprooting and Burning, Chemical herbicides, Eucalyptus oil, Leaf eating beetle, Stem galling moth, stem boring weevil and Fungi. Among many control methods of *P. hysterothorus*, the biological control is one of the most promising, suitable, cost-effective and environmentally-safe method.

### Cultural control

Cultural control is very cost effective and simple method. In this method uprooting of the *Parthenium* plants by hand in young stage has been employed for the past several years but with disappointing results. Even in such condition, with safety measures such mask, nose covers and wearing of hands are necessary. Burning is another option to control the *Parthenium* but not useful control method because it needs large amount of fuel and this method also destroys all other beneficial important plants germinating in its vicinity. Cultural method also finds a place in the integrated approach to find quick results. Only cultural method for controlling *Parthenium* weed is not effective.

### Chemical Control

Chemical control is a most effective technique to control the *Parthenium* in that areas where it's natural bioagents are absent. In this method several selective herbicides, salt water and soap water have been applied in the subsequently under actual *Parthenium* infested field condition and experimental plots. Chemical like glyphosate, 2,4-D, 2,4,5-T, Paraquat, Bromacil, Sodium chloride, Simazine and Metribuzin in recommended dose kill the standing *Parthenium* and to some extent suppress immediate germination of the seeds and deposited in the soil.

Herbicidal control is best option to control the rosette stage of *Parthenium* in non-cropped areas like wasteland, railway tracks, river side, water channels and road side. All stages of *Parthenium* controlled by 80% sodium salt of 2,4-D at 5.0 Kg a.i./ha as post-emergent within a period of 20 days after spray. Under the non-cropped condition 2, 4-D, and Metribuzin, Glufosinate, Chlorimuron and Metsulfuron failed to reduce the *Parthenium* while Glyphosate was most effective (90%) for the control of this weed (Singh *et al.*, 2004).

### Biocontrol by microorganism

In this method, bacteria, fungi, and viruses are used to control the *gajarghas* (*P. hysterothorus*). Weed can be also managed by using pathogens or bioherbicides and mycoherbicides that is introduced as biological control by microorganism. Bioherbicides and mycoherbicides produce toxic material which can reduced the growth and germination of weeds. Among different microorganisms maximum experiment was concentrated on mycoherbicides (fungi). About twenty six varieties of fungi were reported on *P. hysterothorus* out of which *Entylomacompositarum*, *Pucciniamelampodi* and *P. abrupt* were thought to be suitable for biocontrol (International Institute of Biological Control) during 1983-84 & 1995-97 in Argentina, Cuba, Mexico and Trinidad.

Mycoherbicides and pathogens has been reported (Evans, 1997; Sreeramkumar, 1997; 1998; Sreeramkumar and Evans, 2005; & Sushilkumar and Varshney, 2007) for control of *Parthenium* weed.



## Biological Control by Insects

In this situation, the biological control methods is found safe sound, ecofriendly and sustainable. Some insect pests such as Mexican beetle (Leaf feeding beetle). *Z. bicolorata* belongs to family Chrysomelidae, *Epiblemastrenuana* (stem galling moth) and *Smicronyslutueantus* (Curculionidae), a flower feeding weevil attack on the *Parthenium* plant. Among these Mexican beetle *Zygogramma* reported to be to be an emerging nature enemies for controlling Carrot grass (*P. hystrophorus*) in India, Nepal, Vietnam, Australia and South America.

### Biological Control of *Parthenium* by *Zygogramma bicolorata*

*Zygogramma bicolorata* is a leaf feeder and belongs to family Chrysomelidae, approx. 100 species in which 13 species reported from Mexico. This beetle variously referred to as Mexican beetle. Body of *Zygogramma* is small in size and colour is brown. Prothorax is yellowish and brown and one special mark is present on elytra. This beetle belongs to Mexico and after then introduced to Australia and India. Adult and grub stages of *Zygogramma* are reported as a biocontrol insect of invasive weed, *P. hystrophorus*. In India, this Mexican beetle was imported from Mexico in 1983 like a biological control insect of this weed (Krishnamurthy, 1998; Annadurai, 1989; Dhileepan, 2001, 2003 and Singh, 2014). The Mexican leaf beetle had been released and approved as a classical biocontrol agent in 1980 in Queensland, Australia where this biocontrol agent has a significant impact on *Parthenium* (Dhileepan, 2001/2003). The biological control of this noxious weed is an urgent requirement (Tripathi and Tripathi, 2020). *Zygogramma bicolorata* is an effective and eco-friendly biocontrol agent of very harmful and health hazardous weed, *Parthenium hystrophorus*. This beetle founds feeding primarily on the *Parthenium* weed. The Mexican beetle *Z. bicolorata* (Pallister) (Coleoptera: Chrysomelidae) was imported into India in 1983 for the biological control of the noxious carrot weed *P. hystrophorus*. Life cycle of the beetle is approximately 4-6 weeks and there are four different life stages are occurred i.e. egg, larva, pupa and adult. Larval stages comprises of four instars. The adult feeds on fresh and young leaves of *Parthenium* and tends to hide on adaxial side on the leaves. Both adult and grubs of *Zygogramma bicolorata* Pallister were found feeding on leaves of *P. hystrophorus* L. The beetle was reared in the laboratory condition under organdy net cages. First time it was found that the female beetle also laid eggs on organdy net which is very helpful in the transportation of this beetle. The early stage grubs feed on the auxiliary buds and move on to the leaf blades as they grow. The full-grown grubs enter into the soil and pupate. An insect density of one adult per plant caused skeletonization of leaves within 40 days. Food consumption of *Parthenium* was maximum by second and third instars larvae followed by fourth instars and minimum food consumed by adult stage of *Zygogramma*. The reduction in the density of *P. hystrophorus* by *Z. bicolorata* is highly significant. According to this experiment, there is no doubt that the feeding activities of the Mexican beetle were more predominant during monsoon periods viz., July to September. *Zygogramma* has contributed significantly to suppress effectively *Parthenium* in large area and helped indigenous species to re-establish, thus saving loss of biodiversity.

### Life Cycle of *Zygogramma abicolorata*

There are 4 life stages are found in the whole life cycle of Mexican beetle i.e. egg, larva, pupa and adult. Eggs are yellow to orange in colour, elongated cylindrical in shape and generally laid on dorsal surface of both young and old leaves, stem and flowers of host plants. Eggs of this beetle hatch in three to four days and larvae are yellowish white and feeding *Parthenium* leaves for 10 to 15 days and growing through four instars stage. After hatching the first instar grub starts moving to the upper portion of host plants in search of soft leaves and buds. They feed by making a whole in the apical leaves and buds by scraping the mesophyll tissues which disturbed the photosynthesis activity of plant and ultimately control the growth and flowering of *Parthenium* plant which is very useful to control the *Parthenium* weed. Fully grown grub remained as pre-pupae for about a day before entering in the pupation. No feeding was recorded in the pre-pupae stage grub, it is also showed electivity.

After completed the larval stage, mature larvae enter into the soil below up to 8 to 15 cm in depth for the pupation. Pupa was excreted and the colour of body surface was creamy white; and transparent. The total life cycle of beetle is just over 100 days. Life cycle of this beetle is 25 to 28 days at favorable conditions (July to September) at a constant temperature of 27 to 29°C (Chandra and Tripathi, 2020). Eggs to adult development takes place 23 days at a constant temperature 27°C (King 2008). The emergence of Mexican beetle is high in the average temperature, rainfall in spring. In the minimum temperature beetle goes to diapause in to the soil depth (Dhileepan et al., 2000). Similar observation has been made by Pandey et al., (2001).

*Z. bicolorata* is very selective host specific beetle which do not feed on other beneficial crops of Chitrakoot region. In this work twenty five different plants were provided for feeding but none of infested by any stage of this beetle. In this investigation it is also very important to mention that the 2<sup>nd</sup> and 3<sup>rd</sup> instars of grub voraciously feed the *Parthenium* weed and skeletonised easily.



### Feeding potential

Overall mean days of two years data indicated that feeding efficiency of Mexican beetle on different age of host plant i.e. early stage, young stage and flowering stage were significantly superior. The highest time taken (14.86 days) for complete defoliation by two pairs of beetles followed by (12.99 days) by three pairs whereas, minimum time was taken by five pairs of Mexican beetle (5.29 days) for complete defoliation.

In 2017, the maximum consumption of food was noticed (12.01 mg) by third instar larvae followed by fourth larvae (9.1 mg) and adult consumed minimum food (0.83mg). Similar finding was noticed during 2018. The 3<sup>rd</sup> instar grubs consumed highest amount of food (12.06 mg) followed by next instars grub (8.88mg) and minimum by adults (0.95mg). Overall food consumption pattern of this beetle was shown by 3<sup>rd</sup> instars grub (12.03mg) followed by 4<sup>th</sup> instars grub (8.99mg) and minimum by adults (0.89mg).

### Effect of *P. hysterophorus* on diversity of Local Flora

In this investigation it was reported that *Parthenium* weed grows and spreading everywhere in the Chitrakoot region in a widely habitats and to be a cause of changes and replacing to other vegetation. This aggressive weed is capable to replace and out-competing to native and non-native flora. During the survey many other associated weed were found with the *Parthenium* weed but the overall density of *gajarghas* (*Parthenium*) was very high in the comparison of other associated weed in the survey sites of Chitrakoot region. *P. hysterophorus* is a harmful toxic weed for local flora, grazing animals and human being. It is required to develop easy and cost effective technique to control and remove this toxic weed with eco-friendly manner. Analysis of the data revealed that weed species growth was in abundance. The maximum relative density 49.42 % was reported for *P. hysterophorus* in Rajapur followed by 45.34 % at Karwi, 43.07% at Pahadi, while the lowest relative density (34.20 %) of *Parthenium* was recorded in MGCGV. The highest frequency of *Parthenium* was observed in MGCGV 83.3% followed by 80% and 76.7% at Rajapur and Karwi respectively, while the minimum frequency (66.7%) of *Parthenium* was observed at Pahadi.

The Importance value is the best technique to determine the floral distribution in an area. Among the locations surveyed the highest importance value (33.56%) of *Parthenium* was recorded at Rajapur, closely followed by 30.52% at Karwi and 29.15 at MGCGV. *Parthenium* weed however ranked at the top emerging dominant weed at all the locations as well as its mean values for all four districts is the highest (30.32%). *Parthenium* is known to inhibit the growth and activity of nitrogen fixing bacteria like *Rhizobium* and *Azotobacter* and nitrifying bacteria like *Nitrosomonas*.

Protection and conservation of medicinal plants of Chitrakoot area are very essential because *Alectra parasitica*, *Butea monosperma*, *Aristolochia indica* and *Gloriosa superba* are reached in endangered stage. The findings on absolute density (%), relative density (%), absolute frequency (%), relative frequency (%) and importance values (%) of *Cynodon dactylon*, *Doobhghas*; *Euphorbia helioscopia*, *Doodhighas*; *Chenopodium spp.*, *Bathua*; *Amaranthus viridis*, *Chaurai*; *Cyperus rotundus* *Motha*; *Xanthium strumarium*, *Chota Dhatura*; *Dactyloctenium aegyptium*, *Crow foot grass*; *Rumex crispus*, *Curly dock*; *Coronopus didymus* *Chick weed*; *Argemone Mexicana*, *Satyanashi*; *Calendula arvensis*, *Field marigold*; *Poa annua* *Meadow grass*; *Sorghum halepense* *Jhonson grass* indicate the rare distribution which were very dense before three decades.

The threatened species of medicinal plants are *Alectra chitrakutensis*, *Butea monosperma* var. *lutea*, *Butea sp.*, *Cordia macrodii*, *Litsea glutinosa*, *Piper longum*, *Zingiber zerumbet*, *Acorus calamus*, *Aristolochia indica*, *Gloriosa superba*, *Dioscorea puberula*, *Costus speciosus*, *Tacca leontopetaloides*, *Eulophia herbacea*, *Operculina petaloidea*, *Nervellia prainiana*, *Clerodendrum serratum*, *Actinopterys radiata* and *Embelia* *basal*, *Dioscorea bulbifera*, *Urariapicta*, *Habenaria plantaginea*, *Citrullus colocynthis*, *Trichosanthes bractiata*, *Plumbago zeylanica*, *Chlorophytum tuberosum*, *Arisaema tortuosum*, *Plesmonium margaretiferum*, *Curcuma amada*, *Gymnema sylvestre*, *Cochlospermum religiosum*, *Mucuna pruriens*, *Sterculia urens*, *Gymnema sylvestre*, *Baliospermum montanum*, *Steriospermum chelonoides*, *Celastrus paniculatus* and *Pterocarpus marsupium* etc.

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## **HOW FAR THE AGROFORESTRY PRACTICES CAN ADDRESS THE EMERGING CHALLENGES OF CLIMATE CHANGE, BIODIVERSITY CONSERVATION, FOOD SECURITY AND LIVELIHOOD IMPROVEMENT IN INDIA**

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Agroforestry is a dynamic land management practice that integrates trees, crops, grasses and animals on farm lands either simultaneously or sequentially in a definite spatial and temporal pattern to enhance the overall productivity, profitability, diversity and ecosystem sustainability. It is ecologically, economically and socially viable practice targeted to diversify the agriculture production base, while maintaining biodiversity, sustaining the yields and covering the risks involved in monocropping system of agriculture. Agroforestry is the way of life of farmers and these practices are in vogue since immemorial times, it cannot be separated from agriculture as farmers are well aware the multiple benefits viz., wood, fuel, fodder, fibre, food etc. derived from wood components in agricultural landscapes. India being the second most populous country in the world is highly vulnerable as majority of the population depends on agriculture and allied activities for their livelihoods and household economy could face the brunt of climate change in future. It could affect the food production which will increase hunger, poverty, malnutrition and food insecurity and accessibility. The major drivers of climate change in India are fossil fuel burning, cement industries, unscientific agricultural and forestry practices, while deforestation and inappropriate land management, overexploitation, urbanization and mining have tremendously increased in the last few decades, which has not only deteriorated the productivity of forest but also degraded agricultural ecosystems. Since a large area covering more than 66% of agriculture is under rainfed and depends up on the monsoon rains. The erratic rainfall, drought and rising winter temperature affected the production across the country. The food security will be a major challenge in the future and our country has to double the food production over the couple of decades to feed the burgeoning population. However, the present scenario of agriculture practices might no longer sustain food production system cope with the rising demands of food coupled with number of growing problems in Indian Agriculture, which are suffering from vagaries of land degradation, water crisis, climate change, loss of biodiversity and disruption in socio-economic conditions. The current unplanned developmental activities are further degrading soil health and threatening sustainability of food production creating huge gap in the demand and supply. There is worldwide consensus to paradigm shift from conventional agriculture that has narrow focusing only on yield only but there is need to move toward multifunctional agriculture, which is much broader to achieve the ecological, social and economic goals under the rubric sustainable intensification. Although food security, poverty, biodiversity conservation and environmental development have received the greater attention in targeted sustainable development goals (SDG), however the progress in development of sustainable and resilient agricultural practices is at very slow phase and yet to be realized in India. Within the physical and human geography, one of the most multifunctional forms of agriculture is now recognized as agroforestry that could be reinvigorated in different regions to tackle the growing needs of the country. The faulty agriculture practices are not only declining the land productivity but also contributing for increase in green house gases and climate change, loss of agrobiodiversity and disrupting the livelihoods of farmers. The farming is back bone of the rural India, which is going to be largely affected by climate change. The increasing population of stray cattle and mismanagement of livestock are also contributing for emissions of green house gases.

Agriculture was ranked as the second largest (19.6%) source of GHGs in the country followed by Industrial processes (IP), land use change and forestry (LUCF), and waste contributed 6.0%, 3.8% and 1.9% respectively for total emissions in 2014. India is one of the signatories of the Paris Agreement (ambitious target of maintain global warming well below 2°C by cutting down GHG emissions of 1990 level) of United Nation Frame Work on Climate Change (UNFCCC) pledged to reduce the emission intensity of their economy by 33-35% compared to 2005 through reducing fossil fuel and coal burning and increase in tree cover by 30% to create a cumulative C sink of 2500-3500 Mt CO<sub>2</sub>e (roughly equal to its total emission from a single year) by 2030 under Nationally Determined Commitments (NDC).

Agroforestry has strong potential for climate change mitigation through increase in C stocks, conservation of biodiversity besides extending many ecosystem services needed for well being of environment and societies. It provides diverse ecosystem services that include provisioning, regulatory, cultural and supporting services. In India both traditional and modern agroforestry practices are prevailing in irrigated and rainfed conditions under different landscape settings. Agroforestry systems (AFS) could conserve soil and water resources, biodiversity, C sequestration and possess the strong mitigation and adaptation to climate change and extreme weather events of droughts, heat stress, floods and cyclones facing by the country. Many agroforestry systems found to be suitable for addressing the challenges of food, nutritional, energy, environment and livelihood securities of rural communities. The industrial agroforestry plantations in India established during the last five





years have been estimated to sequester 3.65 Mg of C and address the environmental concerns. The average carbon storage potential in Indian agroforestry has been estimated to be 25t C ha<sup>-1</sup> over 96 million ha.

There is enough evidence that well managed scientific agroforestry can increase yields by a factor of 1.5 to 2 times depending on the crop type, local conditions, and level of expertise. The yields could be increased due to moderating effects on climate by trees in agriculture, enhanced soil fertility through efficient recycling of nutrients, reduced crop stress and regulation of water supply by tree roots. It increases crop resilience to several likely climate change impacts such as droughts or higher temperatures, as it enhances the infiltration rate, storage capacity besides reducing evaporation. It also increase the livelihood resilience as the trees under agroforestry reduces depend on unpredictable distant commodity markets, while in circumstances of failure in crops, the trees provide alternate income through fruit, fodder and fuel. It provides local employment opportunities and paves a path way to alleviate rural poverty. The reduced dependency on chemical inputs could drastically improve the market fluctuations in hiking prices of inputs, where the farmers are affected by the price fluctuations. The increase in input cost will lead to decreased profits which make the farmers to migrate from agriculture to other sectors. The report of the task force of Greening India for Livelihood Security and Sustainable Development has suggested bringing 10 million ha of irrigated land and 18 million ha of rain-fed land under agroforestry systems for climate change mitigation and livelihood improvement. There is a potential for further employment generation under improved agroforestry systems, amounting to 943 million person-days annually from 25.4 million ha. Maximum employment opportunity is seen to be accrued from tree-borne oil seeds, followed by silvipasture. The potential of agroforestry for rural development and employment generation amounts to 5.763 million persondays yr<sup>-1</sup> in the Himalayas alone.

The efficient AFS could fulfill the nations demand for wood and other raw material needed for industries besides supplying the many non wood products like gums, resins, tannins, dyes, essential oils, medicinal plants, grasses, many other products etc. Agroforestry as trees outside the forestry are fulfilling the 66% demands of raw material of wood in the country. The agroforestry will help in combating the deforestation and desertification, while creating employment opportunities and developing entrepreneurship among rural masses. Entrepreneurship is the engine for economic growth and development. It can address the issues of poverty, unemployment and livelihoods, where the farmers migrating to urban areas in search of employment and other source of income. Agroforestry can also enhance multiple social dimensions provides a pathway out of poverty because the combination of increased yield, low cost, and additional tree-based farm products can significantly increase net farm income. Many non-timber products in tribal areas of Chhattisgarh, Orissa, Jharkhand and Madhya Pradesh India, have potential for conservation of useful species as well as for making a contribution to the well-being of local people. Such initiatives have enhanced likelihood of success as most of the tribal communities are dependent on wild resources for their livelihood. The agroecosystems is particularly valued for specific roles including that of host species to insects yielding marketable products such as silk, lac, gums, resins etc. The agroforestry also benefit the farmers by the way of providing payment for environmental services like C sequestration on farms, maintaining biodiversity, ecotourism and incentives for tree plantations.

Agroforestry, as part of a multifunctional working landscape, can play a major role in conserving and even enhancing biodiversity from farms to the landscape level since many natural ecosystems are disturbed in the country. Landscape scale in agroforestry science has made links between agroforestry and the conservation of biodiversity more relevant and more obvious. Agroforestry have three possible roles in biodiversity conservation on a landscape scale: the provision of supplementary, secondary habitat for species that tolerate a certain level of disturbance; the reduction of rates of conversion of natural habitat in certain cases; and the creation of a more benign and permeable 'matrix' between habitat remnants compared with less tree-dominated land uses, which may support the integrity of these remnants and the conservation of their populations. Agroforestry practices have often been shown to increase levels of wild biodiversity on farm land, and it is hypothesized that they are also able to play a supporting role in the conservation of biodiversity in remnants of natural habitat that are interspersed with farm lands. The rich indigenous or traditional knowledge of farmers will be utilized in conserving on farm biodiversity and also bio prospecting of untapped resources to ensure the additional benefits to farmers.

In India land man ratio is gradually shrinking with population explosion and the number of small land holding farmers are increasing day by day, the practice of agroforestry on commercial manner become rather difficult because of the poor socio-economic conditions of the farmers and long gestation periods of trees. Agroforestry is not gaining momentum because of several constraints. The stringent policies of tree harvesting, transit pass and marketing have also become hurdles. The procedures of qualifying the small farmers for payment of environmental services like C sequestration benefits are very complex. The supply of quality tree planting material, package of practices of tree-crop management and lack of financial resources have become bottle necks. All the above factors are cumulatively preventing the wide spread adoption of agroforestry in the country.



Despite the potential and success of agroforestry models in different agro-climatic zones, it could not be percolated and the expected benefits have not reached the poor farmers of the country. This created a large vacuum and dilemma on future directions in adoption of agroforestry on commercial scale. There are many hidden threats which need to be addressed to promote scientific modern agroforestry. The forest and agroforestry policies should be revisited, farmers and ecologically friendly proactive policies need to be evolved to promote agroforestry. The various stakeholders of agroforestry mutually understand the complex problems, the synergies and tradeoffs shall be carefully analysed. The participatory public-private partnership models should be encouraged. Separate National Board and Agroforestry Consortium should be developed in the country to develop complete value chain. The success stories of agroforestry should be replicated in different zones of the country. The various departments of government should collaboratively work together with a view to diversification of farm production and the farmer groups should be created to smooth channelling delivery of agroforestry produce to end users. The supply of quality planting materials, free harvesting, lifting the restrictions on harvesting of agroforestry produce, waiving the transit passes, institutional mechanisms for buy back arrangements, minimum support prices, post harvest, value addition of products, research and development of complete value chain will foster the agroforestry in desired direction. The financial incentives for tree planting and also the assured payments for environmental services, credit, insurance and subsidies will be promoted to reinvigorate agroforestry for the sustainable development. The integration of appropriate agroforestry systems will not only address the climate change through improving carbon stocks but also help in diversifying the production base and bring resilience that could simultaneously address the food security and rural livelihoods which are indispensable for meeting the targeted goals of sustainable development (SDGs). We should aim enough yield for food security, with maximal co-benefits. Agroforestry also increases resilience of crops and farm livelihoods, especially among the most vulnerable food producers. However, conventional yield-enhancement strategies have naturally dominated the debate on food production, hindering implementation of more multifunctional alternatives. Governments and institutions now have the opportunity to rebalance agricultural policy and investment toward such multigoal approaches. In doing so, they could achieve important improvements on multiple international commitments around the interlinked themes of food security, climate change, biodiversity conservation, and social well-being. The search for opportunities to refocus both policy and finance needed, which should better reflect an appropriate balance of agricultural solutions in a multigoal framework. For less-mainstream techniques such as agroforestry, such a rebalancing would bring large new investment, research, and institutional improvements, driving yields upwards. Agroforestry could be revitalized aiming at food security, social well-being, and environmental integrity. The paper discusses the role of agroforestry systems in climate change mitigation, biodiversity conservation, food security and livelihoods improvement with specific examples from different agroclimatic zones of India.



## TRENDS IN AGRONOMIC INNOVATIONS FOR MAXIMIZING CROP POTENTIAL IN SEMI ARID TROPICS OF INDIA

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### Abstract

A genotype, however, superior it may be, cannot achieve its potential unless it is put in to an enabling agronomic context. In this context to tap full genetic variety of best management practices ranging from simple methods of planting, vegetation management through nipping in indeterminate cultivars to site specific nutrient management, and drip and fertigation techniques in commercially important crops of semiarid tropics have been evaluated. Thus, the forgoing presentation assures tapping of full genetic potential of new crop cultivars with eco-friendly agronomic practices in the SAT in spite of changing climate and dwindling natural resources.

Modern agricultural science and molecular biology technologies have boosted the production of several crops over the past few decades through the development of new germplasm, but there have been evidences of partial realization of this potential on the farm front in general while there has been yield plateaus or decreasing yield gain rates in some crops at places in recent years. Nevertheless, the concerted efforts of agronomists including growers are raising hopes in the Semi arid tropics. A few of the evolving technologies for maximizing crop potential in important crops comprising a pulse two cereals and two commercial crops are briefed in this paper.

**Pigeonpea :** A leading pulse almost assuming the commercial status of late, its productivity is vulnerable due to *Helicoverpa* pod borer and changing climate and rarely potential yields (37.5 – 45 q ha<sup>-1</sup>) are realized. Until few years back it never occurred that the crop can respond to irrigation and transplanting. Being photosensitive proper time of planting is critical; planting early in the season with the onset of monsoon is more paying as it ensures adequate soil moisture throughout life cycle besides escape from pod borer. For instance under drip irrigation farmers realized as high as 35-40 q ha<sup>-1</sup> from May last week planted crop in the north-eastern transitional zone of Karnataka. Recently transplanting technique [Northeastern transitional zone (Chittapur, 2017) and northeastern dry zone (Pavanet al, 2009), and Eastern Gangetic plains of India (Prahara et al., 2015)] is emerging as one of the alternate agronomic practices to overcome yield reduction associated with late sowing. As the established seedlings, pick up their growth from where they stopped in the nursery and become competitive. This helps to reap the benefit of early sowing. Wider planting facilitates easy to spray of insecticides and air movement within the plant canopy. It is a tailor made technology for small and marginal farmers. Nipping off of 5-6 cm main shoot tip growth at 20-25 days after transplanting or between 50 and 55 days of germination and pruning of the secondary branch tips promotes development of large number of tertiary shoots which bear more number of pods, thus increasing the yield by 30-50% (Sharma *et al.*, 2003). Pigeonpea requires 35-40 cm water during its entire growth period. Scheduling of irrigation at 75% CPE with wider spacing of 120 x 60 cm (2869 kg/ha) recorded significantly higher seed yield of pigeonpea (Rathod, 2021). Further, yields further improved (3340 kg ha<sup>-1</sup>) with drip fertigation of recommended N and P<sub>2</sub>O<sub>5</sub> (25:50 kg ha<sup>-1</sup>) in five splits using water soluble fertilizers (Vanishree et al., 2019).

The legume pod borer *Helicoverpa armigera* (Hubner), a polyphagous accounts for nearly 50 per cent of total cost of production. Considering the complexity of effective management of *Helicoverpa* infestation, an eco friendly approach viz., intercropping/ trap cropping - push-pull strategy (Cook *et al.*, 2007) is one such management option. At ARS, Kalaburagi, Karnataka, pigeonpea yields (1286 kg ha<sup>-1</sup>) under intercropping with sunflower (6 pigeonpea : 1 sunflower) were comparable with sole crop yield (1310 kg ha<sup>-1</sup>) followed by pigeonpea + mesta (17556 Rs ha<sup>-1</sup> and 2.98, respectively) (Poddar, 2016). The pod damage in sole crop was 19.3 % in spite of prophylactic measures while it was hardly 5.95 % with pigeonpea + sunflower (ETL crossed twice) with just two terminal control measures, and was 9.97 % with pigeonpea + mesta (ETL crossed thrice) with three of the last three recommended pesticide sprays. Thus, there was saving on pesticides and consequent environment pollution besides more safer food.

**Rice :** With the joint efforts of CIMMYT and University of Agricultural Sciences, Raichur, development and validation of DSR technology had shown promise for its out-scaling through innovative strategies in the areas where water supplies are limited and farmers do not get sufficient water at right time and constrained with ON-OFF canal water supply. Response to early dry seeding or take advantage of early rains received before canal supplies was met with imminent success with farmers. In addition to increase in net income, timely sowing, reduced seed rate by half, reduced fuel consumption by 40-50 lit/ha, reduced water use by 25-35%, reduced GHGs, increased NUE are the other benefits. Among establishment methods tested SRI method is the best practice for getting higher yield (with 5.39% more yield than transplanting), water use efficiency and



mitigation of GHGs (13.92%) (Jagadish, 2018). Among different irrigation scheduling, Alternate wetting and drying (AWD) besides higher yields helps to mitigate GHGs emission by 26.91 per cent than continuous submergence along with 10 per cent saving of total water over continuous submergence. The per cent increase in grain yield with AWD was 3.70, 17.21 and 23.05 per cent over farmer method, saturation and critical stage of irrigation. Drip irrigation scheduling at Further, 1.50 IW/CPE ratio (5060 kg ha<sup>-1</sup>) and 125% recommended dose of nitrogen (RDN) recorded significantly higher (5049 kg ha<sup>-1</sup>) grain yields. Rice nutrition based on target yield was advantageous. Soil testing and fertility management is of great importance to any country for sustained crop production. The STCR or SSNM approach or targeted yield approach is a step ahead in fertilizer recommendation over the prevailing blanket recommendation as these approaches are based on soil fertility class (low, medium and high), nutrient content and crop requirement. Significantly higher rice kernel yield (7462 and 7137 kg ha<sup>-1</sup>, respectively) was recorded in STCR/Nutrient expert based nutrient management with a yield target of 8 t ha<sup>-1</sup> with application of micronutrients (Shubha *et al.*, 2018).

**Maize** : Production interventions during rainy season in the TBP irrigation command in the form of sowing time, exposure to moisture stress and genotypes and their interactions revealed varied responses (Swetha, 2021). During rainy season, significantly higher kernel yield occurred with early (June) to mid (July) season sowing with better harvest with the latter (5412 kg ha<sup>-1</sup>), while end (August) season sowing was not beneficial (4790 kg ha<sup>-1</sup>). Heat tolerant genotype RCRMH 3 recorded significantly higher kernel yield (5329 kg ha<sup>-1</sup>) followed by RCRMH 2, both were significantly superior to RCRMH 4 (4930 kg ha<sup>-1</sup>). The impact of stress on these cultivars was insignificant due to occurrence of rain during imposition of stress through withholding irrigation and greatly due to tolerance of these lines to stress. During rabi/summer, sowing from first fortnight of November to last fortnight of January revealed higher kernel yield with November sowing (8022-8000 kg ha<sup>-1</sup>) with progressive decrease with subsequent sowings.

A genotype, however, superior it may be, cannot achieve its potential unless it is put in to an enabling agronomic context. Nutrition strongly influences maize performance, and in that response to targeting yield through nutrition is phenomenal and achievable. Witt *et al.* (2006) reported that highest yield ranged from 9.4 t ha<sup>-1</sup> in Lampung to 13.7 t ha<sup>-1</sup> in Central Jawa of Thailand which they considered close to the environment genetically simulated with hybrid maize (><http://www.hybridmaize.unl.edu/varajc7@gmail.com>). By following SSNM technique in the southern dry zone of Karnataka, Biradar *et al.* (2013) at ZARS, Bangalore, obtained 9.77 t ha yield against a yield target of 10 t ha<sup>-1</sup> (while, 4.04 t ha<sup>-1</sup> with state recommendation) with hybrid NAH 1137 (Hema), at MARS, Dharwad, Joshi *et al.* (2018) obtained 9.88 q ha<sup>-1</sup> with cultivar S 6668 against a yield target of 10 q ha<sup>-1</sup>, and in northern dry zone, Pagadet *et al.* (2018) obtained still higher yield of 12.83 q ha<sup>-1</sup> against a yield target of 14 t ha<sup>-1</sup>. In north eastern dry zone, the study area, Vikramet *et al.* (2015) reported advantage of SSNM and recorded higher grain yield with 95.5% yield realization with 10 t ha<sup>-1</sup> yield target. Higher yield realization during rabi/summer season particularly with heat stress tolerant genotypes is first of its kind and the results favour study using still higher targets as already studied elsewhere. During rabi/summer the set yield targets (6, 8 and 10 t ha<sup>-1</sup>) were achieved with 92.46% efficiency with 10 t ha<sup>-1</sup> target (9246 kg ha<sup>-1</sup>) (Swetha, 2021).

**Cotton** : In SAT irrigation commands cotton though a popular commercial crop, yields are often low due to delayed planting in the season owing to late release of water. To augment this transplanting of seedlings was considered wherein cotton responded favourably with much higher yields (1.56 to 1.84 t ha<sup>-1</sup>) than with seed dibbling (1.22 to 1.1.39 t ha<sup>-1</sup>) and was economical. With the evolution of new and highly responsive and potential cultivars for commercial use the set yield target has also almost seen four-fold increase over the targets set initially (1.2 to 6 t ha<sup>-1</sup>) (Table 1). Trial on farmers' field with SSNM for a yield target of 4 t ha<sup>-1</sup> in TBP irrigation command was found achievable (Chhtapur, 2017). Further, studies with still higher (5 t ha<sup>-1</sup>) yield target with SSNM and nutrient supplementation for leaf reddening revealed the possibility (5246 kg ha<sup>-1</sup>), however targets were elusive with delay in sowing irrespective of genotypes used (Pyati, 2015 and Hosmani).

**Sugarcane** : In sugarcane different new production technologies helped maximizing yield potential (Nooli, 2021). Now, drip irrigation is a rule than exception in sugar cane. In earlier studies, cane yield was higher (153.6 and 144.2 t ha<sup>-1</sup> in pre-seasonal and seasonal crops, respectively) in drip irrigation with 60-180-60 cm with recommended practices and weekly fertigation with water soluble fertilizers. While, conventional practice of furrow irrigation and urea as N source recorded significantly lower yield levels (105.4 and 117.2 t ha<sup>-1</sup> in pre-season and seasonal crops, respectively) during both planting seasons (Chandrashekhhar, 2009). Subsequent studies revealed that planting in paired row of 3'-6'-3' / 2'-4'-2', wide row of 4' or 5' and pit proved superior compared to normal method. Green manuring of pure or mixed stands green/grain crops helped increasing cane and sugar yield. Further, fertigation at weekly, fortnightly or monthly intervals did not reveal any significant variation, however, significantly higher cane yield and nutrients uptake were recorded in ratoon under monthly interval. Single eye bud seedling at 180 cm X 60 cm recorded significantly higher cane yield of 162 t ha<sup>-1</sup> followed by planting at 180 cm X 90 cm (154 t ha<sup>-1</sup>),





**Table-1** : Yield targets set and nutrients applied at different locations in India.

| Place          | Yield Target<br>(t ha <sup>-1</sup> ) | Actual yield<br>(t ha <sup>-1</sup> ) | Fertilizer applied<br>(N, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O kg ha <sup>-1</sup> ) | Reference                     |
|----------------|---------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------|
| Rahuri         | 1.2-1.6                               | -                                     | 86:61:12 (STCR)                                                                                  | Sonar et al.(1984)            |
| Coimbatore     | 2.5                                   | -                                     | 50:0:0 (STCR)                                                                                    | Basu (1995)                   |
| Siruguppa      | 2.5                                   | 2.3                                   | 130:70:120 (SSNM)                                                                                | Biradar and Aladakatti (2005) |
| Dharwad        | 3                                     | 3.22                                  | 217:59:148 (SSNM)                                                                                | Police Patil (2007)           |
| Raichur        | 4                                     | 4.27                                  | 195:100:200                                                                                      | Manjunath et al. (2014)       |
| Yadgir         | 4.5                                   | 5.14                                  | 272:150:62 (STCR)                                                                                | Vidyavathi, et al. (2014)     |
| TBP, Karnataka | 5                                     | 4.38                                  | 400:140:142.5(SSNM)                                                                              | Chittapur et al. (2017)       |
|                | 5                                     | 5.25                                  | 00:105:190 (SSNM)                                                                                | Hosamani et al. (2018)        |
| UKP, Karnataka | 6                                     | 4.27                                  | 480:168:171 (SSNM)                                                                               | Shivaraja (2015)              |

which are comparable with national recommendation of 150 X 60 cm (150 t ha<sup>-1</sup>) with seed cost advantage, while conventional method with three budded sets recorded significantly lower yield (102 t ha<sup>-1</sup>).

Thus, the forgoing presentation assures tapping of full genetic potential of new crop cultivars with eco-friendly agronomic practices in the SAT in spite of changing climate and dwindling natural resources.

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## INNOVATION OF PLASTIC GADGETS AND SYSTEMS FOR USE IN FRESHWATER AQUACULTURE AND FISH MARKETING

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Plastics is fast replacing the conventional materials such as wood, steel, glass, cement, paper, etc. in every segments of life including agriculture. The use of plastics in agricultural sector has increased tremendously in the country and contributing greatly to the increased farm production including agriculture. The ICAR-AICRP on Plastic Engineering in Agriculture Structures & Environment Management (PEASEM), Centre at ICAR- Central Institute of Freshwater Aquaculture, Bhubaneswar is working since 1988 on the use of plastics in aquaculture and has developed several gadgets and systems made of partially or fully with different plastic materials. The design and development of these plastic gadgets and systems have been done considering the biological requirements of the aquaculture. This paper presents some of the developed gadgets and systems that are presently in use in aquaculture in the country.

### Portable FRP Carp Hatchery

Portable carp hatchery fully made up of fiberglass reinforced plastic (FRP) has been suitably designed and developed for small/marginal fish farmers. The system is suitable for small scale breeding with production capacity of 1.0-1.2 million spawn in one operation. The hatchery possesses several advantages viz., (i) easy transportation to different locations, (ii) easy to install and operate, (iii) require less water for breeding and spawn production, (iv) require less space for installation and can even be placed on a pond dyke, (v) easy to repair and replace minor fittings, (vi) durable for more than fifteen years and (vii) low capital investment. It is suitable for breeding most of the cultured Asiatic carps viz., rohu (*Labeorohita*); catla (*Catla catla*); mrigal (*Cirrhinus mrigala*); kalbasu (*Labeo calbasu*); fimbriatus (*Labeo fimbriatus*); silver carp (*Hypophthalmichthys molitrix*); grass carp (*Ctenopharyngodon idella*); common carp (*Cyprinus carpio*); etc. in the field conditions. By now more than 500 hatchery units have been provided to 26 states of the country for installation and operation.

In farmers' field through standard carp seed nursing practices, 1.0 million spawn produced from the hatchery in one operation of four days can be grown to 0.3 million fry in 15-20 days assuming 30% survival from spawn to fry stage. These fry in pond rearing system, @ 50% survival can produce 0.15 million fingerlings in 2-3 months time. Total 30 hectares of grow out ponds can be stocked with the produced fingerlings, keeping the stocking density @ 5000 nos/ha. In a normal monsoon season of three months, the FRP hatchery can be operated for at least 20 times. If the unit with one breeding pool and one hatching pool runs in full capacity, in a season it is sufficient for providing stocking material (@ 5000 fingerlings/ha) for 600 ha ponds for grow out purpose. If the hatchery unit is having two or three hatching pools, the seed produced from the unit can be sufficient for stocking 1200 or 1800 hectares of ponds respectively for fish production.

### Portable FRP Pabda Hatchery

Fishes of genus *Ompok*, widely called as 'butter catfish', and in India and neighboring countries commonly known as 'Pabda' having high consumer preferences. This species is most popular and gaining importance as a promising aquaculture candidate in recent time. But, insufficiency of seed is the major bottlenecks, which hindering its wide and mass scale culture. Portable FRP pabda hatchery has been designed, developed and tested for its field use. The system consisted of two major parts i.e., Hatching/incubation unit; and Brood acclimation – cum-Latency stage nurture – cum - Hatchling rearing tanks with water supply lines. Three cylindro-vertical hatching/ incubation pools are placed one above the other on a triangular iron frame to minimize requirement of space. The pools are so designed that, one fit inside the other, for ease of transportation. The incubation unit can accommodate about 45,000-50,000 nos. of fertilized eggs in a single cycle. Three Brood acclimation-cum-Latency stage nurturing-cum-Hatchling rearing tanks of different sizes are designed for multiple purpose uses, viz., for acclimation of pabda brood fish after collection; for nurturing of brooders during latency period after injecting inducing hormone; and for rearing of hatchlings to early fry stage. The system is suitable for acclimation of 8-10 kg brooders of pabda and also for nurturing of injected brooders of 5-6 kg. The system is so designed that, it reduces the use of space and in one operation 25000-30000 nos. of early fry of pabda can be produced.

### Portable FRP Magur Hatchery

Portable magur hatchery fully made up of fibreglass reinforced plastics (FRP) has been designed and developed for fish farmers, keeping in view its easy transport to different farm sites, low water consumption, easy installation and operation. It is suitable to produce 50,000 fingerlings in one operation. Its components are (i) Rectangular Larval Rearing Tank (4 nos): Dimension-4.0 m (Length) x 0.9 m (Breadth) x 0.35 m (Height), one bottom outlet is given with 25 mm diameter socket and



plug for removal of water from the tank (ii) Round Larval Rearing Tank (4 nos): Circular tank with size 1.5 m diameter and 0.35 m height, and (iii) Hatchery (Circular type) (1 no): Diameter 1.5 m, height 0.35 m and a central outlet of 63 mm diameter at the bottom, four numbers of duck mouths are fixed equidistant at side walls just above the bottom.

### **FRP Silo Fish Rearing System**

Increased fish production can be achieved through horizontal and vertical expansion of the aquaculture systems. Silo, hi-tech aquaculture system comes under the vertical one. Culture of fishes in silos/ vertical-tire system is a new approach, where, the stocking densities are dependent on the volume of water as well as to the height of silos. In order to have low space requirement, FRP silos for recirculatory aquaculture system have been designed and developed under the scheme, where flow-through facility can easily be incorporated for high fish production. FRP silos of 9999, 6666 and 3333 liter capacities with respective heights of 2.7, 1.8 and 0.9 m, each two numbers were fabricated and installed for experimentation purpose. The diameter of the silo is kept 2.15 m. The system is integrated with aeration facility, water recirculation, and biological filtration unit and demand feeders for fish feeding. These units are suitable for holding live fishes in hotels, restaurants and fish spots for attracting customers for the products prepared from live fishes.

### **Polyhouse/Greenhouse Ponds**

The technology is mainly developed for the low temperature regions, where the temperatures are below 25°C. The technology mainly comprised of two different set-ups which basically differed in their construction. The first one being the GI framed polyhouse made out of GI pipes and LDPE film of 200 micron thickness, and the second one being the Bamboo framed even span polyhouse. The results indicated that polyhouse ponds showed 4.50-6.25°C more water temperature than open fishponds and the fish growth inside greenhouse is better in terms of weight-gain and survival due to prevailing higher water temperature. The plankton production is also higher in the polyhouse ponds because of temperature effect which in turn posed to be a reason in higher productivity.

### **Plastic-lined Ponds**

A technique has been developed to line fishpond with plastic liners. Side slopes of pond were designed as per the angle of repose of the soil. Steps at the vertical interval of 50 cm were provided on the whole side slopes of the pond, and a channel 30 cm on top of it was cut for the purpose of anchoring the LDPE (Low Density Polyethylene) sheets, thus, preventing the sheets on the bed and sides of the pond from sliding down. A sand layer of 15 cm thick was made below the liner to smoothen the pond surface and also to provide stability to the liner. Two fishponds of size 11 × 7 m top surface area were lined with LDPE (250 micron) sheets covering bottom as well as sides of the pond to control seepage at ICAR-CIFA, Bhubaneswar farm. Plastic liner was then covered with soil of 15-30 cm depth to simulate pond condition of earthen pond. LDPE sheets were joined by folding the sheets and pouring hot bitumen inside the folds and pressing it with iron.

### **FRP made NFT Aquaponics System**

A Nutrient Film Technique (NFT) aquaponics system has been designed and developed in Fibre Reinforced Plastic (FRP) with circular fish culture tank (Ø 2.15×0.9 m, operational capacity of 2800 liter), trickling biofiltration unit utilizing 85 liter volume filled with 10-25 mm gravels and seashell (S:V=12.77), hydroponics tanks (4×0.9×0.35 m) with an optimum water column of 0.25 m containing trays with 72 perforations (Ø2.5") to hold the plastic mesh pots and a 200 liter sump made of HDPE with three conductive water level sensors and a 0.3 HP submersible water pump for the recirculation. The system utilizes gravity flow up to 75% in the recirculation process. Using this system, various plants along with different fish species have been grown for biomass production.

### **Demand Fish Feeder**

Fish feed is the major constituents in different aquaculture production systems. The economy of a fish farm is strongly dependent on the efficiency with which the fish utilize the food supply. Feed account for more than 50-70% of the total operating costs depending on the type of feed used, and the intensity of their management practices. Demand fish feeder was developed in the year 2009 with the aim to increase the efficiency in feeding techniques and reduced efforts in manual feeding, and thereby reducing the expenses incurred by the farmers in giving excess feed. The main components of the feeder are 30 l capacity feed hopper and activated mechanisms. The feeder is designed to be installed in a pond with the activating mechanism extending into the water through an activator rod. The activating mechanism includes a steel baitrod, feed platform, feed protecting cover and a pendulum or feeding tray in case of sinking feed. The feed drops by gravity onto an adjustable acrylic feed platform when fish activates the rod. Feed drops by gravity onto an adjustable acrylic feed platform positioned below the hopper and above the water level. An acrylic tube protects the feed platform, which was fitted with



hopper. The bait-rod is suspended from the conical tube on V- shaped steel wire that holds the rod. The feeder has been designed to be suspended from a MS pipe stand with the activating mechanism extending into the water through the conical portion of the hopper. It is capable of feeding the ponds of 0.1 ha and which upon its testing resulted in an efficiency of 15% in comparison to the hand feeding techniques. The features such as low cost, maintenance free use, easy to install and operate best suited for the pond/ tanks/ raceways thereby allowing the farmers in the adaption of the technology at a faster rate.

### **FRP Live Fish Transportation Tank**

Transportation of live fishes in large quantities is always a problem due to lack of proper transporting devices. Use of oxygen filled polyethylene bags is popular among the fish farmers for transportation of fish seed. Transportation of larger fishes including brooders is still a difficult task. Considering the above factors, FRP live fish transportation tank was designed, fabricated and field-tested to cater the needs of fish transportation. It is rectangular in shape (1.6 x 0.8 x 1.0 m) with volume 1,280 l suitable for transporting in a jeep trailer or in a power trailer/trolley. It is provided with a top door of 0.66 x 0.4 m for water filling and loading of fishes, and a rear side door of 0.3x0.25 m at the bottom to drain the water and to release fishes. A vent pipe of 25 mm is provided at the top for facilitating the supply of air / oxygen at the time of necessity. The tank is well suited for transportation of 100 kg live table fishes for marketing. The field trials indicated that the system is suitable to transport live fishes within the radius of 50 km.

### **Fish Seed Transportation Tank**

One seed transportation unit has been fabricated and being tested for reduction in slush intensity, better thermal insulation and in-transport aeration for better survivability of fish seed during long distance transportation. The tank has dimensions as, L×B×H: 1050 x 550 x 650 mm with total water holding capacity of 250 L. For thermal insulation, 50 mm thick thermocol sheet has been embedded in the tank walls. The unit is incorporating critical elements for user friendliness, such as the quick air disconnect and internal drain plug for risk-free transport.

### **Mobile Fish Vending Trolley**

A mobile fish vending trolley has been designed and developed to aid the fisher folks for vending their fish harvests in hygienic condition. It is 4'x2'9"x2'6" in terms of dimension. The specialty of the carriage is its unibody design as all the facilities and equipments are integrated in to it. An ice box of size 2'x2'9"x2'6" is integrated in the carriage box and packed with 1" thick Polyurethane Foam to serve the insulation factor. The icebox can store 80-100 kg of fish in ice which can be sold in a single day by the fisher folks. The cutting tool is made removable and more than one type of cutting tool can be used. There is also provision of water storage tank of around 20 liter capacity and waste collection crate chamber in the carriage. Tool box is also provided for keeping the cutting tools, money box and other items required during the marketing process. The unique selling proposition (USP) of the vending unit is its unibody design. The complete unit of mobile fish vending carriage is fabricated with FRP, because of its high strength compared to other plastics, ease of fabrication and good insulation property of fiberglass. This fish vending trolley is a boon for the marginal fish vendors, who want to sell fish in a hygienic condition.

### **Poly-tent Solar Drier (PSD) for Fish**

Poly tent drier 8' x 8' x 6' has been designed using UV film of 200 micron. It is portable. Highest temperature recorded in a sunny day was 49.4°C and lowest temperature 30°C. Inside temperature of 43-45°C was maintained for four hours. The poly-tent dried maximum load of 200 kg fish silage of moisture 75% up to 30% in three days. In one experiment markendi (small indigenous fish) was tried to develop dry fish in the Polytent solar dryer (PSD). Six hours of active drying (9 AM to 5 PM) was taken for the experiment. During the active drying period, the outside temperature range was 38-44°C; inside temperature 48-56°C and drying rate was calculated to be 60 g/hr. Initial moisture of 75.5% in the markendi fish was reduced to 8.1% after 12 hours of active drying, giving an excellent dry fish.

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## COMMON MOLECULAR MARKERS OF MULTIDRUG-RESISTANT (MDR) BACTERIA

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### ABSTRACT

Therapy of multidrug-resistant (MDR) bacteria has emerged as a major threat to human as well animal health. MDR are increasingly attaining resistance against the most commonly used drugs that has led to a reduced number of reliable options and effective use of currently available anti bacterial agents in combination for effective treatment. This need the development of newer drugs, but it is time taking and costly process. There is a long list of antimicrobial resistant bacteria, however some are of major concern as methicillin resistant *Staphylococcus aureus* (MRSA), vancomycin resistant *Staphylococcus aureus* (VRSA), vancomycin resistant *Enterococcus* spp, extended-spectrum  $\beta$ -lactamases (ESBLs) producing bacteria, multi-drug resistant *Pseudomonas aeruginosa* (PSA), carbapenemase-producing bacteria and multi-drug resistant *Acinetobacter* (ACB). These resistant bacteria may have acquired resistance against one class or group of antibacterials or multiple class or group of antibacterials. MRSA are mostly resistant to penicillin group of antibiotics like methicillin, penicillin, amoxicillin, oxacillin and some may show resistance to cephalosporins. The another group of drug resistant bacteria like multi-drug resistant *Acinetobacter* (ACB) may show resistance to two or more types of drug classes out of five following drug groups of fluoroquinolone, antipseudomonal cephalosporins, aminoglycosides, carbapenems and  $\beta$ -lactam/ $\beta$ -lactamase inhibitors. For obtaining drug resistance these bacteria, adopt different mechanism and produces stress over host system. Both lead to escape of bacteria from therapy as well as host defense mechanism.

**Keywords :** Multidrug resistance, Multi-drug resistant (MDR), Antimicrobial resistance, Bacterial stress, Therapeutic efficacy

To find out new targets to combat the drug resistance, it is mandatory to find the mechanism involved in the current and emerging resistance against commonly used antibiotics. It is a major concern for the treatment of many bacterial pathogens. The most common and prevalent drug resistance is resistance against methicillin in *Staphylococcus aureus*. The drug-resistance of *S. aureus* strain is considered upon acquisition of the *mecA* gene, that encodes the penicillin-binding protein 2a (PBP2a), and its integration within a large chromosomal element, the staphylococcal cassette chromosome *mec* (SCC*mec*). There is evidence that the methicillin sensitive strains of *S. aureus* acquired the SCC*mec* element probably from coagulase negative staphylococcal strains and became methicillin resistant (Robinson and Enright, 2004). With the emergence of MRSA, methicillin became ineffective and, vancomycin became the drug of choice for MRSA (Ng *et al.*, 2011). The excessive use of vancomycin against MRSA led to the emergence of two types of glycopeptides resistant *S. aureus*, vancomycin intermediate *S. aureus* (VISA) and vancomycin resistant *S. aureus* (VRSA) (De souza, 2012). Almost after 40 years of methicillin resistance, the resistance of vancomycin evolved among the *S. aureus*. In 1996, first glycopeptides-intermediate *S. aureus* (GISA) isolate was described in Japan (Hiramatsu *et al.*, 1997) and another one with high resistance to vancomycin was first diagnosed in the USA, which contained both *vanA* gene from enterococci and methicillin resistance *mecA* gene. *vanA* gene is responsible for the high level resistance, which is acquired from vancomycin resistant enterococci, and is the only one detected in *S. aureus*, emerged in Detroit and Michigan in 2002 (Kacica and McDonald, 2004; Courvalin, 2006). The DNA sequence of the *vanA* gene of *Enterococcus faecalis* isolate from a patient was similar to the *vanA* sequence of carries transposon Tn1546 and *vanA* gene cluster from VRSA isolate (Chang *et al.*, 2003). Tn1546 alters cell wall structure and leads to modification of the target site of vancomycin. VRSA exhibits two different resistance mechanisms. Initially, it was believed to be due to the thickened cell wall, which traps the vancomycin molecules, clogging the peptidoglycan meshwork and preventing further entry of vancomycin molecule (Thati *et al.*, 2011). Later it was found due to the presence of operon that encodes for enzymes that produce low affinity precursors D-Ala-D-Lactate or D-Ala-D-Ser, and for enzymes which eliminate the competitive high affinity peptidoglycan precursors produced normally (Courvalin, 2006). These vancomycin resistant genes (*VanA*) were acquired from Vancomycin resistant *enterococcus* (VRE). *Enterococcus* spp. carry an intrinsic resistance against the most of  $\beta$ -lactam antibiotics, clindamycin, fluoroquinolones, trimethoprim/sulfamethoxazole, and aminoglycosides like vancomycin (Arias and Murray, 2012).

The formation of biofilm is another important pathogenic strategy, which decreases the susceptibility to antimicrobial drugs and immune defenses, thereby less option for treatment and ultimately high morbidity and mortality (Foulston *et al.*, 2014). A biofilm is defined as a sessile microbial community in which cells are attached to a surface or to other cells and embedded in a protective extracellular polymeric matrix. The composition of the biofilm matrix varies between strains, but in general can contain host factors, polysaccharide, proteins, and extracellular DNA (eDNA) (Cui *et al.*, 2006; Montanaro *et al.*, 2011;





Garipcin and Seker, 2015). Methicillin-sensitive *S. aureus* (MSSA) strains are supposed to produce an *icaADBC* operon-encoded polysaccharide intercellular adhesin (PIA)-dependent biofilm. Biofilm-embedded bacteria gain resistance to immune defense and antibiotics by antibiotic degrading enzymes, efflux pumps, and certain gene products of which expression are changed by the quorum sensing cause chronic and recurrent infections such as indwelling device-associated infections. Quorum sensing and proteins control the formation of biofilm. These include, such as the intercellular adhesion protein (Ica), the accessory gene regulator (Agr), the biofilm-associated protein (Bap) and the *S. aureus* surface protein (SasC). Following biofilm accumulation, cells within the biofilm can reactivate to a planktonic state through dispersal (Azimianet *et al.*, 2012). Two steps are needed for biofilm formation. In the first step, *S. aureus* attaches to the surface with capsular antigen that known as capsular polysaccharide/adhesion (PS/A). It is facilitated by the expression of different microbial surface components recognizing adhesive matrix molecules (MSCRAMMs) that can bind to different extracellular matrix factors such as elastin, fibronectin A and B, laminin, collagen, fibrinogen and clumping factors. In the next step, multilayered biofilm is formed by multiplication of bacteria. It is related to the production of polysaccharide intracellular adhesion (PIA) (Simojokiet *et al.*, 2012). The intracellular adhesion (*ica*) locus is an operon presents in *S. aureus* and is responsible for synthesis of PIA and PS/A. Among *ica* locus, the *icaA* and *icaD* genes play an important role in the biofilm formation rather than other genes (Vanderhaeghen *et al.*, 2010).

The second group of bacteria that is matter of concern for its resistance is Enterobacteriaceae. These are also known for multi drug resistance and now-a-days also designated as extensively drug resistant (XDR) (Pitout and Laupland, 2008). The resistance is due to presence of number of  $\beta$ -lactamases, Extended Spectrum Beta-lactamases (ESBL's), AmpC's and Carbapenemase (Pitout and Laupland, 2008; Jacoby, 2009). AmpC - lactamases are governed by LAT-1, CMY-2, BIL-1 genes and considered to produce resistance against cephalosporins, penicillins, aztreonam, cephamycins and other cephalosporins in *Enterobacter spp.*, *Shigella spp.*, *Morgenella spp.*, *E.coli*. Similarly in penicillinase or  $\beta$ -lactamases based drug/ antibiotic resistance is also due to certain group of enzymes in *Staphylococcus aureus*, *Haemophilus influenza*, *Moraxella spp.*, *Neisseria spp.*, *Legionella spp.*, *Bacteroides spp.*, *Provetella spp.*, *Porphyromonas spp.* and *Fusobacterium spp.*. These include Carbenicillin-hydrolyzing enzyme for resistance against Penicillins, carbenicillin due to CARB-3, PSE-1 genes. CepA genes provide resistance against Cephalosporins through the production of Cephalosporinases. Carbapenem-hydrolyzing nonmetallo-  $\beta$ -lactamases that are responsible for the resistance against All  $\beta$ -lactams, including carbapenems are governed by KPC, GES, IMI-1, SME genes. Penicillinases are produced by PC1 genes and induces resistance against all the 'enicillins'. Similarly, many of the genes like TEM-1, 2 & 13, SHV-1 & 11, TEM-3, 10 & 26, SHV-2 & 3, CTXM, PER, VEB, TEM-30 & 31, SHV-10 & 72, TEM-50 & 158 have been identified to induce extended broad-spectrum enzymes and govern the resistance against penicillins, cephalothin, cefotaxime, ceftazidime, ceftriaxone, cefepime, monobactams, clavonic acid, sulbactam, tazobactam, oxyimino-cephalosporins. IMP, VIM, IND genes produce Metallo-  $\beta$ -lactamases to provide resistance against All  $\beta$ -lactams, including carbapenems, with exception of monobactams (Hall and Barlow, 2005; Paterson and Bonomo, 2005; Pitout and Laupland, 2008; Jacoby, 2009; Bush and Jacoby, 2010; Vanderhaeghenet *et al.*, 2010; Yadav *et al.*, 2018a,b, Sumanet *et al.*, 2020).

Thus to overcome AMR, understanding the genes involved in the synthesis of protective enzymes and proteins leading to understanding of mechanisms of bacterial response is inevitable to find out suitable drug for successful treatment. Selective inhibition of bacterial translational proteins may be an effective way to break its defence mechanism and that is possible by developing alternative medicines including herbal biomolecules which has complex structure to confuse bacteria to find out way to fight with it. In this way, the use of complex biomolecules particularly of plant origin may lead to the better protection against these pathogens by better bacterial killing and in that way may overcome the rising problem of drug resistance.

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## **PIG FARMING : A TOOL TO ADDRESS THE AGRARIAN CRISIS IN THE FRONT RUNNERS STATES OF GREEN REVOLUTION IN INDIA**

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Punjab and Haryana are the two important agrarian states who played predominant role in green revolution in India. Green revolution, in mid-1960, significantly contributed to make India self-sufficient in food grain production, with quantum increase in production and productivity of wheat and rice. The success of green revolution revolved around introduction of following measures :

1. Introduction of high yielding hybrid varieties.
2. Multiple cropping patterns.
3. Development of surface and ground water irrigation facilities.
4. Mechanization of farm operations.
5. Use of chemical fertilizers, pesticides and insecticides.
6. Assured minimum support price and market for wheat and rice.

Green revolution led a paradigm shift in traditional cropping pattern of this agro climatic zone from wheat/maize/pulses/pearl millet to wheat-paddy. The economic and social benefits of above measures reached plateau in mid 1990s and subsequently the fall out of above measures even raised doubt on sustainability of agriculture and gave rise to new sets of problems like;

1. Loss of plant genetic biodiversity due to introduction of high yielding varieties.
2. Exhaustion of soil nutrients resulting in poor soil health due to indiscriminate use of chemical fertilizers, insecticide and pesticides.
3. Depleting and polluted ground water due to excessive harvesting of ground water for irrigation of water guzzling paddy crop.

These problems are culminating in burning social, economic and environmental issues like polluted and scarcity of ground water, indebtedness of farmers due to decreasing margin of profit in agriculture associated with increasing cost of inputs against saturated level of crop productivity and decreasing land holding over the years and environmental pollution associated with paddy stubble burning and greenhouse gas emission in paddy cultivation.

Agriculture profile of transgangetic plains (Punjab and Haryana) in relation to cropping pattern, irrigation facilities and chemical fertilizers over 1970-71 to 2018-19.

| Parameter                                    | Punjab  |         | Haryana |         | Transgangetic plains<br>(Punjab and Haryana) |         |
|----------------------------------------------|---------|---------|---------|---------|----------------------------------------------|---------|
|                                              | 1970-71 | 2018-19 | 1970-71 | 2018-19 | 1970-71                                      | 2018-19 |
| Total geographical area (thousand square Km) | 50.36   | 50.36   | 42      | 42      | 92.36                                        | 92.36   |
| Total cultivable area (Th ha)                | 3974    | 4158    | 3448    | 3676    | 7422                                         | 7834    |
| Total area under wheat (Th ha)               | 2336    | 3510    | 1129    | 2558    | 3465                                         | 6068    |
| Total area under paddy (Th ha)               | 390     | 3065    | 271     | 1386    | 661                                          | 4451    |
| Cropping intensity (%)                       | 140     | 190     | 139     | 184     | 139.5                                        | 187     |
| Total area under maize (Th ha)               | 548     | 114     | 113     | 6.2     | 661                                          | 120.2   |
| Chemical fertilizers (Thousand MT)           | 213     | 1481    | 70      | 1358    | 283                                          | 2839    |
| Fertilizer application (Kg/ha)               | 54      | 356     | 20      | 369     | 37                                           | 363     |
| Total number of tube wells (lakhs)           | 1.92    | 14.76   | 1.04    | 8.48    | 2.96                                         | 23.24   |
| Tube well density (No./square Km)            | 4       | 29      | 2       | 20      | 5                                            | 25      |
| Total farm holdings (lakhs)                  | 13.75   | 10.93   | 9.13    | 16.28   | 22.88                                        | 27.21   |
| Average size of farm holding (ha)            | 2.9     | 3.77    | 3.8     | 2.2     | 3                                            | 3       |



### Crop diversification

Undisputedly crop diversification, aiming to reduce the area under paddy cultivation in this nontraditional belt of transgangetic plains is immediately required to address the environmental and human health issues arises of depleting water table, soil health and paddy stubble burning, but lack of robust marketing facilities for alternate agriculture produce is major deterrent for farmers for adoption alternate crops. Further, in changing climate

scenario, alternative diversification plan should be comparatively climate tolerant, so that farmers, particularly small and marginal get protection in the event of frequent natural calamities like drought, rain, hailstorms, insect and pest attack etc. Therefore current situation favors, that livestock farming should be in the core of any crop diversification plan.

### Factors favorable for livestock farming in crop diversification plan

| Factor                | Agriculture farming                                                            | Livestock farming                                   |
|-----------------------|--------------------------------------------------------------------------------|-----------------------------------------------------|
| Land Holding          | Continuously decreasing and fragmented land holding and increasing input cost. | Lower land requirement                              |
| Climate vulnerability | More vulnerable to sudden Climate change and losses                            | Less vulnerable to sudden climate change and losses |
| Price stability       | Wide fluctuation in price                                                      | Not much fluctuation                                |
| Employment            | Generate seasonal employment                                                   | Generate employment round the year                  |
| Risk                  | High risk                                                                      | Low risk                                            |

**Pig Farming : An Emerging Opportunity For Crop Diversification :** India with a huge 1380 million human population provides a vast market for animal protein sources, milk, eggs and meat. Traditionally, dairy remained an integral part of crop farming in Indian agriculture system and during the post green revolution period, significant growth of Indian dairy sector resulted in white revolution proved instrumental to provide the employment and income generation to farmers. Now India has emerged world leader in milk production and surpassing the Indian Council of Medical Research (ICMR) recommendations of availability of 300 g milk per person per day with availability 394 g milk per day per person. However, in meat production, there is still a gap of 44 % to achieve recommended availability of 10.95 Kg meat per annum per person (30 g/day) to ensure nutritional security of Indian population. This huge gap in demand and availability in domestic market provides great opportunity for ushering to Pink revolution in Indian agriculture and livestock sector. Therefore in current situation meat animal production has potential for crop diversification and to deal with agrarian economic crises.

| Animal protein source | Per capita ICAR recommendation | Per capita Availability in year 2018-19 | Per capita gap | % gap   |
|-----------------------|--------------------------------|-----------------------------------------|----------------|---------|
| Milk (g/day)          | 300                            | 394                                     | Surplus        | Surplus |
| Egg (per annum)       | 180                            | 79                                      | 101            | 56      |
| Meat (Kg/annum)       | 10.95                          | 6.14                                    | 4.81           | 44      |

Source : ICMR report and BAHS 2019

**Role of Pig in pink revolution and crop diversification :** Due to high growth rate and prolificacy, pig is a natural meat producing animals. Further, due to low initial capital investment and labor requirement, adaptability of pigs to wider feed resources, no losses associated with involuntary culling, disease resistant, high feed efficiency and flexibility in marketing makes pig farming more relevant in current socio-economic scenarios of shirking input resources. Breaking all the social taboos and misconception pig farming on scientific line is getting popular among farmers. It is evident from the fact that over the years cross bred and exotic pig population have increased while indigenous low producing pig decreased. However, higher slaughter rate than birth rate is another indicators of increasing requirement of pork in domestic market.

| Parameter                        | Punjab | Haryana | Both Haryana and Punjab | India    |
|----------------------------------|--------|---------|-------------------------|----------|
| Total pig population (000)       | 53     | 108     | 161                     | 9055     |
| Pig slaughtered (000)            | 19.33  | 153.77  | 173.1                   | 10734.89 |
| Annual Growth rate %             | 13     | -3      | 5                       | -2.5     |
| Pork production (000 tons)       | 1.09   | 7.02    | 8.11                    | 404.46   |
| Total meat production (000 tons) | 231    | 512     | 743                     | 8110     |
| Pork (% of total meat)           | 0.5    | 1.4     | 0.9                     | 5.0      |
| % Annual slaughter rate          | 36     | 142     | 108                     | 119      |
| Average carcass yield (kg)       | 56     | 46      | 47                      | 38       |

Source : BAHS, 2019



**Scope of pig faming :** The growth and prospectus of market oriented intensive livestock production system predominantly determined by demand of livestock product. So far prospects of pig farming in India is concerned, two types of pork market exist, one traditional pork eaters, which are mainly schedule caste, schedule tribe and some Christian population mainly inhabited in eastern, northeastern and southern states of India and another continental market where high quality pork is used in hotels. But in India pork market is still not fully exploited. According to highly conservative approach the projection for scope of pig farming can be determined on the following facts and figures.

|                                                                                                                                                                                                  |                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Current human population in 2018-19                                                                                                                                                              | 1320 million                                                                                                 |
| Traditional pork consuming population around 20% (people from north eastern states, tribal, Christians and other special classes)                                                                | 264 million                                                                                                  |
| Daily pork consumption by traditional pork eating population                                                                                                                                     | 10 g/day                                                                                                     |
| Annual pork requirement of a traditional pork consumer                                                                                                                                           | 365 10 = 3650 g/3.56 Kg                                                                                      |
| Total annual pork requirement                                                                                                                                                                    | 264 3.56 = 963.6 million Kg/thousand tons                                                                    |
| Current pork production                                                                                                                                                                          | 404.6 thousand ton                                                                                           |
| Pork Deficiency                                                                                                                                                                                  | 559 thousand ton                                                                                             |
| Annual production of fattener pigs (No.) if average dressing percentage 70% and marketing weight is 100 Kg)                                                                                      | 559000000 Kg pork /70 Kg pork per pig = approx. 80 lakhs additional fatteners pigs to be produced per annum. |
| Additional number of breeding sows required (average weaning litter size 9, farrowing index 2, and post weaning mortality 1) so 16 marketing pigs will be produced by one breeding sow per year) | 5 lakhs                                                                                                      |
| Additional number of breeding boars required, if sow : boar ratio (10 : 1)                                                                                                                       | 50 thousands                                                                                                 |
| Total additional pig population required                                                                                                                                                         | 85.5 lakhs                                                                                                   |
| Current pig population                                                                                                                                                                           | 90.55 lakhs                                                                                                  |
| Optimum pig population                                                                                                                                                                           | Approx. 179 lakhs                                                                                            |
| Optimum pig population density (pig/10000 humans)                                                                                                                                                | Approx. 14 pigs /1000 human heads                                                                            |

**Scope of pig farming for diversification of paddy :** In order to achieve optimum pig population density of 14 pigs per 1000 human heads in Punjab and Haryana, corresponding to total human population, projected scope of pig production can be determined as per following facts.

|                                                                                                         |                                                                                            |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Total human population of transgangetic states of Punjab and Haryana                                    | 59.06 million                                                                              |
| Additional pig production to achieve the optimum pig population density of 14 pigs per 1000 human heads | Fatteners of 100 kg body weight = 826840<br>Breeding Boars = 5100<br>Breeding sows = 51000 |
| Feed requirement                                                                                        |                                                                                            |

| Type of animal                                                            | Feeding days                    | Feed/day (Kg) | Number of animals | Total feed required (Kg) |
|---------------------------------------------------------------------------|---------------------------------|---------------|-------------------|--------------------------|
| Boar                                                                      | 365                             | 3             | 5,100             | 55,84,500                |
| Pregnant and Lactating sow                                                | 240                             | 5             | 51,000            | 61,200,000               |
| Dry sow                                                                   | 125                             | 3             | 51,000            | 19,125,000               |
| Total feed required by one fattener to achieve marketing weight of 100 Kg | 300                             | 8,26,840      | 28,40,52,000      |                          |
| Total feed required (Kg)                                                  |                                 | 36,99,61,500  |                   |                          |
| Maize required @ 50% of total feed (Kg)                                   | 18,49,80,750 (185 million tons) |               |                   |                          |
| Land required (hectare) (average maize productivity, 3400 Kg/ha)          | Approx. 54400                   |               |                   |                          |

Minimum around 21580 hectare land in the Punjab and Haryana under paddy cultivation can be shifted to cultivate maize for pig production. This strategy will minimize the cost of pig production, solve the problem of marketing of maize, value addition of production chain, employment generation along with helping in water conservation, energy saving, mitigating green house gas emission, paddy burning.





### **Impact assessment for substituting paddy with maize for pig production :**

#### **Water saving :**

| Parameter                                                                                               | Paddy | Maize |
|---------------------------------------------------------------------------------------------------------|-------|-------|
| Crop yield per hectare                                                                                  | 6167  | 3400  |
| Comparative water requirement for cultivation of per kg crop (liter)                                    | 1704  | 283   |
| Total water requirement per hectare (cubic meter)                                                       | 10505 | 962   |
| Water saving per hectare (cubic meter)                                                                  | 955   |       |
| Total water saving for substitution of 54400 hectare land under paddy with maize (thousand cubic meter) | 51552 |       |

An average Indian daily requires around 135 liters of water. Above saved water can meet out the annual requirement of around 10.60 lakhs persons.

**Energy saving :** There are around 25 tube wells per square kilometer area in trans-gangetic states of Punjab and Haryana for harvesting of ground water for irrigation of water guzzling paddy crop.

| Parameters                                                                                       | Paddy    | Maize  |
|--------------------------------------------------------------------------------------------------|----------|--------|
| Total tubewell operation time for irrigation of one hectare land for cultivation of crop (hours) | 252      | 35     |
| Electricity consumption by 10 HP tubewell                                                        | 1879.92  | 261.10 |
| Electricity cost @ Rs. 8 per unit                                                                | 15039.36 | 2088.8 |
| Total saving after for irrigation of one hectare land (Rs.)                                      | 12950    |        |

A total of Rs. 7045 lakhs can be saved with substitution of 54400 hectare land under paddy in these two states with maize.

**Green house gas emission :** Green house gas emission is associated with paddy cultivation and paddy straw burning. The submerged conditions in paddy fields are actively involved in methane production. The submerged rice fields, characterized by oxygen depletion due to high moisture and relatively high organic substrate levels, offer an ideal environment for the activity of methanogenic bacteria. Application of organic materials also increases methane emission from rice fields. Yagi and Minami (1990) observed that application of rice straw to rice fields increased methane emission rates. On an average 8447.59 Kg greenhouse gases are produced for cultivation of one hectare paddy. Therefore for reduction of paddy cultivation in 21580 hectare area in Punjab and Haryana alone can directly annually reduce the atmospheric load of approximately 1.82 lakh tons of greenhouse gases. According to a report of committee on crop residue management, ministry of agriculture, Govt. of India, around 28.10 million tons of paddy straw was produced in Punjab and Haryana during the year 2018-19. It is estimated that burning of one ton of paddy straw accounts for loss of 5.5 kg Nitrogen, 2.3 kg phosphorus, 25 kg potassium and 1.2 kg Sulphur besides, organic carbon. Generally crop residues of different crops contain 80% of Nitrogen (N), 25% of Phosphorus (P), 50% of Sulphur (S) and 20% of Potassium (K). If the crop residue is incorporated or retained in the soil itself, it gets enriched, particularly with organic C and N. Heat from burning residues elevates soil temperature causing death of beneficial soil organisms. Frequent residue burning leads to loss of microbial population and reduces level of N and C in the top 0-15 cm soil profile, which is important for crop root development. Crop residues burning is a potential source of greenhouse gases (GHGs) and other chemically and radioactive important trace gases and aerosols such as CH<sub>4</sub>, CO, N<sub>2</sub>O, NO<sub>x</sub> and other hydrocarbons. It is estimated that upon burning, Carbon (C) present in rice straw is emitted as CO<sub>2</sub> (70% of Carbon present), CO (7%) and CH<sub>4</sub> (0.66%) while 2.09% of Nitrogen (N) in straw is emitted as N<sub>2</sub>O. Besides, burning of crop residue also emits large amount of particulates that are composed of wide variety of organic and inorganic species. Many of the pollutants found in large quantities in biomass smoke are known or suspected carcinogens and could lead to various air borne/lung diseases. Further substitution of area under paddy with maize will help to some extent to reduce the problems associated with paddy burning in the region.

Therefore paddy for maize and pig for meat and manure is quite relevant to deal with current social, economic and environmental issue of predominant agriculture based economy of Punjab and Haryana and need policy, institutional and financial support for effective implementation of above suggested measures.



## MILLETS-21ST CENTURY SMART FOOD CROPS

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### INTRODUCTION

Climate change, global warming” are the most chanting words nowadays, among the environmentalists and scientific community. Climate change, is the change in the weather parameters viz. temperature, rainfall-amount and distribution, wind velocity, etc., in a manner that is not favourable for life of organisms on earth. Climate change has deleterious effect on both human welfare and agriculture production. Humans however can escape those effects through his intelligence, while crops suffer a lot by climate change, resulting in lower yields and reduced quality of the produce (Theerthankaret *et al.*, 2017). This results in increased malnutrition and insufficiency of food for the increasing population. Researchers are looking for novel ways to combat the adverse climatic effect on agriculture sector, which is feeding the whole world.

Major cereals viz., rice, maize, wheat, etc., have dominated the agriculture sector with their capability of meeting raising food demands due to their high potentiality, yet fail to yield sustainably under changing climate (Cheng *et al.*, 2017). India ranks second in the incidences of malnutrition among children and more than one third of the world’s malnourished children live in India (Nainwal *et al.*, 2018). The major cereals are deficient in many of the nutritional factors, hence cannot check the nutritional balance that are essential components of one’s daily diet for being healthy. Scientists/researchers have concluded that cultivation of alternate crops that can potentially meet nutritional security and can yield sustainably even under varied climate is the only best option to overcome the dominance of the major cereals.

Millets are one of the oldest foods known to humans & possibly the first cereal grain to be used for domestic purposes. Millets are the small-seeded grasses that belongs to the family, Poaceae/Graminae. There are two major millets (sorghum and bajra) and six minor millets (finger millet, foxtail millet, little millet, proso millet, kodo millet and barnyard millet). Recently few more minor millets have been added to this group viz., tef, fonio, quinoa and browntop millet (IIMR, 2020) (Table-1). Since centuries, millets have been a prized crop in India and are staple diet for nearly 1/3<sup>rd</sup> of the world’s population. Millets have potentiality of contributing to increase food production, both in developing and developed countries. Millets are most commonly available in the form of pearled and hulled kind. Millets are tasty grains that have a mildly sweet, nut-like flavour. Millets are amazing in their nutrient content and are commonly known as “nutri-cereals or nutri-millets”.

### Millets Statistics

Millets are most likely to be originated from and around India where they are largely cultivated with a production of 10.91 m t and stand first among the top ten countries having largest area under millet cultivation. In India, Rajasthan stands first in production of millets with a production of 6.57 m t from 5.91 m ha (Indiastat, 2018). Karnataka state is majorly known for cultivation of minor millets in India with finger millet (recently Karnataka awarded with the GI tag for finger millet by central government) as staple food in southern parts (Table-2).

**Table-1** : Top 10 millet producers in the world.

| Country      | Production (m t) |
|--------------|------------------|
| India        | 10.91            |
| Nigeria      | 5.00             |
| Niger        | 2.955            |
| China        | 1.620            |
| Mali         | 1.152            |
| Burkina faso | 1.109            |
| Sudan        | 1.090            |
| Ethiopia     | 0.807            |
| Chad         | 0.582            |
| Senegal      | 0.572            |
| World        | 29.87            |

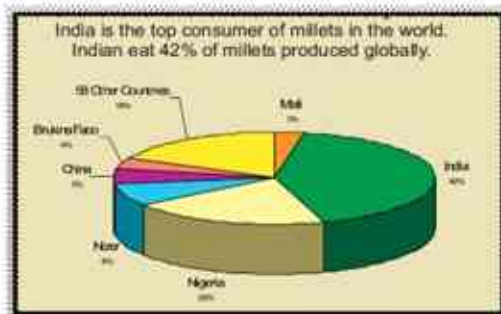
Source : Indiastat, 2018



Millets are the indispensable constituents of Indian traditional foods because of their taste and nutritional aspects. Hence, India is the major consumer of millets (Fig.-1) since ages and is the main reason for healthy being of Indians consuming the nutritionally rich food made of millets.

### Importance/Benefits of Millet Cultivation

**Agronomic :** Short duration (crop duration varies from 75-110 days) of the millets has greater advantage in growing them as catch crops (efficient utilization of resources) and best suited one's under water scarce conditions (escapes water scarcity at later stages by maturing early). Millets have high water productivity as compared to other crops (finger millet-13.4, sorghum-9.0, pearl millet-8.0 and rice-3.0 kg ha<sup>-1</sup>) (Yellamanda Reddy and Sankara Reddy, 2016). These characters make them highly tolerant to aberrant weather. Grains can be stored for more than two years and hence, are known as 'famine reserves'. Sahu (1965) stated that the millets are the crops that have potentiality of contributing to increased food production, both in developing and developed countries. Millets are grown under harsh environmental conditions. Some of them are best suited to high soil moisture and drought situations. Thus, they do not burden the state with demands for irrigation or power (Koleet al., 2015). Millets are adapted to a wide range of ecological conditions often growing on skeletal soils that are less than 15 cm deep (Tilahun, 2004). It does not demand rich soils or inputs for their survival and growth. Hence, for the vast dry land area, they are a boon. They have remarkable rejuvenation capacity and recover very fast once the moisture stress conditions are alleviated (Adekunle, 2012). These millets are grown under traditional methods and no millet attracts any pest. They can be termed pest-free crops. A majority of them are not affected by storage pests either. Therefore, their need for pesticides is close to nil. Thus, they are a great boon to the agricultural environment.



Source : Indiastat, 2018.

Fig.-1 : Global millet consumption pattern.

Table-3 : Millets common and scientific names with their special characters

| Sr. No. | Millets         | Scientific name               | Vernacular names                                 | Special characteristics                                                |
|---------|-----------------|-------------------------------|--------------------------------------------------|------------------------------------------------------------------------|
| 1.      | Sorghum         | <i>Sorghum bicolor</i>        | Jowar, jowari, durra, great millet               | Known as camel of dryland                                              |
| 2.      | Pearl millet    | <i>Pennisetum glaucum</i>     | Bajra, saje, kambu, kambam, sajjalu              | Highly tolerant to drought, heat and soil salinity                     |
| 3.      | Finger millet   | <i>Eleusine coracana</i>      | Ragi, mandua, kapa, marua, nagli                 | Wider adaptability, rich source of calcium                             |
| 4.      | Proso millet    | <i>Panicum miliaceum</i>      | Cheena, baragu, panivaragu                       | Short duration tolerant to heat and drought                            |
| 5.      | Foxtail millet  | <i>Setaria italica</i>        | Navane, kauni, kangni, korra, rala               | Short duration, tolerant to low soil fertility and drought             |
| 6.      | Little millet   | <i>Panicum sumatrense</i>     | Same, samai, samulu, kutki                       | Short duration, withstand both drought and waterlogging                |
| 7.      | Barnyard millet | <i>Echinochloa colona</i>     | Sawan, oodalu, jhingora                          | Fastest growing and voluminous fodder                                  |
| 8.      | Kodo millet     | <i>Paspalum scrobiculatum</i> | Kodo, varagu, haraka, arikalu                    | Long duration, grown well in shallow and deep soil                     |
| 9.      | Teff grass      | <i>Eragrostis tef</i>         | Williams Love grass, teffa                       | Ethiopian staple food, high market price                               |
| 10.     | Quinoa          | <i>Chenopodium quinoa</i>     | Inca wheat, goosefoot, pigweed                   | Nutritionally rich                                                     |
| 11.     | Fonio millet    | <i>Digitaria exilis</i>       | Findi/fundi, white fonio, acha rice, hungry rice | Long panicles, erect habit, long stem, strong and resistant to lodging |
| 12.     | Browntop millet | <i>Brachiaria ramosa</i>      | Baragu                                           | Nutri rich                                                             |

Source : IIMR, 2020

**Nutritional :** Each of the millets is three to five times nutritionally superior to the widely promoted rice and wheat in terms of proteins, minerals (calcium and iron) and vitamins and fibre hence, are known as "super foods" (Amadou et al., 2013). Millets are the ideal food group for all the people irrespective of age. Calcium and iron are essentially required for growing children, pregnant and lactating women who are more sensible for anaemic condition. Among all food crops, finger millet has a higher calcium (344 mg per 100 g) and that of in foxtail millet (12.9 mg per 100 g) followed by little millet (10.0 mg per 100 g) (Veenae et al., 2005). Millets provide energy for a long time due to slow digestion, which makes them best diabetic food. The

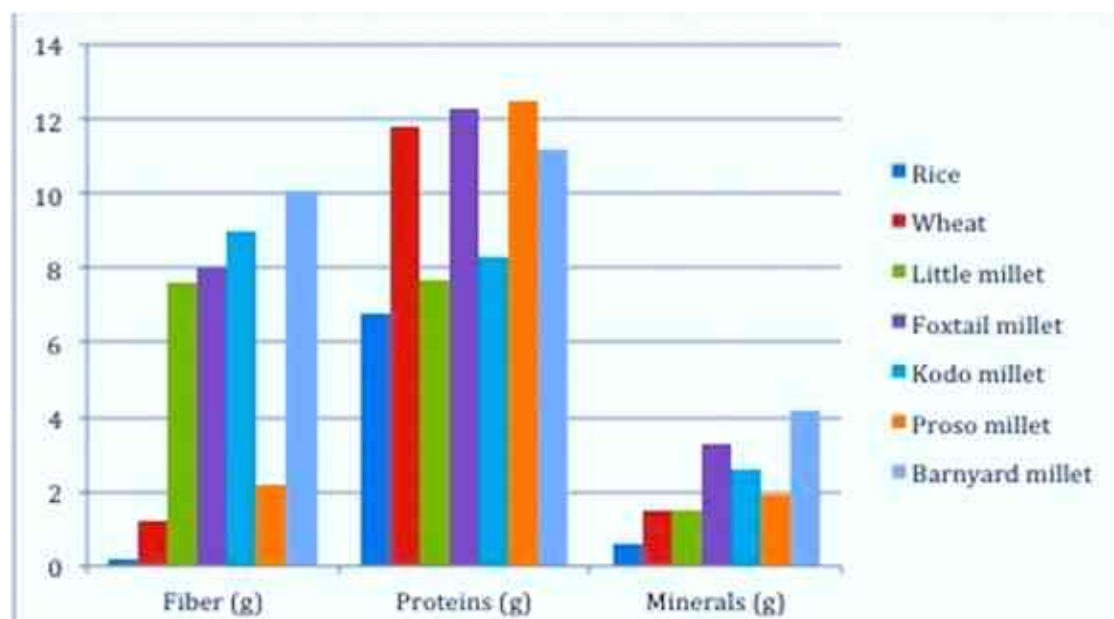


millets are 'free of gluten'- wheat protein that is responsible for celiac disease (damage of the small intestine), is being seen predominately in western countries due to consumption of wheat (Nainwalet *et al.*, 2018). These millets have diversified high food value but the consumption of these millets is being declined due to lack of standardized processing techniques to compete with fine cereals. Recently these millet products are marketed as 'health foods'- to increase the utilization of small millets in popular foods. Small millet-based value-added products including traditional recipes, bakery products, pasta products, flaked and popped products instant food mixes were developed and standardized.

**Table-4 :** Nutrient content of millets (per 100 g)

| Crop/nutrient   | Protein (g) | Fiber (g) | Minerals (g) | Iron (mg) | Calcium (mg) |
|-----------------|-------------|-----------|--------------|-----------|--------------|
| Sorghum         | 10          | 4         | 1.6          | 2.6       | 54           |
| Pearl millet    | 10.6        | 1.3       | 2.3          | 16.9      | 38           |
| Finger millet   | 7.3         | 3.6       | 2.7          | 3.9       | 344          |
| Foxtail millet  | 12.3        | 8         | 3.3          | 2.8       | 31           |
| Proso millet    | 12.5        | 2.2       | 1.9          | 0.8       | 14           |
| Kodo millet     | 8.3         | 9         | 2.6          | 0.5       | 27           |
| Little millet   | 7.7         | 7.6       | 1.5          | 9.3       | 17           |
| Barnyard millet | 11.2        | 10.1      | 4.4          | 15.2      | 11           |
| Browntop millet | 11.5        | 12.5      | 4.2          | 0.65      | 0.01         |
| Quinoa          | 14.1        | 7         | -            | 4.6       | 47           |
| Teff            | 13          | 8         | 0.85         | 7.6       | 180          |
| Fonio           | 11          | 11.3      | 5.31         | 84.8      | 18           |
| Rice            | 6.8         | 0.2       | 0.6          | 0.7       | 10           |
| 5 Wheat         | 11.8        | 1.2       | 1.5          | 5.3       | 41           |

Source : IIMR, 2020



**Socio-economic :** Along with many agronomic and nutritional aspects, millets cultivation also helps in uplifting the socio-economic status of the small/marginal and medium farmers. Cultivation of millets is an integral part of integrated farming system. Millets cultivation helps in getting an average of Rs. 11,506 and 12,116 ha<sup>-1</sup> net returns (little millet and foxtail millet) under dryland conditions (Amban Gouda *et al.*, 2019). Nearly 2 to 3 times higher returns than the money invested in millet cultivation can be obtained under better management of agronomic practices *viz.*, fertilizer, irrigation, spacing, date of sowing, etc. (Ambresha, 2017 and Shankar, 2017). Apart from this, millets cultivation is environment friendly because of lesser pollution involved in its cultivation which requires less amount of external chemical fertilizers, herbicides and pesticides which are essentially required by major cereals, hence, polluting the environment and ultimately adding to climate change.



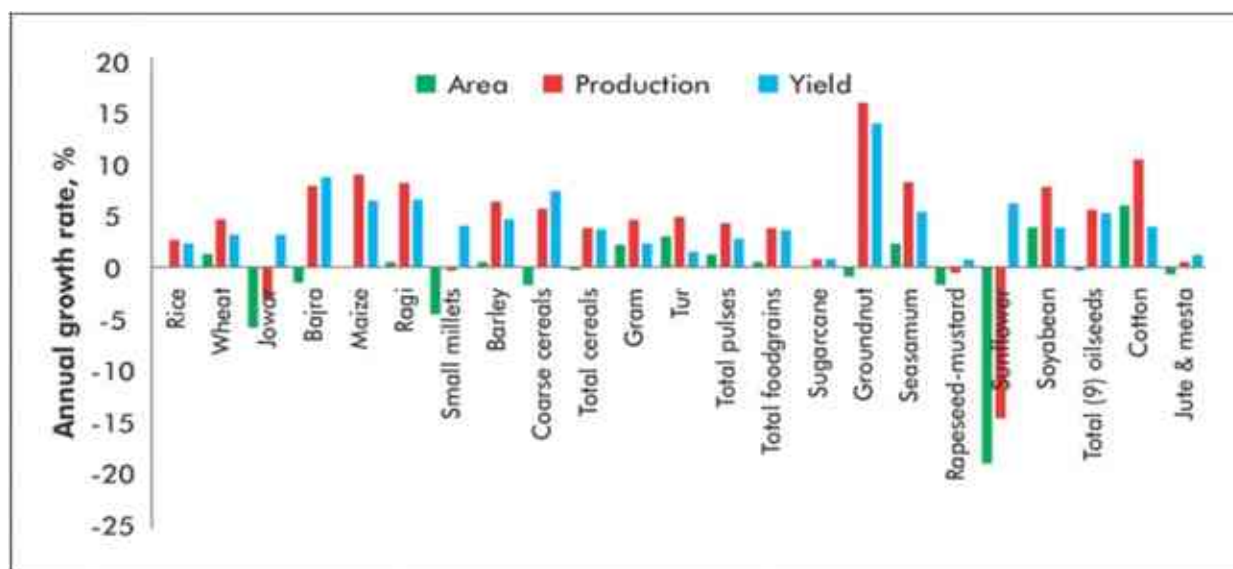


Fig.-2 : Annual growth rate in area, production and productivity of different crops.  
(Source : Indiatat, 2018)

Some of the factors hindering the popularization of millets Production constraints :

- Grown on poor shallow and marginal soils under rainfed conditions.
- Often broadcast - major bottle neck in taking inter-cultivation operation and effective weed control.
- Non adoption of improved varieties.
- Non adoption of recommended practices.
- Lesser use of manures and fertilizers.
- Commercialization in today's agriculture.
- Research on crop improvement and agro-techniques was neglected till recently.

Nowadays farmers are much interested in commercial agriculture and are replacing the sustainable crops with cash crops, hence, area under millets is decreasing day by day (Michaelraj and Shanmugam, 2013; Durgadet al., 2019).

Factors responsible for lower consumption :

- Lack of regular supply due to less preference.
- Availability of cheap and preferred millets.
- Marketing channels were not well developed between producing areas and consumption.
- Food aid systems like public distribution system which supply cereals readily.
- Higher social prestige associated with the consumption of rice and wheat.

On the darker side, these crops have been included under "Orphan crop" list, due to lack of trade across the world. Government is trying hard to encourage cultivation of such nutri-millets through different schemes, and introducing new generation nutri-millets that are both nutritionally rich and can fetch higher price for the farmer viz., teff millet, chia, brown top millet, quinoa, etc., in order to dissect the social stigma attached to these crops as "food for the poor" and to overcome malnutrition among the community.

## CONCLUSION

Millets are the amazing crops suited best for dryland soils. These can yield sustainable even under aberrant weather conditions (climate of twenty first century) where most of the major crops fail. These are nutritionally rich and helps in overcoming malnutrition and food insecurity. Though, millets cultivation is advantageous, the research in improving the age-old cultivation practices is still at infant stage and this needs to be concerned much in order to popularize these healthy foods. Recently introduced millets fetches higher market value (than even major cereals) and hence, help in uplifting the socio-economic status of the marginal farmers under dryland conditions.





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## STRATEGIES FOR MANAGEMENT OF ACARICIDE RESISTANCE IN CATTLE TICKS

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### Introduction

The haematophagous arthropods, ticks are widely distributed in the tropical and sub-tropical countries and account for heavy production losses in animals (Alonso-Díaz *et al.*, 2021). The ticks attach to animals of all age groups and harm them in a number of ways. Ticks and the diseases they transmit cause great economic losses to livestock (Angus, 1996; Andreottiet *et al.*, 2015; Morel *et al.*, 2017). Heavy infestation of cattle ticks produces anaemia, reduced growth rates, milk production, anorexia, hide damage and even mortalities. The ticks also act as vectors for transmission of some very important protozoan and rickettsial diseases of domestic animals like babesiosis, theileriosis and anaplasmosis (Foucheet *et al.*, 2016). Ticks cause annoyance, restlessness and tick worry in animals. The global loss due to ticks and tickborne diseases (TTBDs) was assessed to be between US\$ 13.9 and 18.7 billion every year (De Castro, 1997) while in India the cost of controlling TTBDs has been estimated as US\$ 498.7 million (Minjauw and McLeod, 2003) annually. Cattle and buffalo calves below one year of age are the most affected, followed by grownups (1-3 years) and then the adults (above one year). Crossbred and exotic breeds of animals are more infested as compared to indigenous breeds.

In India, tick control is mainly limited to the application of synthetic chemical products. Deltamethrin (Swaidet *et al.*, 2013; Anand *et al.*, 2021), fenvalerate and cypermethrin (Yadav *et al.*, 2017; Kumar *et al.*, 2019), flumethrin (Roy *et al.*, 2005) are the commonly used synthetic pyrethroids against ticks. Other acaricides include ivermectin (Kumar *et al.*, 2005), amitraz (Singh *et al.*, 2007) and closantel (Yadav *et al.*, 2017). Newer compounds like milbemycins, development inhibitors like fluazuron and fipronil (Amithamolet *et al.*, 2012) are also becoming popular in India. However, the indiscriminate use of chemical acaricides not correlated with epidemiology along with incorrect concentration has resulted in emergence of acaricide resistance (Aguilar *et al.*, 2018). Acaricide resistance is one of the main reasons for the failure to control ticks.

### Status of Acaricide Resistance

Resistance of ticks to a particular acaricide is evident when their susceptibility to it is reduced despite being used at recommended concentration and according to all recommendations for its use (FAO, 2004).

### Global Scenario

The first report of acaricide resistance in cattle ticks was against the one host tick i.e. *Rhipicephalus (Boophilus) microplus* which came from Australia where the ticks showed resistance to arsenicals in 1937 (George *et al.*, 2004), followed by reports from South Africa (Yilma *et al.*, 2001), Columbia, Brazil and Mexico (Rodriguez-Vivas *et al.*, 2012). *R. microplus* developed resistance to organochlorines like DDT at the end of the 1940s (Whitehead, 1956, 1958) and organophosphates during 1970s (Miller *et al.*, 2005) in Latin America. Cases of ticks especially *R. microplus* developing resistance to several classes of acaricides are well documented. At present, *R. microplus* is resistant to all the acaricides used including synthetic pyrethroids, formamidines (Li, 2004) macrocyclic lactones (Martins and Furlong, 2001; Klafke *et al.*, 2006) and phenylpyrazoles (Miller *et al.*, 2008). *R. microplus* has shown greatest tendency to develop resistance amongst ticks probably because it is a single host tick and all its stages (larva, nymph and adult) remain exposed to acaricidal treatments for prolonged periods (Baffi *et al.*, 2007). *R. microplus* been reported to be resistant to synthetic pyrethroids in Mexico (Li *et al.*, 2007); deltamethrin and amitraz in New Caledonia (Barre *et al.*, 2008); cypermethrin, deltamethrin and chlorpyrifos in Brazil (Mendes *et al.*, 2011); synthetic pyrethroids (flumethrin, deltamethrin and cypermethrin), organophosphates (chlorpyrifos and diazinon), ivermectin and amitraz in Mexico (Fernandez *et al.*, 2012); cypermethrin, chlorpyrifos, amitraz, fipronil and ivermectin from Brazil (Klafke *et al.*, 2017); synthetic pyrethroids from Iran (Ziapour *et al.*, 2017).

### Acaricide Resistance in India

Chaudhuri and Naithani (1964) reported resistance in ticks for the first time in India. Resistance was observed in ticks which infested the cattle kept at Latoli kraal (night yards) of Indian Veterinary Research Institute (IVRI), Mukteswar in the Kumaon region of Uttarakhand state. Reduced efficacy to BHC was observed in 1960. After series of *in vivo* tests, it was established that the ticks were resistant to BHC. Thereafter, acaricide resistance in ticks has been reported from different parts of the country (Table-1).



**Table-1 : Status of Acaricide Resistance in Ticks in India.**

| S. No. | Place (State)                       | Tick                                               | Name of Acaricide                      | Reference                    |
|--------|-------------------------------------|----------------------------------------------------|----------------------------------------|------------------------------|
| 1.     | Hisar (Haryana)                     | <i>Hyalomma anatolicum anatolicum</i>              | Dieldrin                               | Sangwan <i>et al.</i> (1993) |
| 2.     | -                                   | <i>Rhipicephalus (Boophilus) microplus</i>         | Carbaryl                               | Basu and Haldar (1997)       |
| 3.     | Ludhiana (Punjab)                   | <i>R.(B.) microplus</i>                            | Malathion, Diazinon                    | Rath <i>et al.</i> (2006)    |
| 4.     | Ludhiana (Punjab)                   | <i>R.(B.) microplus</i>                            | Deltamethrin, Cypermethrin             | Singh <i>et al.</i> (2010)   |
| 5.     | Uttarakhand                         | <i>R.(B.) microplus</i>                            | Deltamethrin                           | Vatsya and Yadav (2011)      |
| 6.     | Uttarakhand                         | <i>R.(B.) microplus</i>                            | Deltamethrin                           | Vatsya <i>et al.</i> (2012)  |
| 7.     | Uttarakhand                         | <i>R.(B.) microplus</i>                            | Deltamethrin, Cypermethrin             | Swaid <i>et al.</i> (2013)   |
| 8.     | Ludhiana, Punjab                    | <i>R.(B.) microplus</i>                            | Malathion                              | Jyoti <i>et al.</i> , (2014) |
| 9.     | Bihar                               | <i>R.(B.) microplus</i>                            | Deltamethrin, Diazinon<br>Cypermethrin | Ghosh <i>et al.</i> (2015)   |
| 10.    | Gujarat                             | <i>R.(B.) microplus</i>                            | Deltamethrin, Flumethrin,<br>Fipronil  | Shyma <i>et al.</i> (2015)   |
| 11.    | Gujarat                             | <i>H. a. anatolicum</i>                            | Amitraz,<br>Cypermethrin               | Singh <i>et al.</i> (2015)   |
| 12.    | Ludhiana, Punjab                    | <i>R.(B.) microplus</i>                            | Ivermectin                             | Singh <i>et al.</i> (2015)   |
| 13.    | Nagpur, Sakleshpur<br>(Maharashtra) | <i>R.(B.) microplus</i>                            | Synthetic Pyrethroids                  | Lenka <i>et al.</i> (2016)   |
| 14.    | Hisar (Haryana)<br>Rajasthan        | <i>R.(B.) microplus</i><br><i>H. a. anatolicum</i> | Deltamethrin, Diazinon                 | Gaur <i>et al.</i> (2016)    |
| 15.    | Uttar Pradesh                       | <i>R.(B.) microplus</i>                            | Deltamethrin,<br>Cypermethrin          | Kaur <i>et al.</i> (2017)    |
| 16.    | Haryana                             | <i>H. a. anatolicum</i>                            | Cypermethrin,<br>Deltamethrin Amitraz  | Surbhi <i>et al.</i> (2018)  |
| 17.    | Ludhiana, Punjab                    | <i>R.(B.) microplus</i>                            | Ivermectin                             | Singh <i>et al.</i> (2019)   |
| 18.    | Uttar Pradesh                       | <i>R.(B.) microplus</i>                            | Deltamethrin,<br>Cypermethrin          | Kumar <i>et al.</i> (2019)   |
| 19.    | Kerala                              | <i>R.(B.) microplus</i> <i>R. sanguineus</i>       | Deltamethrin                           | Anand <i>et al.</i> (2021)   |

### Diagnosis of Acaricide Resistance

There are several methods of diagnosing acaricide resistance in ticks in cattle. The Laboratory Bioassay Techniques include the Larval Packet Test (LPT) (Stone and Haydock, 1962), Larval Immersion Test (LIT) (Shaw, 1966) and Adult Immersion Test (AIT) (Whitnall and Bradford, 1947). The conventional LPT bioassays are suitable for isolation and characterization of laboratory reference strains and also to establish base line data for an acaricide. But LC<sub>50</sub> values cannot be used to predict tick control failure especially in a population in early stage of developing resistance (Foil *et al.*, 2004). The bioassay takes a minimum of 6 weeks and also fails to reveal the genetics of the tick and identify the mechanism of resistance unless synergist studies are conducted. Synergist compounds like triphenyl phosphate (TPP) (esterase activity inhibitor), piperonylbutoxide (PBO) (cytochrome P450 oxidase inhibitor) and diethyl maleate (DEM) (glutathione S-transferase inhibitor) have been used in conjunction with acaricides to assess the role of different metabolic enzymes in imparting acaricide resistance in ticks (Chevillon *et al.*, 2007). Several biochemical techniques like gel filtration chromatography followed by isoelectric focusing, native PAGE gels, DEAE-Sephacel anion-exchange fractionation, comparison of the electrophoretic profiles of protein extracts have been used to demonstrate the acaricide resistance in ticks (De Jersey *et al.*, 1985; Jamrozet *et al.*, 2000; Cossio-Bayugaret *et al.*, 2008). Molecular assays are also employed to diagnose acaricide resistance (Amrutha *et al.*, 2021). Molecular techniques are valuable in that they reveal the genetics of the tick. Guerrero *et al.* (2001) developed an allele-specific PCR assay to genotype pyrethroid resistant *R. microplus*. With this assay, they genotyped individual tick larvae



for the presence of Phe<sup>?</sup>Ile<sup>a</sup>. substitution in S6 transmembrane segment of domain III of para like sodium channel and thus were able to distinguish homozygous and heterozygous larvae. The results of LPT bioassays and PCR analysis were found to be consistent. Molecular assays fail to reveal the phenotypic character of a tick population. They can detect genotypes at known sites responsible for conferring resistance or else the tick populations would be diagnosed as susceptible genotypes (Willadsen, 2006). This means that while diagnosing acaricide resistance, both the conventional LPT assays along with synergist studies and molecular tests should be conducted.

#### **Acaricide Resistance: Mechanisms**

Arthropods resist the action of pesticides by metabolic detoxification, target site modification, increased and sequestration (or lowered availability) of the drug (Foil *et al.*, 2004; Cossio-Bayugar and Miranda-Miranda, 2009). Metabolic detoxification of acaricides is known to be mediated by multigene- families of enzymes such as GST, Esterases and Mixed Function Oxidases (cytochrome P450) besides the target site insensitivity on the sodium channel and acetylcholinesterase genes. The cytochrome P450s, esterases, and glutathione S-transferases are the enzyme families generally involved in causing metabolic resistance and this type of resistance phenomenon has been studied in *R. (B.) microplus* (Chen *et al.*, 2009).

Two types of resistance mechanisms have been described in *R. microplus* – enhanced metabolic detoxification (Jamrozet *et al.* 2000) and target site insensitivity resulting from sodium channel point mutation (Guerrero *et al.* 2001). Mutations in sodium channel gene (Phe<sup>?</sup>Ile substitution) have been reported in tick strains exhibiting high resistance to pyrethroids and those in esterase gene (Asp<sup>?</sup>Asn substitution) in ticks with moderate resistance (Chen *et al.* 2009). Target site mutations are more common mechanisms of pyrethroid resistance and a single mutation in the sodium channel may end in high level of resistance (Foil *et al.* 2004). Existence of more than two mechanisms in tick populations has also been reported. Synergist studies conducted to monitor the status of deltamethrin resistance in field populations of *R. (B.) microplus* from different geographical locations of Uttarakhand state in northern India and mechanisms involved therein revealed the likely involvement of monooxygenases (minor role) and esterases in the resistant phenotypes of ticks (Vatsya and Yadav, 2011). Allele-specific polymerase chain reaction has also been employed to detect Phe<sup>?</sup>Ile substitution in the sodium channel gene in different populations of *R. microplus* collected from foothills of Uttarakhand state (Vatsya *et al.*, 2012).

#### **Factors involved in resistance development**

According to Frago and Soberanes (2001), development of acaricide resistance occurs in three phases – (a) Establishment phase – which occurs naturally independent of selection pressure and is due to the presence of resistant alleles in a population (b) Development phase – occurs when the number of resistant individuals in a population increases even after use of acaricides (c) Emergency phase – arises following enhanced selection pressure by ticks. The number of resistant alleles in a population is high enough to escape the toxic effect of acaricide. Several factors affect acaricide resistance in ticks like:

#### **Genetic factors-Gene frequency and selection pressure**

- Dominance of resistance alleles
- Number of genes involved
- Initial frequency of resistance genes

#### **Operational/Managemental factors**

- Cross resistance
- Drug persistence in host
- Chemical nature and quality of drug
- Drug clearance kinetics
- Mode of application of acaricides
- Frequency and timing of treatments
- Alternative approaches of control
- Under dosing
- Frequent use of the same acaricide for a long period





### Tick Type - (One host, twohost or three host) :

Acaricide resistance is a heritable trait that develops rapidly in a population with high gene frequency for resistance and increased exposure to selection pressure (Mitchell, 1996). It has been observed more in the one-host cattle tick like *R. microplus* compared to two or three host ticks. *R. microplus* has shown greatest tendency to develop resistance amongst ticks probably because it is a single host tick and all its stages (larva, nymph and adult) remain exposed to acaricidal treatments for prolonged periods (Baffi *et al.* 2007). Frequent acaricide treatments coupled with the mode of application play a key role in mediating development of resistance. The suppressive approach of acaricidal treatments provides instant relief from ticks but exerts heavy selection pressure on ticks for that acaricide. In the threshold approach, acaricide is applied when the tick infestation exceeds acceptable limits. The selection pressure in this approach is less though the effects of TTBD are more. The strategic approach, based on epidemiological trend of ticks is more efficient in reducing production losses caused by ticks. Whatever be the approach, acaricide resistance would develop whenever the number of treatments is increased or a large number of ticks are exposed to the acaricide at a given point of time (refugia is small). Acaricides of poor quality and of uncertain concentration along with prolonged sub-lethal decay curve accelerate development of resistance in ticks. Applying high quality acaricide in correct manner and adequate dose rate is very critical in development of acaricide resistance. The non-acaricidal methods like the biocontrol agents, herbal drugs and use of anti-tick vaccines can aid in slowing development of acaricide resistance.

## MANAGEMENT OF RESISTANCE

### A. RATIONALE USE OF ACARICIDES

Acaricides with different modes of action should be used to control ticks in cattle. This will reduce the selection pressure for resistance to any one group of acaricide. The use of combination of acaricides is another approach to delay the emergence of resistance (Lovis *et al.*, 2013) which relies on the fact that one individual tick will lack resistant alleles to two chemicals having different modes of action. However, the drugs in a combination product must be compatible and of equal persistence on the animal and they must be used at recommended concentrations. Regular monitoring of acaricide resistance can play an essential part in delaying the development of resistance. Application of acaricides every twenty one days is suggested during the tick season. Increased frequency of acaricide application is a potential factor for emergence of resistant ticks. Field resistance should be confirmed using laboratory bioassays and this should be correlated with the known management practices. Also important is that the acaricide selection for control should be based on the type of tick species prevalent in an area and status of acaricide resistance.

### B. USE OF ALTERNATIVE APPROACHES TO CONTROL TICKS

#### 1. Immunological Control

Immunological control strategy against ticks entails the use of vaccines (Kumar *et al.*, 2009; Maruyama *et al.*, 2017). The rationale use of vaccines in combination with chemotherapy is required to reduce the need of the acaricides and may delay the onset of resistance to the commonly used acaricides. Although vaccination produces a tick control of just 20-30%, the reproductive capacity of the female tick is drastically hampered. Two recombinant tick vaccines namely Tick GARD (Hoechst Animal Health, Australia)/TickGARDPLUS (Intervet Australia; Australia) and Gavac/Gavac Plus (Heber Biotec S.A., Havana, Cuba) employing recombinant antigen Bm86 expressed in *Escherichia coli* (Rand *et al.*, 1989) and *Pichia pastoris* (Rodriguez *et al.*, 1994), respectively, are available against *R. microplus*. The vaccines have a significant effect on adults and their fertility i.e. egg laying capacity (Ashour, 2017). Immune responses against Bm95 recombinant cattle tick antigen and its protective efficacy for control of *R. microplus* ticks have also been determined in experimental crossbred cow calves in Uttarakhand (Kumar *et al.*, 2009).

#### 2. Genetic Control

The genetic resistance to ticks is lifelong and heritable which may vary between individuals. Breeds that have been exposed to particular species of tick for a long period are likely to have evolution genes, each of minor effect, affecting resistance to that species. For zebu cattle breeds, resistance to *R. microplus* attributed to polygenic effects (Kiss *et al.*, 2012). The polygenic resistance responds commonly to selection in breeds of moderate to high resistance as against low resistant breeds. The Brahman and Nelore breeds have high resistance to both *Rhipicephalus microplus* and *R. decoloratus*, and all Indian zebus may have high resistance to all *Rhipicephalus* (*Boophilus*) spp. (Roberts, 1968). Resistances of the Brahman and Boran (East African zebu) are similar. However, the Brahman is less resistant to *R. decoloratus* than the Nguni (southern African sanga-*B. taurus*) and less resistant than Zimbabwean sanga to *Amblyomma hebraeum* (Shyma *et al.*, 2013).





### 3. Biological Control

Biological control techniques like making use of pathogenic or predator organisms of ticks like insects of genus *Ixodiphagus* has been known since the start of the century.

**Bacteria :** Some bacteria are pathogenic to ticks. *Bacillus thuringiensis* produces crystalline  $\delta$ -endotoxin during sporulation disrupting midgut wall and thus killing ticks by causing toxemia. It is especially used against adult *Argas persicus* and *Hyalomma dimorpha*. *Proteus mirabilis* is pathogenic to *Dermacentor andersoni*, *Amblyomma hebraeum* and *Rhipicephalus decoloratus*. Likewise, *Cedecealapagei* (Enterobacteriaceae) is pathogenic to *Rhipicephalus microplus* (Ashour, 2017).

**Fungi :** *Beauveria bassiana* and *Metarhizium anisopliae* have strong anti-tick activity (Alonso-Díaz *et al.*, 2021). Entomopathogenic fungi penetrate the cuticle of ticks killing them. Some commercially available products contain fungi as active ingredients based on *M. anisopliae* such as Tick-EX EC, Metazam, Metaril SC 1037 and anti-termite mycoside (Faria and Wraight, 2007).

**Parasitoids/Predators :** The chalcid wasp, *Hunterellus hookeri* has been used to control the American dog tick *Dermacentor variabilis*. These are parasites on nymphal stages of ticks, lay eggs on them and ticks are literally eaten out by the hatching larvae of insect (Soulsby, 1982).

Many tick predators such as ants, wasps, and many bird species feed occasionally on ticks and can help to reduce tick populations at nearly no cost. Fire ants (*Pheidole megacephala*) and parasitoid wasps (*Ixodiphagus*) are the noteworthy tick predators (Muhammad *et al.*, 2008).

Entomopathogenic Nematodes: Entomopathogenic nematodes (families *Heterorhabditidae* and *Steinernematidae*) are known to be obligatory parasites of insects (Chaston and Goodrich-Blair, 2010).

### 4. Phytoacaricides

The foundation of utilization properties of plant concentrates as acaricides emerges from the traditional practices adopted by people. The neem tree (*Azadirachta indica*) derivatives have demonstrated their impact against insect pests and have picked up consideration as a characteristic acaricide (Benavides *et al.*, 2001; Srivastava *et al.*, 2008). It has been studied that the neem derivatives are rich in at least 35 biologically active principles, of which azadirachtin, a tetranortriterpenoid, is highly crucial (Lucantoniet *et al.*, 2006). It has been observed that several of plant extracts exhibit efficacy against ectoparasites and hence have the capability to be used for controlling ticks. Therefore, several phyto accessible products, for example, MyggA® Natural and Citriodiol® are being utilized for tick control (Gardulf *et al.*, 2004; Jaenson *et al.*, 2006; Freitag and Kells, 2013). The *in vitro* acaricidal effects of lyophilized extracts of four tannin rich plants (*Acacia pennatula*, *Piscidia piscipula*, *Leucaena leucocephala* and *Lysilomalatisiliquum*) against diverse stages of *R. microplus* have been found to reduce the viability of *R. microplus* larval stages (Fernandes-Salas *et al.*, 2011). Vatsya *et al.* (2006) have also found potent phytoacaricidal activity of *Artemisia annua*, *A. vulgaris*, *Ocimum kilimandscharicum* and *Pongamia glabra* against *R. microplus*. The extracts of plants like karanj, kali tulsi have also been found successful in controlling ticks and can best be used at times of the year when tick load on the animal is not very heavy.

### 5. Management of Pasture

Pasture alternation and/or rotation combined with application of chemical acaricide has proved as an effective way for the control of cattle ticks (Stachurski and Adakal, 2010). Pasture spelling and rotational grazing have shown good results in reducing the population of one-host ticks on dairy farms. If cattle are allowed to graze on divided pastures early in winter when few ticks are present or they produce least progeny and then alternated at 4-monthly intervals, the tick control can be achieved with less number of acaricidal treatments. Duration of the spelling period varies from 2 to 3 months in summer and 3 to 4 months in winter, but these intervals need to be determined for each area. Pasture spelling and rotation of pastures are not very effective for the control of multi-host ixodid ticks (e.g., *H. a. anaticum*) or argasid ticks because of the long survival periods of the unfed nymphs and adults (David, 2005).

Clearance of vegetation can also impact the number of ticks on animals. Various stages of some ticks (e.g., *Rhipicephalus* species) attach themselves to the blades of grass and other vegetation and stealthily attach to the cattle passing nearby.

### 6. Pheromone-Mediated Control

Some aggregation attachment pheromones enhance the aggregation or attachment of unfed nymph and adult ticks (Abdel-Rahman *et al.*, 1998). Aggregation attachment pheromones could be exploited in strategies to control ticks by



incorporating the pheromone tick compounds into plastic tags infiltrated with acaricides. Tag release pheromones can be used as tick decoys that will slowly attract ticks.

### **The way forward : Future strategies**

Use of Biotechnological tools for early detection of acaricide resistance

Biotechnology can prove to be a powerful tool in identification of molecular markers for diagnosis of acaricide resistance. Functional genomics coupled with analysis of expressed sequence tags, proteomics and metabolomics can be utilized in finding new molecular targets for acaricide resistance as tools to substitute traditional bioassays. Sequencing of cloned genes associated to acaricide resistance is being employed for analysis of mutations associated with acaricide-resistant phenotypes. The study of single nucleotide polymorphisms (SNP) associated to the acaricide resistance phenomenon is one of the most popular approaches in trying to find genetic markers for diagnostic purposes (Aguilar *et al.*, 2018). To overcome the multi-acaricide resistance, newer generation acaricides targeting novel metabolic pathways or bio-molecules synthesis pathway can be generated.

### **Use of Endosymbionts**

Endosymbionts are commonly found in midgut, haemolymph and ovaries of the different arthropod vectors and help arthropods by augmenting their functional capabilities. Ticks can harbor a wide range of endosymbiotic bacteria including *Rickettsia*, *Francisella*, *Coxiella* and *Arsenophonus* to name a few (Alberdi *et al.*, 2012). Determining the molecules crucial for the endosymbiont-tick –pathogen interaction will help in the designing transgene products which will disturb this interaction and can be used in potential future strategies to control ticks (Taylor *et al.*, 2011) and thus delay acaricide resistance.

### **Use of Pheromones**

Another innovative strategy involves the incorporation of pheromones in devices that contain acaricides.

### **CONCLUSION**

There is a need to gather information on the status and magnitude of acaricide resistance in different parts of the country in deciding any control strategy against ticks. Over reliance on chemicals coupled with lack of effective check points regarding their sale may result in emergence of acaricide resistance on large scale. Frequent monitoring of the distribution and level of acaricide resistance is of great importance as it would enable to extend the life of the existing acaricides.



## INFLUENCE OF HIGH TEMPERATURE ON INDIAN MUSTARD CROP AND BREEDING FOR HEAT TOLERANCE

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### Abstract

Heat stress is a major limiting factor for crop productivity. Indian mustard is a crop of tropical as well as temperate zones requiring somewhat cool and dry weather for satisfactory growth and development. High temperature at flowering and maturity stage causes reduction in seed yield. For adjusting with current and future heat stress, it is essential to develop agronomical superior and high yielding varieties of mustard which are suitable to heat tolerant. In this review, information regarding effect of high temperature on morphological, yield and its contributing traits, physiological traits and biochemical traits are provided. Similarly, information of mechanism of heat tolerance, various strategies manage heat stress, information of breeding methods viz., selection, selection for morpho physiological characters, use of landraces or wild relatives, backcross breeding for transfer of heat tolerance, heterosis and marker assisted selection are discussed. Screening techniques for selection of heat tolerance plants are also reviewed.

**Key Words :** Heat stress, heat tolerance, breeding methods for heat tolerance, morpho physiological traits.

### INTRODUCTION

Indian mustard [*Brassica juncea* (L.) Czern & Coss.] is a crop of tropical as well as temperate zones requiring somewhat cool and dry weather for satisfactory growth and development. High temperature at flowering stage causes reduction in seed yield as it may lead to pollen sterility. Although mustard is a long day plant requiring 16 h of light period in 24 h cycle, it can be made to flower if it is provided with a cycle of 8 h of light period with 4 h of dark period (short night). It exhibits an efficient photosynthetic response at 15–20°C and gets affected by both early (during germination and seedling stage) as well as by terminal (during flowering and seed ripening stage) heat stress. In India, delayed sowing of the mustard crop after harvesting of rice and cotton exposes the crop to high temperature stress during the reproductive stage (Chauhan *et al.* 2009); referred to as terminal heat stress (THS). Due to delayed planting, terminal heat stress occurs during the post-anthesis / seed filling stage that not only affects the movement of photosynthates to the developing sinks and inhibits the synthetic processes, but also leads to an increase in disease incidence and insect-pest infestation, thereby causing lower seed weight and seed yield (Tuteja *et al.* 1996). Delayed planting also leads to shortening of the vegetative phase, advances flowering time and decreases seed development period (Srivastava and Balkrishna 2003 and Dhaliwal *et al.* 2007). The effect of heat stress on seed yield and its contributing traits viz. plant height, main shoot length, number of primary and secondary branches, number of pods on main shoot and seed size, has been well documented (Morrison and Stewart 2002; Alam *et al.* 2014; Sharma 2014 and Sharma and Sardana 2016). Young *et al.* (2004) reported impaired seed filling on exposure of *B. juncea* crop to terminal heat stress. Nutall *et al.* (1992) recorded a decline of 430 kg/ha in seed yield with a rise of 3 °C in maximum daily temperature (21–24°C) during the flowering phase.

The most of the farmers of Eastern Vidarbha region of Maharashtra grow late or mid late varieties of paddy and harvest up to last week of November. Mustard crop sown first to second week of December. In western Vidarbha, after harvesting of cotton crop, there is scope for growing of mustard crop. But, due to delayed sowing of mustard, terminal heat stress occurs during the flowering / seed filling stage that not only affects the movement of photosynthates to the developing sinks and inhibits the synthetic processes, but also leads to an increase in disease incidence and insect-pest infestation, thereby causing lower seed weight and seed yield. Therefore, it is necessary to develop terminal heat tolerance variety. Hence in this paper, discussion about the factors responsible for heat tolerance, breeding methods required for heat tolerance and traits for selection heat tolerance.

### EFFECTS OF HIGH TEMPERATURE ON CROP PLANT

High-temperature (Heat stress) is particularly in the Vidarbha region of Maharashtra become a major limiting factor for mustard crop production. Heat stress (HS) is often defined as the rise in temperature beyond a threshold level for a period of time sufficient to cause irreversible damage to plant growth and development. A transient increase in temperature of 10–15°C above ambient is generally considered as heat shock or heat stress (HS) (Govindraj *et al.* 2018). However, Heat stress is a complex function of intensity (temperature in degrees), duration, and rate of increase in temperature (Wahid *et al.* 2007). Following are the effects of high temperature on crop plant.



### (i) Morphological and yield traits

High temperatures may result into considerable pre and post-harvest damages, in which scorching of leaves and stems, sunburns symptom on leaves, branches and stems, root growth inhibition, pollen abortion, reduced fertility, yellowing of siliques, reducing the seed size, force maturity of plant, damage and reduced yield.

It reduces biomass production by inducing chlorosis in vegetative plant parts, senescence and abscission in leaves and inhibits shoot and root growth. It causes flower abscission, pollen death, poor fruit set, fruit discoloration and damage.

### (ii) Physiological and biochemical traits

High temperature stress during flowering and maturity stage has detrimental effects on many physiological processes in plants, which include reducing photosynthesis, accumulation of dry matter, translocation of dry matter and stomatal exchanges that affect their growth stages. It also disturbs plant water relations and reduces water-use efficiency. (Singhet *et al.* 2014). High temperature may adversely affect membrane stability, moderate levels of hormones, primary and secondary metabolites. Heat stress during seed development in several crop species has been found to cause reductions in quality parameters such as starch, protein, and total oil yield (Mahmood *et al.* 2010). It reduces rate of photosynthesis, increases respiration rate, protein denaturation, accumulation of heat shock proteins etc. It reduces photosynthate translocation leads to reduce grain growth.

## MECHANISM OF HEAT RESISTANCE

### 1. Heat resistance :

It is defined as the capacity of a genotype to grow and produce equally good or suffer with smaller margin of economic yield under the stress as those in case of without stress. In crop plants, various physiological mechanisms related to transpiration, leaf reflectance due to pubescence, insulation by bark, membrane stability, photosynthate translocation, osmo regulation etc. are responsible for heat stress resistance. They may cause heat avoidance or heat tolerance. It is hardly possible to clearly work the differentiation like between these two. In many genotypes, both of them overlap to express the heat resistance.

### 2. Heat avoidance:

It is ability of plant to maintain internal temperature by driving away the radiation energy. The plant avoids heat stress through increasing rate of transpiration and maintains its body temperature. In addition to this, reflectance of leaves is also responsible for heat avoidance. Presence of pubescence, glaucousness, etc. on leaf surface reduces light interception. Similarly, thick bark covers on plant organs act as insulator for reducing heating and help the plant to avoid the ill effects of heat.

### 3. Heat tolerance:

It is ability of plant to survive and grow with high internal body temperature. Heat tolerance may occur due to membrane stability, photosynthate translocation, stem reserve mobilization, osmo regulation. These components are associated with heat hardening and they produce heat shock proteins which are responsible for sustaining heat stress.

## STRATEGIES TO MANAGE HIGH TEMPERATURE

Following strategies are to be adopted to manage the heat stress.

### 1. Adaptation of cultivation methods to avoid heat stress

Crop management practices should be adjusted to heat stress. Date of sowing of crop can be adjusted according to occurrence of the heat stress (Lotze-Campen and Schellnhuber, 2009 and Driedonks *et al.* 2016). Early sowing of mustard crop results in escape from heat stress which is occurring during physiological maturity of crop.

### 2. Breeding for heat tolerance

#### (i) Selection

Selection of plants for heat tolerance is better approach of conventional plant breeding. Selection of germplasm is conducted in hot region under hot conditions (Mickelbart *et al.* 2015). During selection process, breeders should concentrate on yield and its yield related traits under heat stress. Therefore, genotypes having higher yield under heat stress may be selected (Chaudhary *et al.* 2020).

#### (ii) Selection for morphophysiological characters

Morpho-physiological characters play an important role in improving the heat tolerance as these could act as surrogate traits for





selecting heat tolerance (Reynolds *et al.*, 2007). These characters are canopy temperature, chlorophyll fluorescence, chlorophyll content, cell membrane stability, stomatal conductance, carbon isotope discrimination and delayed senescence. Effects of heat stress during terminal stage were investigated by Singh *et al.* 2014 on photosynthesis, transpiration, stomatal conductance, stress intensity, mean productivity and geometric mean productivity, yield attributing characters and seed yield of 43 germplasm of rapeseed-mustard in which BPR 349-9- was identified and got registered for high temperature tolerance at juvenile stage. BPR 540-6 for salinity and high temperature tolerance at juvenile stage. While BPR 549-9 was registered for salinity tolerance at juvenile stage and high water use efficiency. Thus, such type of genotypes can be used to breed for high temperature tolerance.

The physiological character based breeding has gained more attention for improving plant adaptation to heat stress in various crop plants especially in wheat (Reynolds *et al.*, 2007 and Reynolds and Langridge, 2016). Selection based on physiological characters along with yield and its contributing characters either directly or indirectly result into accumulation of yield contributing genes which are responsible for higher plant yield under heat stress (Reynolds and Langridge, 2016).

### (iii) Use of landraces or wild relatives

In many plant species limited genetic variations for heat tolerance exist within the cultivated species in such situation, identification and use of land races, wild relative and wild species for transferring of heat tolerance is crucial. But, there are number of difficulties in identification and successful use of wild relatives and species for stress tolerance breeding. Sandhu *et al.*, 2019 documented a fixed diversity stock of 491 genotypes for wide range of variations for seed yield under natural terminal heat stress. A set of top 20 genotypes comprising introgression lines from wild species *Erucastrum cardaminoides* and *B. tournefortii*; derived *B. juncea* lines using *B. carinata* and *B. napus*; land races, commercial cultivars and breeding lines, having the lowest heat susceptibility index and the least yield reduction under heat stress, have been identified as potential heat tolerant donors.

### (iv) Backcross breeding for transfer of heat tolerance

For transferring the heat tolerance trait to agronomical superior, high yielding but sensitive to heat varieties from heat tolerant lines, backcross breeding is effective strategy. Backcross of agronomical superior, high yielding but sensitive to heat varieties with heat tolerance parent result into the recovery of all the characteristics of agronomical superior, high yielding varieties along with heat tolerance (Chaudhary *et al.* 2020).

### (v) Impact of heterosis on high temperature

Heterosis minimizes the negative impact of heat stress on important agronomic and seed quality traits in Canola. Inbreds are more susceptible to heat stress, when more tolerant inbreds are used to produce hybrids, the resulting hybrids are more tolerant. Inversely, when two susceptible inbreds are combined, the resulting hybrids are susceptible, suggesting an additive genetic effect. This indicates that breeders can screen inbreds for heat tolerance, which will provide increased phenotypic variation and predictive information for hybrid combinations (Koscielny *et al.* (2018)

### (vi) Marker assisted selection

Molecular markers identified and mapped genes/QTLs responsible for heat tolerance in several crops e. g. *Brassica* (Branham *et al.*, 2017). Marker assisted selection is useful for transferring the heat tolerant QTLs/genomic region into agronomical superior and high yielding but heat stress sensitive cultivar. Advancement in gene sequencing technologies which allow faster sequencing of genomes at lower costs result into generation of SNP markers that enabled genome-wide association studies (GWAS) for elucidating novel genomic regions controlling heat stress tolerance (Chaudhary *et al.*, 2020). GWAS for identifying heat stress tolerance genomic regions have been conducted in *Brassica* (Rahaman *et al.*, 2018).

## SCREENING FOR HEAT TOLERANCE

Selections of heat tolerant plants are carried out in following the environments viz., field or in lab (glass house or growth chambers).

### (a) Evaluation in normal field conditions

Selection of heat tolerant plants is carried out in field conditions. If the, heat stress is repeated over years. Hence, it is desirable to grow the breeding lines or germplasm at hot spot when the probability to occur stress every year is very high.

### (b) Evaluation in glass house or growth chambers

The plants are tested in glass house or growth chambers where required temperature can be maintained constantly. It is very well established under "phytotron facilities".





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## **SEED TREATMENT : AN EFFECTIVE CROP VACCINATION STRATEGY FOR STRESS MANAGEMENT**

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### **INTRODUCTION**

Human ballooning population has put tremendous pressure on food production. Diseases and pests affecting crops can have devastating consequences in crop production if not properly managed. Seed treatments, in broad terms, are the application of biological, physical and chemical agents and techniques to seed that provide protection to seeds and plants and improve crop safety which in turn leads to good establishment of healthy and vigorous plants which results in better yields. It is estimated that 80% of the seeds sown in our country is untreated as against 100% seed treatment practice in developed countries (Sharma et al., 2015). Seeds saved by farmers may be infected with microbes that can induce diseases on the seedling and the crop. This can affect seed germination and may be transmitted from seed to seedling to plant. Seed treatment prevents and controls seed-, soil-, and air-borne diseases. It improves germination, substantially vigor, and productivity. Seed treatment is probably the cheapest and often the safest method of direct plant disease control.

### **Seed treatment**

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The rise of mechanization in agriculture has reduced the time and dependency of labour in sowing and harvesting of crop plants to a large extent (Emami et al., 2018). However, the management of diseases, insect pest, nutrient application, irrigation etc. are still largely depending upon supply of labour and timely completion of these activities for sustainable production and productivity. As seed treatment is a well proven technology to protect seeds/planting materials not only from pathogens but also provide several beneficial effects to crop growth and development without any extra effort after planting (Sahni et al., 2021). Different seed treatments are being used alone or in combination to prevent a number of insect/ pests, diseases, nutrient deficiencies, stress mitigation etc. The seed treatment includes the use of fungicides, insecticides, inoculants, biofertilizers, plant growth regulators, nano materials etc. (Sharma et al., 2015). Conventionally, seed treatments were used for protection of seed and seedlings against various disease and insect pressure from the moment they are planted.

### **Recent advancement in seed treatment**

The recent advancement in seed treatment with different bioagents and nanomaterials has further revolutionized the process (Sahni et al., 2021). Treatments with bioagents have shown improvement in seed germination, seedling vigour, availability of nutrients (like nitrogen, phosphate, potash etc.), reduction in the incidence of seed-borne pathogens etc. Seed priming with nano materials is a promising technique to improve seed germination, seedling growth, pest control, plant nutrition etc. more efficiently. The use of nano materials has also shown enhanced seed vigour and seedling growth under stress conditions like salt stress. In this difficult time, if farmer don't able to take proper and timely care of their crops or escape some or all management steps at different stage of crop growth period due to time or financial crisis then the seed treatment will be the perfect and profitable tool for farmers.

### **Nano-priming**

Nano-priming, an innovative technique, has gained tremendous attractions among researcher, industrialist and farmers for its application for seed treatment. Nano-priming has risen to prominence as a cutting-edge seed priming technique for smart agriculture. Nano-priming can be applied to seeds in order to provide protection for seeds during storage, improve germination, germination synchronization, and plant growth, as well as to increase the resistance of crops to abiotic or biotic stress conditions, which can help to reduce the required quantities of pesticides and fertilizers (Malik et al., 2021).



Nanoparticles have important and unique properties, such as a significantly higher surface to mass ratio than other particles and materials, which allows them to efficiently increase catalysis as well as adsorb and deliver molecules of interest (González-Melendi et al., 2008). Recent studies showed that nano-priming improves seed germination as it triggers certain metabolic processes that are normally activated during the early phase of germination (Kasote et al., 2019). According to numerous studies, nano-priming improves the rate of emergence, as well as the crop's subsequent growth, yield, and quality (Kasote et al., 2019; Acharya et al., 2020). The use of seed nano-priming improves resistance against environmental stresses. Nanoparticles can act directly against pathogens, as well as alter the metabolism of seeds and plants, consequently enhancing the innate immune system, altering hormone production, and making the plants more resistant to diseases or abiotic stress (Panyuta et al., 2016). Because of its beneficial impacts on plant metabolism and development, seed nano-priming also boosts the yield of several crop species. Fast root development improves the plant's ability to acquire nutrients and water, which is accompanied by faster leaf expansion, which boosts the usage of light energy for plant growth (do Espirito Santo Pereira et al., 2021).

Conventionally, inorganic reducing agents are used to synthesize nanoparticles which pose risks for environmental and human health hazards. Recently, there has been a focus on the synthesis of plant-based nanoparticles, often known as green nanoparticles, for use in agriculture that is both safe and sustainable. Recently, turmeric oil nanoemulsion has been prepared using turmeric oil extracted from curcumin-removed turmeric oleoresin. For preparing silver nanoparticles (AgNPs), onion peel extract was used as a reducing agent. Silver-based 'green' nanoparticles have the added protective advantage because silver has proven anti-bactericidal and anti-fungicidal properties (Vurro et al., 2019).

## CONCLUSION

The agricultural practice has shown the pleiotropic beneficial effect of seed treatment on seedling establishment, growth regulators, moisture-attractive or moisture-repulsive agents, fighting against various abiotic and biotic stresses and enhanced yield and yield attributing traits. The new advancement in nano-based technology for seed treatment has potential to move the traditional agriculture based on the use of agrochemicals to a more sustainable agriculture, once these systems can promote the establishment of plants, as well as provide protection against biotic and abiotic stresses, resulting in improvements of productivity and food quality.

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## INTEGRATED MANAGEMENT APPROACHES FOR EARLY BLIGHT OF TOMATO AND THEIR EFFECT ON CROP GROWTH AND YIELD PARAMETERS

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Tomato (*Lycopersicon esculentum* Mill.) is considered as one of the most important and remunerative vegetable crops cultivated throughout the world owing to its high nutritive values as well as its antioxidant and curative properties. It is a major contributor to the fruits and vegetables diet of humans throughout the world (Kapasiya *et al.*, 2015). It is also considered as “Protective food” both because of its special nutritive values and wide spread cultivation. Tomato is a rich source of minerals, organic acid, essential amino acids, dietary fibres, vitamin C, vitamin B and vitamin A. The vitamin C content increases as the vegetable ripens.

The major tomato growing countries in the world are China, India, USA, Turkey, Egypt and Italy. The total area under tomato cultivation is about 5.02 million hectares with the production of 170.75 million tons and productivity of 33.99 tons/ha. The largest area and production of tomato in the world is china which is occupying 1.00 million hectares with the production of 52.72 million tons.

In India, it ranked thirds among vegetables next to potato and onion in terms of production but ranks first among canned vegetables. The major tomato growing states in India are Andhra Pradesh, Karnataka, Madhya Pradesh, Telangana, Orissa, Gujarat, Maharashtra, West Bengal, Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Assam, Tamil Nadu and Uttar Pradesh, Andhra Pradesh ranked first in terms of area and production of tomato in India. In India, total production of tomato is 18,227,000 metric tons with the productivity of 21.2 metric tons/ha. which comes from 0.458 million hectares of land in 2013-14. The productivity of tomato in India is very low as compared to other countries of the world which is mainly responsible for some biotic and abiotic factors. Among the biotic factors diseases are the main constraints to tomato cultivation in India which is mainly caused by viruses, bacteria, nematodes and fungi. Among the diseases, early blight also known as target spot disease incited by *Alternaria solani* (Ellis and Martin) Jones and Grout, is one of the world's most catastrophic disease of tomato (Abada *et al.*, 2008). The disease appears on leaves, stems, petiole, twig and fruits under favourable conditions resulting in defoliation, drying off of twigs and premature fruit drop and thus causing loss from 50 to 86 percent in fruit yield in different parts of the country. (Mathur and Shekhawat, 1986).

### Symptomatology

The symptom of early blight on tomato was characterized by the appearance of brown to dark leathery necrotic spots first on leaflets producing target board effect. The spots were oval or angular in shape upto 0.3 or 0.4 cm diameter and there was usually a narrow chlorotic zone around the spot which later faded into the normal green colour. Older leaves of tomato were affected first as a rule and the disease progressed upwards. Finally, the leaves dried up and dropped down. Ramakrishnan, *et al.* (1971) observed cankerous spots on tomato stems. They were especially injurious when they occurred at the junction of the stem and side branches. Collar rot, another symptom on tomato occurred as stem lesions on seedlings at soil line extending above and below that point to form cankers which resulted in girdling of the plants (Basu, 1971 and Mc Carter *et al.*, 1976).

*A. solani* could attack fruits in the green and ripe stages cause cracks and other wounds. According to Mayee and Datar (1986), the early blight disease was characterized by the appearance of brown to dark brown colour necrotic spots. Appearance of concentric rings inside the spots produced target board effect. Singh (1987) reported that the spots were oval to angular in shape measuring up to 0.3-0.4 cm in diameter and usually with a chlorotic zone around the spot.

### Conditions for disease development:

The disease appears early in the seasons, normally 3 – 4 weeks after transplanting. But can appear at any stages of plant growth. The disease is favored by warm, rainy and wet weather. Favorable times for appearance of disease from October – December. High soil fertility reduces the disease incidence. Poly Saha and Srikanta Das (2014) reported that the among the seven meteorological factors considered only average temperature, RH and total rainfall were found to act positively and significantly, whereas, bright sunshine hours were found to have negative significant effect on early blight disease severity on tomato. The pathogen survive for a long time in the diseased plant parts, soil and on alternative/ collateral hosts in the absence of main host, determine the wide ability of the pathogen to perpetuate (Moore and Thomas, 1942; Basu, 1971 and Rands, 1917a). The pathogen is also air borne and soil inhabiting in nature (Datar and Mayee, 1981). It is well established that the tomato early blight fungus could survive on the infected seeds for several days. Microclimate of the crop canopy also contributes in increasing disease severity. It is observed that disease severity increases with increase in leaf wetness duration at all temperatures. The maximum disease severity occurred after 24hrs duration of wetness at 18°C (Evans *et al.*, 1992).





### Mode of perpetuation

The fungus survives during overwinter /over summer as conidia or mycelia on plant debris, soil, seed and alternate hosts, particularly in fields with poor cultural practices such as continuous cropping of tomatoes or potatoes.

The pathogen can survive as conidia for about four months and as mycelium for five months, when diseased leaves were kept between folds of blotting papers (Mahabaleswarappa, 1981). The mycelium remains viable in dry infected leaves for a year or more. Conidia have been found to remain viable for 17 months at room temperature. Conidia require desiccation for production of chlamydospores while desiccation prevents chlamydospore production from hyphae. Infection of lower leaves first takes place, during periods of warm, rainy, humid weather, through conidia formed on soil. Conidia are disseminated by wind, rains and insects. Mycelium of this fungus is more resistant than spores and survived under dry conditions at temperature higher than those permitting growth. For example, mycelium survived for 16 months at 40°C, while spores survived for only 10 months under the same conditions (Rotem, 1968).

**Management:** The management of disease can be done through the cultural practices (Rashmi Tewari *et al.* 2012), biological control (Kokalis-Burelle, N. 2002), chemical measures (Nguyen Khanh *et al.* 2013). Cultural practice like field sanitation, deep summer ploughing, soil solarization, soil amendments and crop rotation etc. can minimize the possibility of disease but cannot completely control the disease in standing crops. Several plant extracts from various plant species were tested for their fungitoxic effects on the mycelial growth and spore germination of *A. solani*, the causal agent of tomato leaf blight disease. Among them, 10% extracts of *Acacia concinna* pod and *Basialati folia* [*Madhucalongifolia* var. *latifolia*] oil cake were effective followed by *Allium sativum* bulb, *Annonasquamosa* seed, *Cissusquadrangularis* stem extracts and neem products. In some cases, plant extracts and fungicide (Ridomil Plus) significantly reduced the early blight disease as well as increased the yield of tomato compared to infected control under field condition. In greenhouse experiments the highest reduction of disease severity was achieved by fungicide (Ridomil Plus 50% WP, 15% metalaxy+35% Copper oxychloride, at 2 g L<sup>-1</sup>). Other alternative method of disease management strategy is biological control. In this context, *Trichoderma harzianum*, *Trichoderma viride*, *Chaetomium globosum*, *Gliocladium virens* etc. have been exploited for management of diseases but biological control alone cannot manage the disease completely because a little fluctuation in temperature, pH, moisture, etc. largely affects the efficacy of bio-agent. The use of resistance variety is another important method which is reliable and cheap for management of plant disease but due to development of new races of pathogen, the resistance variety becomes susceptible one. Hence, the use of fungicides is the last and only method for plant disease management. The most effective fungicides were Dencozeb 80WP (Mancozeb), Evamil 72WP (Mancozeb 64%+Matalayxil 8%), Mosum 80WP (Mancozeb), Companion 72WP (Mancozeb 60%+Carbendazim 12%), Mancovit 70WP (Mancozeb), Baimyl 72WP (Mancozeb 64%+Matalayxil 8%) and Pesterozeb 50WP (Mancozeb). But continuous use of fungicides may develop resistance strain of the pathogen which has also adverse effect to tomato fruits as well as human health. Hence, an integration of different methods are the only and one methods for management of disease like Seed treatment with fungicides enhanced germination and reduced seedling infection and thiram was found to be the best for seed treatment as it enhanced the germination and reduced seedling infection. Fungicides, along with cultural practices (inter cropping with marigold, mulching and stacking) were evaluated to develop an effective management strategy to manage the disease. Cultural practices integrated with fungicides then reduced the per cent disease index and increased the yield. Management of early blight disease of tomato can also be effectively done by the application of bio-growth stimulant-cum-growth regulator along with bio-soil enricher, liquid NPK fertilizer and chlorothalonil. Therefore, single method is not enough for management of plant diseases in near future. Hence, there is a need to search for new management strategy which can keep environment free from chemical hazards and pollutions and ultimately fulfill the customer desire to protect their livelihood.

The present showed that soil application of FYM + seedling treatment with bio formulation of *T. harzianum* + spray of Mancozeb reduced the disease severity by 8.56% against 95.50% in case of control. The treatment as soil application of FYM + seedling deep in Mancozeb + spray of Mancozeb showing 08.32% disease severity representing second highest among the treatment. Seedling treatment with different treatments stimulated the growth parameters of plant. The plant height was noted in case of soil application of FYM + seedling treatment with bio formulation of *T. harzianum* + spray of Mancozeb which was 31.43cm. Fresh and dry weight of shoot were also found in soil application of FYM + seedling treatment with bio formulation of *T. harzianum* + spray of Mancozeb treated plant representing 25.30gm and 7.27gm respectively. Similarly fresh and dry weight of root were also found in soil application of FYM + seedling treatment with bio formulation of *T. harzianum* + spray of Mancozeb treated plant representing 22.00gm and 4.25gm respectively. The spread of root zone was found maximum in case of soil application of FYM + seedling treatment with bio formulation of *T. harzianum* + spray of Mancozeb with 22.66cm. The yield was also obtained maximum with 480.08gm/plant from soil application of FYM + seedling treatment with





bio formulation of *T. harzianum* + spray of Mancozeb followed by soil application of FYM + seedling treatment with bio formulation of *T. viride* + spray of Mancozeb with 420.78gm/plant.

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## BOVINE ANAPLASMOSIS : CURRENT STATUS, DIAGNOSIS AND CONTROL MEASURES

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### Abstract

Bovine anaplasmosis is considered as a major constraint for the dairy sector in tropical and subtropical regions. The disease is usually transmitted by ticks or mechanically through contaminated needles, dehorning, ear tagging and castration equipment. Cattle become carrier throughout their life after infection with *Anaplasma* spp. The trusted regime for the clearance of *Anaplasma* infection from bovine is not available. However, the information on the prevalence, distribution, risk factors, molecular epidemiology of this infection is inadequate or completely lacking in India. The present paper provides a more comprehensive insight on the current status, epidemiology, diagnosis and control measures of bovine anaplasmosis.

**Keywords :** *Anaplasmaspp*; cattle; erythrocyte; *Rickettsia*; tick-borne; zoonosis

The economy and most of the population of India depends upon agriculture and livestock sector. Livestock also provides employment to about 18.8 % of the population in India. Various diseases caused by different pathogens such as bacteria, virus, fungi and parasites causesignificant economic losses to the dairy industry. Among these diseases, anaplasmosis is increasing in the livestock and posing a serious threat to the industry. Bovine anaplasmosis is disease caused by *Anaplasmaspp* and clinically characterized by pyrexia, anaemia, weight loss, loss of appetite, decreased milk production, abortion anddeath. *Anaplasma*, the causative agent of bovine anaplasmosis is gram negative obligate intracellular parasite that inhabits and replicate within the vacuoles of diverse cells (monocytes, granulocytes, erythrocytes, endothelial cells) of eukaryotic hosts and mainly transmitted through ticks. Genus *Anaplasma* belongs to the order Rickettsiales and family Anaplasmataceae family and to date, eight classified species (*A. phagocytophilum*, *A. bovis*, *A. centrale*, *A. marginale*, *A. ovis*, *A. platys* *A. odocoilei*, and *A. capra*) of genus *Anaplasma* cause anaplasmosis across the world in a large range of wild and domesticated vertebrates. In India, the disease was first time reported from Odisha state and then the two species of *Anaplasma* i.e. *A. marginale* and *A. bovis* have been reported to cause disease in dairy animals. The transmission of *A. marginale* is more complex than other tick-borne diseases of animals due to several reasons. The disease may be transmitted biologically through ticks and mechanically through infected blood or veterinary operations like contaminated needles, instruments and bites of insects.

The diagnosis of bovine anaplasmosis can be made by microscopic examination of stained thin blood smear, but this method is useful only in clinical cases with acute infection not for the subclinical or carrier animals. So, the more sensitive diagnostic assay like immunological and molecular tests have been developed to detect low level of infection in animals. Several serological tests, including competitive ELISA using a recombinant antigen have been developed and found sensitive and specific for detection of *Anaplasma* infected animals, but there are chances of cross reactivity. Recently, molecular test such as PCR, multiplex PCR, PCR-ELISA, semi-nested PCR, and real-time PCR are being used for the detection of *Anaplasmaspp* with high sensitivity and specificity. PCR detection methods are more sensitive in detecting nucleic acid of pathogen but due to time consumption and expensive chemicals, it is not recommended for large scale epidemiological work. Various genes such as ribosomal RNA (16S rRNA) gene, 23S rRNA, major surface protein (msp), heat-shock protein groEL and citrate synthase gltA, msp1 $\alpha$ , msp1 $\beta$ , msp4 and groEL with the msp4 gene and msp5 genes are widely used for molecular detection, phylogenetic analysis and inter-species variation of *Anaplasma* spp.

The prevalence of bovine anaplasmosis was reported to be 20.55% in Puducherry Region, 16.67% in Kerala, 22% in Telangana, 46.9% in Haryana, 19.5% in Punjab, 1.2% in Gujarat. In a meta-analysis study on *Anaplasma* species from India and World from 1988 to 2017 and 1978–2017, respectively, using online databases and offline literatures, the prevalence of *Anaplasma* species in India and World were 11% and 39%, respectively. For the treatment of bovine anaplasmosis, tetracycline (tetracycline, chlortetracycline, oxytetracycline, rolitetracycline, doxycycline, minocycline) enrofloxacin antibiotics and imidocarb are currently used, but none of these reliably eliminated persistent *A. marginale* infections in all cattle. Since, the vaccine of anaplasmosis is not available in the country, so tetracycline is main method for the control of bovine anaplasmosis. Chlortetracycline in feed and oxytetracycline as injectable are the only method for the control of diseases. But the off-label use of chlortetracycline in feed is illegal in some countries. Among tetracycline antibiotics, the most commonly used treatment consist of single IM injection of long-acting oxytetracycline at a dosage of 20 mg/kg with two injections with a 1 week interval.

Various studies based on the recommended protocol (five daily injections of oxytetracycline intravenously at 22 mg/kg) of



World Organization for Animal Health (OIE), failed to eliminate *Anaplasma spp* from blood of animals. So, the trusted regime for the clearance of Anaplasma infection from bovine is not available. On the other hand, herbal medicines are gaining popularity in rural areas along with conventional drugs. Some of the plants used in remedies indicated that farmer's possesses knowledge of plant activities to treat gall sickness. Some *in vitro* and *in vivo* studies showed encouraging results for herbal drugs such as *Brucea javanica* (*Java brucea*) and artemisinin against tick borne diseases (Yarnell, 2016).

In conclusion, bovine anaplasmosis is highly endemic in India and there is requirement of epidemiological studies as well as detailed surveillance to design the prevention and control strategies of this disease, which may be helpful in increasing the productivity of dairy sector.

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## **ROLE OF MEDICINAL AND AROMATIC PLANTS IN DIVERSIFICATION OF TRADITIONAL CROPPING SYSTEM**

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### **Importance**

Any material or part obtained from the plant sources used for treating or curing an ailment(s) is called the medicinal plant or herbal medicine. India is one of the country in the world where different traditional systems of medicine are practiced from ages i.e. Ayurveda, Sidha, Unani, Homoeopathy, Allopathy, Naturopathy, Tibetan and Folk Medicine. India has 15 agro-climatic zones, 47,000 different plant species and 15,000 medicinal plants. The Indian systems of medicine have identified 1,500 medicinal plants, out of which 500 species are mostly used in the preparation of drugs. The effectiveness of these drugs mainly depends on the proper use and sustained availability of genuine raw materials. The domestic market of the Indian systems of medicine like Ayurveda, Unani etc. runs into thousands of crores and is expanding day by day. Moreover, there is a growing demand for natural products, including items of medicinal/pharmaceutical value, food supplements and cosmetics and both for the domestic and international markets. India, with its diversified biodiversity has a tremendous potential and advantage in this emerging sector.

According to the WHO, over 80 per cent of the world population relies on traditional medicine largely plant based for their primary healthcare requirements. The value of medicinal plants trade in India is worth 5.5 billion \$ and is growing rapidly. The international market of herbal products is estimated at 62 billion \$ which is poised to grow to 5 trillion \$ by 2050. Presently, our share of the global medicinal plants exports is a mere fraction. In these circumstances, it is imperative to mention that a new concept of herbalism has been emerging rapidly in domestic and global scenario offering a great opportunity to India for expansion and diversification of medicinal and aromatic plants through cultivation and processing industry.

### **Concept of diversification**

Diversification in agriculture denotes shifting from one crop to another crop for desirable change. It takes into account of economic return from different crops and implies the use of diverse crop group to achieve most remunerative and resource conserving production system. Shifting of resources from less value crops to high value crops and enhance land use capability in terms of productivity and soil health forms the integral object of crop diversification.

### **Why diversification?**

Our most obvious use of plants is for food. There are more than 20,000 known species of edible plants and yet we are increasingly dependent upon fewer and fewer species to provide food. Indeed fewer than 70 species of plants now supply about 90 per cent of our plant foods. As a result we now see huge areas of land under a single crop and increasing dependence upon chemical fertilizers, insecticides, fungicides and herbicides. There is constant threat of new diseases and this could create havoc in large areas. One has to consider the famine in Ireland last century which was caused by potato blight. Just imagine the result if our wheat or paddy crops were similarly devastated.

A changing world climate could also cause major disruptions in agriculture with much food growing regions and becoming incapable of producing their traditional crops. Therefore, diversification is urgently required.

### **Need for diversification in Uttar Pradesh**

Uttar Pradesh though a small state but has 9 different agro-climatic zones with various micro-climatic conditions. The state has geographical area of 240.93 lakh ha. The forest area is just 6.89 per cent of the total geographical area. 168.19 lakh ha i.e. 69.48 per cent area of the state is under cultivation and out of this 69 per cent of the total cultivable area is 49 lac ha under irrigation. The emerging threat of rice-wheat rotation, frequent failure of cotton crop due to insect-pests attack, lowering down of water table to a critical limit in South-west semi arid zone and reluctance of the government in purchasing of rice and wheat have issued alarming bell for the sustainability of the ecosystem and farming community as a whole. About 40-45 per cent of the total electricity is consumed by lakhs of tubewell and every year the water table goes down by 50 cm to 1.50 m. A critical water table depth of more than 750 ft. has been reached in some of the part of Uttar Pradesh. Therefore, we have no alternative but to go for diversification in some of the areas of the state and medicinal and aromatic plants cultivation is one of the best choice to meet their escalating demand in the world market. The area under medicinal and aromatic plants is below 20,000 ha out of the total 168.19 lakh ha cultivable area, thereby has a large scope to brought more area under their cultivation. The



government is planning to bring about 50,000 ha area under the medicinal plants cultivation upto the end of the 12<sup>th</sup> plan period.

If agriculture is the economy of Uttar Pradesh, wheat and paddy are turned to be two villains, suggesting alternatives or diversification in the state as a profession or livelihood is a difficult proposition, as there are not so many. Diversification, therefore, is not simply switching of furrows or sowing of an alternate crop but are attached to it human ethos, economics and many more. Alternate crop must yield higher income than existing wheat-rice, cotton based and other existing crop rotations of the state. Unfortunately alternate are less and therefore, income support programme are required in the form of subsidy or establishment of MSP of different medicinal and aromatic (MAP's) crops. However, the unpredictable monsoons and drought in the last few years have resulted in loss of income from many of the traditional crops. Therefore, cultivation of MAP's is being preferred because of the following reasons:

- (i) The MAP's are valuable commodities as there is demand all over the world today.
- (ii) Plants can be grown in available climatic conditions.
- (iii) These plants have wider adaptability to adverse climatic conditions.
- (iv) Some plants/crops are better accommodated into intercropping/mixed cropping/multitier cropping.
- (v) Most of the species are not browsed or grazed.
- (vi) Crops are not prone to attack by diseases and do not require constant monitoring as in case of traditional crops.
- (vii) There is very little danger of theft of crops mainly because lack of knowledge about the market and processing becomes as hindrance factor.
- (viii) Profits realized are on the higher side.
- (ix) WTO has put strong restriction on wild collection.
- (x) Farm produce materials of these plants are mandatory for processing industries.
- (xi) International buyers will strict on good agricultural practices and good manufacturing practices.
- (xii) Uniform quality herb raw materials of known identity and properties can be ensured through cultivation.

#### **(1) South-West -Semi-arid zone**

|     |                |                                                                                                                                                                                                                         |
|-----|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) | Monocrops      | Mulhati, Senna, Ashwagandha, Guarpatha, Isabgol, Satavar, <i>Ocimum</i> sp., Kalmegh, Chandersur                                                                                                                        |
| (b) | Crop rotations | Pearlmillet-Ashwagandha- <i>Ocimum</i> sp.<br>Senna-Mustard/Wheat/Barley<br>Kalmegh-Mustard/Wheat/Barley<br>Pearlmillet-Ashwagandha-Sunflower<br>Kalmegh (seed)-Chandersur<br><i>Ocimum</i> -Ashwagandha- <i>Ocimum</i> |

#### **Economic potential of different mono crops :**

| S. No. | Name of the crop | Cost of cultivation (Rs./acre) | Net expected income (Rs./acre) |
|--------|------------------|--------------------------------|--------------------------------|
| 1.     | Kalmegh          | 10,000-11,000                  | 23,000-27,000                  |
| 2.     | Ashwagandha      | 10,000-11,000                  | 28,000-30,000                  |
| 3.     | Senna            | 9,000-10,000                   | 20,000-22,000                  |
| 4.     | Mulhatti         | 35,000-40,000 (for 3years)     | 1,35,000-1,40,000              |
| 5.     | Guarpatha        | 18,000-19,000 per year         | 38,000-40,000                  |
| 6.     | Satavar          | 45,000-50,000 (for 2 years)    | 1,50,000-2,00,000              |
| 7.     | Ocimum           | 11,000-12,000                  | 15,000-18,000                  |
| 8.     | Chandersur       | 8,000-10,000                   | 27,000-28,000                  |
| 9.     | Isabgol          | 9,000-10,000                   | 18,000-19,000                  |



In present scenario, the cultivation of MAP's is the alternate way by which one can diversify their present traditional system of agriculture to earn/generate more income. It is very difficult to earn more income as a mono-cropping of these medicinal plants as the choices/alternate crops are limited. To meet the demands of world requirements, scientific cropping of industrially important MAP's plants must be integrated with agriculture and forestry for optimum use of land and water resources. In broad sense, Uttar Pradesh can be divided into 9 agroclimatic zone. The cropping systems are entirely different in these regions and therefore, same will be the situation for MAP's cultivation. The possible monocropping/cropping systems could be as under in these two zones:

**(1) Central Plain zone :**

There are some MAP's crops which can be profitably taken under fertile and irrigated situations of this agroclimatic zone; Sarpagandha, SafedMusli, Satavar, Stevia, Mango Ginger, Kalmegh, Rose, Lemongrass, *Ocimum*sps., *Mentha*sps., Muskabala, Citronella, Palmarosa and Chamomile. The following crop rotations can be possible alternatives in these areas :

|                                              |                                        |
|----------------------------------------------|----------------------------------------|
| Mustard - <i>Ocimum</i> sps./Kalmegh - Wheat | Sugarcane - Mint Rice – Potato - Mint  |
| Potato - <i>Ocimum</i> sps./Kalmegh          | Kalmegh - Wheat - <i>Ocimum</i> sps.   |
| Berseem - <i>Ocimum</i> sps. - Potato        | Muskabala - Wheat - <i>Ocimum</i> sps. |
| <i>Ocimum</i> sps. - Vegetables              | SafedMusli - Mentha                    |
| <i>Ocimum</i> sps. - Potato - Mint           | SafedMusli - <i>Ocimum</i> sps.        |
| Rice – Wheat - Mint                          |                                        |

**Economic potential of different medicinal and aromatic crops under irrigated conditions :**

| S. No. | Name of the crop | Cost of cultivation (Rs./acre) | Net expected income (Rs./acre)    |
|--------|------------------|--------------------------------|-----------------------------------|
| 1.     | Safed Musli      | 1,70,000-1,75,000              | 1,30,000-1,40,000                 |
| 2.     | Sarpagandha      | 35,000-40,000 (1.5yr crop)     | 1,12,000-1,20,000                 |
| 3.     | Stevia           | 50,000-60,000                  | 1,35,000-1,40,000                 |
| 4.     | Mango Ginger     | 30,000-40,000                  | 35,000-38,000                     |
| 5.     | Rose             | 45,000-50,000                  | 42,000-90,000                     |
| 6.     | Lemongrass       | 25,000-30,000                  | 35,000-45,000                     |
| 7.     | Citronella grass | 30,000-32,000                  | 28,000-28,000                     |
| 8.     | Palmarosa        | 22,000-25,000                  | 26,000-30,000                     |
| 9.     | Menthasps.       | 24,000-26,000                  | 40,000-65,000 (depending on sps.) |
| 10.    | Muskabala        | 24,000-26,000                  | 28,000-30,000                     |
| 11.    | Brahmi           | 25,000-28,000                  | 50,000-53,000                     |

**Crops for marshy lands :**

1. *Acoruscalamus* (Bach)

2. *Bacopamonniari*

The success of these some crops as monocrops/sole crops under field situations is limited. Therefore, as a general policy 'Polyculture' models for cultivation of medicinal plants where species mix is based on natural associations should be preferable to monoculture cultivation. In this situation, Multitier Agriculture System (MTAs) is the only way, which can be helpful for farmers, pharmaceutical companies and the world to get good quality of genuine plant materials. Polyculture save 80 per cent of the expenditure over traditional system in the form of purchase of hybrid seeds, ploughing, irrigation requirement and 100 per cent saving as there is little need for chemical fertilizers, pesticides and weedicides. The produce will be organic and fetch more prices.

**Model of Multitier Agriculture System (MTAs) :**

(i) **Selection of the base plant :** These should be fast growing to give shade to shade loving plants and provide a base for climbers.

(ii) **Selection of climbers :** Selection of climber is done according to the climatic conditions of the regions.

**Selection of shade crops :** Shade loving crops Haridra (*Curcuma longa*), Adrak (*Zingiberofficinales*), SafedMusli and Sarpagandha should be taken up.



Following are the MTAs under different situations of Uttar Pradesh :

**A. Rainfed situations (1-2 protective irrigations) :**

| Factor A (Main Crop) | Factor B (climbers)          | Factor C (Inercrops)                                                              |
|----------------------|------------------------------|-----------------------------------------------------------------------------------|
| Jatropha/Belgiri     | Kawanch/Kounch, GiloeVidhara | Mulhathi, Gokhru, Sonamukhi/Senna, Babchi, Satavar, Ashwagandha, Isabgol, Vetiver |

**B. Limited irrigation situations with 3-4 irrigation availability:**

**Aonla based MTAs through MAPs**

| Factor A (Main Crop) | Factor B (climbers)          | Factor C (Inercrops)                                                                                                               |
|----------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Aonla                | Dioscoreasps., Giloe, Gurmar | Kalmegh-Isabgol/Chandersur, Ashwagandha-Ocimumsps, Guarpatha, Aromatic Grasses like Lemongrass, Citronella and Palmarosa, Satavari |

**C. Irrigated situations with good water quality :**

| Factor A (Main Crop)                | Factor B (Intercrops)                                                         |
|-------------------------------------|-------------------------------------------------------------------------------|
| Guggal (No irrigation to main crop) | Rose, Brahmi and aromatic grasses                                             |
| Guava/Popular/Eucalyptusps.         | Safed Musli, Stevia, Brahmi, Lemongrass, Citronella, Palmarosa and Ocimumsps. |

Many MAP's can be cultivated under rainfed/irrigated situations on neglected shallow soils having poor soil properties and water holding capacity. Presently, it is occupied by agroforestry or is kept fallow for grasses to cattle. Many small medicinal herbs can be diversified under such situations. The selection of species and plant varieties should certainly be based upon the available resources, irrigation facilities and existing cropping systems/crop rotations. This will be wise step to start with cultivations of MAP's. An extraction plant for essential oils can be designed and instead of selling the raw produce, crude form of extract can be brought into the market for better profit. Future generations can be benefited by conserving the important plant species which are now neglected and under extinction due to deforestation.

Let us help preserve and maintain the precious wealth of nature together hand in hand.

**CONCLUSION**

- (i) Selection of best established product out of available plant resources in the region.
- (ii) Introduction of suitable exotic MAP species having high demand in the industry.
- (iii) Supply of good quality material to the growers.
- (iv) Determination of different agronomic management strategies like optimum sowing and harvesting time in the state/region.
- (v) Formation of cooperatives for production and prime processing at farmer's level.

Centralized/organized marketing system - For that Uttar Pradesh can be divided into 9 zones and processing units can also be established for this purpose.

**List of Medicinal and Aromatic Plants for Uttar pradesh**

**(i) South-Western Semi-Aridzone**

| Trees    | Shrubs              | Herbs        |
|----------|---------------------|--------------|
| Aonla    | Jatropha/Ratanjot * | Isabgol*     |
| Bael     | Jal/Peelu           | Ashwagandha  |
| Lasuda   | Anar                | Senna/Sanai* |
| Mahaneem | Phalsa              | Kalmegh*     |
|          | Teant/Kair          | Kanghi       |
|          | Karonda             | Gokhru       |





|  |                   |            |
|--|-------------------|------------|
|  | Guar Patha *      | Mulhati*   |
|  | Mehendi *         | Satawar    |
|  | Sagargota/Gataran | Muskdana   |
|  | Guggal            | Gurmar     |
|  | Jojoba            | Babchi     |
|  |                   | Kasni      |
|  |                   | Chandrasur |
|  |                   | Datura*    |
|  |                   | Makoi      |

**(ii) Eastern part of Uttar Pradesh (Irrigated/High rainfall)**

| <b>Trees</b>     | <b>Shrubs</b> | <b>Herbs</b>                                               |
|------------------|---------------|------------------------------------------------------------|
| Jamun            | Malkangini    | Safed Musli                                                |
| Harar            | Bansa         | Bach,                                                      |
| Bhahera          | Nagar Mothia  | Sarapgandha                                                |
| Aonla            | Gulab/Rose    | Kawanch                                                    |
| Amaltas          |               | Keokand (Costas)                                           |
| Arjun            |               | Periwinkle*                                                |
| Sukhchain/Karanj |               | Haldi                                                      |
|                  |               | Ama Haldi                                                  |
|                  |               | Aromatic Grasses (Palmarosa, Java, Lemon/Tulsi and Mentha) |

\*Not damaged by stray animals and birds.

**(iii) Medicinal plants in high demand/widely used by local Vaidyas :**

Isabgol, Senna, Ashwagandha, Arjun, Kasni, Chandrasur, Harar, Bhahera, Mahendi/Henna, Gokhru, Mulhatti, Aonla and Jamun



## ECO-FRIENDLY SEED TREATMENT TECHNOLOGIES FOR AUGMENTATION OF GERMINATION AND SEEDLING GROWTH OF TREE SPECIES

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Seeds of many tree species fail to germinate even under most favourable conditions due to dormancy. Seed dormancy is regarded as the failure of an intact viable seed to complete germination under favorable conditions. The seeds of some species are prevented from completing germination because the embryo is constrained by its surrounding structures. This phenomenon is known as seed coat enhanced dormancy or physical dormancy and embryos isolated from these seeds are not dormant. Pre-sowing treatments of seeds aim at breaking the physical barrier to enhance water absorption and expansion of the embryo. In other species, a second category of dormancy is found in which the embryos themselves are immature, which require growth and differentiation termed as morphological dormancy. Various kinds of pre-sowing seed treatments are being followed to break such dormancy in seeds of forest crops. Pre-sowing seed treatments such as soaking with water, mineral solutions and organic solutions alone or in combination found to speed up germination process, increased germination rate, seedling vigour, improved resistance to water and salinity stress and increased productivity (Rahayu Wulandini and Nurin Widayani, 2007 and Ali *et al.*, 2010). Being a low cost, easy to understand and simple technology, location specific and crop specific recommendations are needed.

### Effect of water treatment

A study conducted by Hossain *et al.* (2005) on effect of seed treatments on germination and seedling growth attributes of *Terminalia chebula* showed the highest germination percentage of 66.7 in the de-pulped seeds soaked in cold water for 48 hours followed by 60 per cent in the de-pulped seeds soaked in cold water for 24 hours. Sankhyani *et al.* (2005) reported that seeds of *Hippophae salicifolia* treated with hot water at 80 °C for 10 minutes resulted in maximum germination (76.7 %), shoot length (45.6 cm), root length (70.9 cm) and seedling vigour index (8931). Whereas, in case of *Hippophae rhamnoides*, seeds treated with cold water for six days resulted in maximum germination per cent (93.33), shoot length (37.8 cm), root length (53.3 cm) and seedling vigour index (8502) compared to control. Sujatha (2014) reported that pre-sowing seed treatment with cold water recorded significantly higher mean daily germination and peak value of *Melia dubia* seeds as compared to other treatments. Bello and Gada (2015) observed 68 per cent higher germination of tamarind seeds treated with water compared to control. Lavania (2016) reported that significantly higher germination per cent and germination value of *Picea smithiana* and *Pinus wallichiana* when seeds were soaked in water for 30 hours as compared to control. Rai *et al.* (2018) reported significantly higher germination per cent and seedling vigour index of Khirni (*Manilkara hexandra*) seedlings in presowing seed treatment with distilled water as compared to control.

### Effect of nutrient solution

Sinhababu *et al.* (2007) reported that pre-treatment with nitrogenous substances like KNO<sub>3</sub> and thiourea were effective in increasing germination percentage of *Acacia holosericea* and *Cassia fistula*. Further, the number of days taken to reach 100 per cent germination in these species were also reduced in KNO<sub>3</sub> treatment. Manasi (2011) reported that soaking the seeds of *Hydnocarpus pentandra* in 0.2 per cent KNO<sub>3</sub> solution found to be increased germination per cent (54), mean daily germination (0.70), peak value (1.74), germination value (1.46) and germination rate (0.90) significantly when compared to cold water treatment (34 %, 0.52, 0.83, 0.43 and 0.39, respectively) and control (31 %, 0.47, 0.72, 0.34, 0.34, respectively).

Rai *et al.* (2018) studied the effect of different pre-sowing seed treatments in *Manilkara hexandra* seeds at GBPAU, Pantnagar, Uttarakhand and results revealed that seeds soaking in GA<sub>3</sub> followed by KNO<sub>3</sub> solution recorded higher germination percentage, shoot length, number of leaves, shoot fresh and dry weight, root length, stem diameter, root dry weight, vigour index and root: shoot ratio as compared to control treatment.

### Effect of cowdung slurry

A study conducted on plantation technology for selected indigenous trees in the Indian peninsula by Nair *et al.* (2005) reported that in *Melia dubia*, percentage of seed germination was observed to be very low (14 %). Among the various pre-treatments tried, seeds soaked in farmyard manure showed the maximum germination. Krishna *et al.* (2011) reported that the seed germination of *Melia dubia* was maximum in cowdung treatment for 5 days (44.7 %) followed by mini sachet method (33.3 %). Further, seedling quality parameters *viz.* seedling length and vigour index were also higher in cowdung treatment. In another study conducted by Anand *et al.* (2012) to explore the effects of different seed treatments on germination and seedling growth parameters of a multipurpose plant, *Melia dubia* in the College of Forestry, Ponnampet nursery during 2010-2011, seeds were subjected to seven pre-sowing treatments. The results showed that cowdung slurry treatment for seven days had



significantly enhanced germination and seedling growth. Seed germination started 32 days after sowing and continued up to 66 days. The highest germination percentage was observed in the soaking of seeds in cowdung slurry for seven days (34.3 %) followed by 100 ppm gibberlic acid for 24 hours (31.5 %). The lowest germination percentage was obtained from control (18.7 %). Khushboo Tandon *et al.* (2019) conducted experiment at Gwalior, observed that pre-sowing seed treatment with GA<sub>3</sub> followed by cowdung slurry recorded higher germination percentage and survival of tamarind seedlings as compared to the control.

Pre-sowing seed treatment using water, mineral or organic solutions reduced germination period, increased germination percentage and seedling vigour, a low cost, easy to understand and simple technology for enhancing the seedling growth, location and crop specific recommendations are needed to develop in view of growing problems in stand establishment under different conditions.



## PROSPECTS OF HYBRID PIGEONPEA FOR BREAKING YIELD PLATEAU IN INDIAN AGRICULTURE

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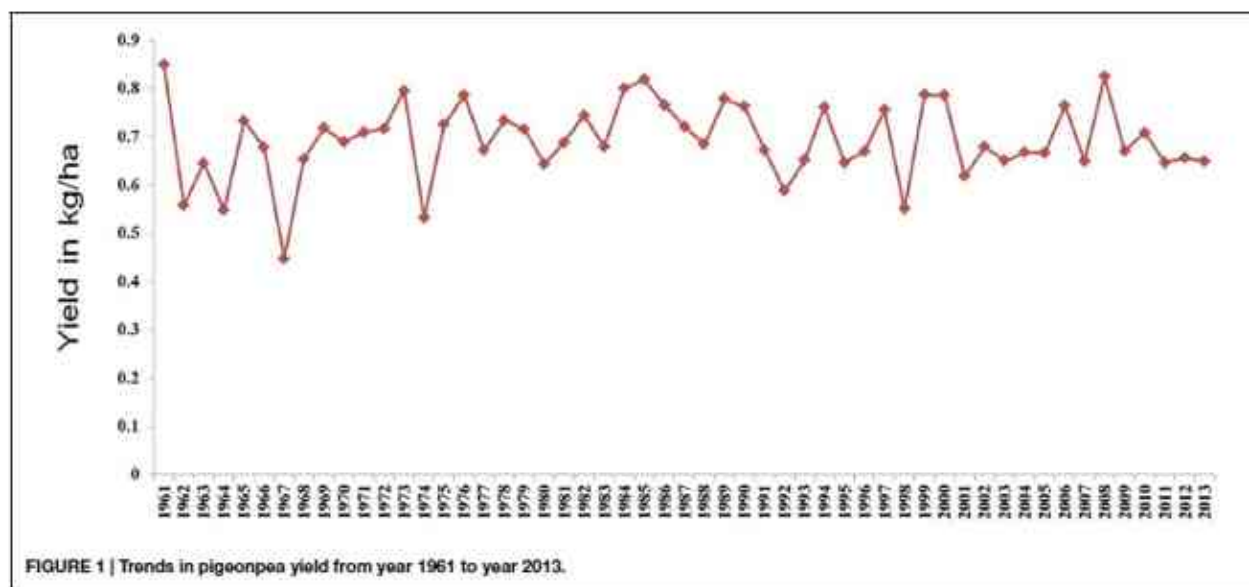
### Abstract

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is the second important pulse crop in India. To promote the pigeon-pea production, genetic improvement of pigeon-pea is being continuously emphasized by scientist and researchers for more than five decades and a number of cultivars were developed through hybridization programmes and selection of landraces. However, the progress in the genetic improvement of yield potential has been limited and the improved cultivars failed to enhance the productivity of the crop. The identification of genetic male sterility in pigeon pea (Reddy *et al.*, 1978 and Wallis *et al.*, 1981) has opened new vistas for commercial exploitation of hybrid vigour in this crop. However, the technology suffers from a major technical bottleneck when it comes to a large *scale* seed production. To overcome the inherent problems associated with GMS system, Cytoplasmic Genetic Male Sterility (CGMS) system were developed using various wild relatives of pigeonpea. A new hybrid pigeonpea breeding technology is capable of substantially increasing the productivity of red gram, and thus offering ray of hope for breaking yield plateau of pigeonpea in the country. Three lines system of hybrid technology, which is based on cytoplasmic-nuclear male-sterility, is expected to make a quantum increase in production and boost the productivity of pigeonpea yield in India. This review paper discusses the progress, current status and prospects of genetic enhancement of yield through hybrid breeding for breaking the yield *plateau* in pigeonpea.

**Key words :** Hybrid Pigeonpea, Genetic Male Sterility, Cytoplasmic Genetic Male Sterility, Heterosis.

Pulses constitute an important ingredient in predominantly vegetarian diet and important source of protein. They supply minerals and vitamins and provide an abundance of food energy. Pulses provide a cheaper source of protein, they contain nearly twice as much protein as that of cereals and hence correctly called as poor man's meat. Pulses are also important for sustainable agriculture, enriching the soil through biological nitrogen fixation.

Since 1976, globally recorded a 56 percent increase in its area production but the productivity remained low about 700 kg ha<sup>-1</sup>. The Indian Government annually imports about 0.5 to 0.6 m. tons of pigeonpea mainly from Myanmar and southern and eastern Africa. To promote the pigeonpea production, number of cultivars were developed through hybridization and selection (Singh *et al.*, 2005). Over the last six decades, pigeonpea productivity has remained stagnant at around 780 kg/ha, mainly due to the exposure of the crop to various biotic and abiotic stresses. Besides, it is mostly grown in marginal environments with limited inputs and inefficient management practices (Varshney *et al.*, 2012b).







## Constraints to High Productivity in Pigeonpea

The major challenge for pigeonpea improvement is increasing the productivity at the same time reducing the yield losses due to various biotic and abiotic stresses under changing climate scenario. The major constraints affecting pigeonpea production are mainly biotic stresses like Fusarium wilt (*Fusarium udum* Butler), sterility mosaic disease (sterility mosaic virus) and phytophthora blight (*Phytophthora drechsleri*) and pests such as pod borer complex (*Helicoverpa armigera*, *Maruca vitrata*), pod fly (*Melanagromyza obtusa*), plumemoth (*Exelastis atomosa*) and abiotic stresses like drought, water logging and sensitivity to salinity. Apart from this, lower harvest index of all the available pigeonpea cultivars also results in less productivity. This emphasizes the need for developing high yielding varieties with resistance to multiple stresses to survive the challenges of the marginal environments.

Pigeonpea varietal improvement program started in India in 1931 with selection from landraces for traits such as seed size, fusarium wilt, plant type, and yield (Ramanujam and Singh, 1981). During this period over 100 pigeonpea cultivars have been released in India but the crop productivity remained stagnant.

This is a matter of concern in view of increasing population and reducing per capita availability of protein (27.3 kg/year in 1950 to 10 kg/year in 2000) that led to malnutrition among growing children and women, in particular. Considering the above mentioned constraints, new scientific approaches and tools are needed to raise the productivity of this important pulse crop.

In this context, cytoplasmic male sterility (CMS)-based hybrid technology was developed and the world's first pigeonpea commercial hybrid namely; GTH 1 and ICPH 2671 was released, with 46% yield advantage in farmers' field (Saxena et al., 2013) In order to popularize hybrids it is necessary that new high yielding hybrids are bred for different climatic conditions. Besides this, the technology be made grower-friendly.

In this regard the new developments in genomics science can be of great help. Beyond doubt, integration of genomics with breeding can enhance the pace of breeding new widely adopted hybrids The genomics can be effectively used in the selection of heterotic hybrid, male and female parents, incorporation of resistances and stability in the performance, assessment of purity of hybrids and their parents

In this seminar an effort has been made to highlight the potential role that genomics can play in accelerating the pace of hybrid breeding in pigeonpea.

## Overview of Hybrid Breeding in Pigeonpea

### (a) GMS-based Pigeonpea Hybrids – The Starter Technology

Pigeonpea is unique among the pulses as its floral morphology allows partial cross-pollinations (Saxena et al., 1990). ICRISAT in 1974 started breeding hybrids using the natural out-crossing. As a first step a program was launched for breeding a male sterility system that could be used in breeding hybrids; and a genetic male sterility (GMS) system, controlled by a single recessive gene (*ms1ms1*), was identified (Reddy et al., 1978).

This GMS was used to develop hybrid technology to assess the extent of hybrid vigor and ability of out-crossing in seed production on the male sterile plants. The first ever pigeonpea hybrid ICPH 8 performed very well in the multi-location trials, coordinated trials, and in the farmers' fields with mean standard heterosis of 25–35%, was released in 1991 for cultivation (Saxena et al., 1992). This was followed by the release of five other GMS based hybrids bred at different centers of Indian Council of Agricultural Research (ICAR; Saxena et al., 2006). Despite the yield advantages of 25–40%, these hybrids could not be commercialized due to seed production difficulties (Saxena et al., 2006).

**Table-1** : Genetic male sterility based pigeonpea hybrids in India.

| S. N. | Hybrid    | Year of release | Duration | Yield (kg/ha) | Superiority over check (%) |
|-------|-----------|-----------------|----------|---------------|----------------------------|
| 1.    | ICPH 8    | 1991            | 125      | 1780          | 41 over UPAS 120           |
| 2.    | PPH 4     | 1994            | 137      | 1930          | 14 over UPAS 120           |
| 3.    | COPH1     | 1994            | 117      | 1210          | 32 over Vamabn 1           |
| 4.    | COPH2     | 1997            | 120-130  | 1050          | 35 over Co 5               |
| 5.    | AKPH 4101 | 1997            | 130-140  | —             | 64 over UPAS 120           |
| 6.    | AKPH 2022 | 1998            | 180-200  | —             | 35 over BDN 2              |



This valuable experience indicated that in pigeonpea sufficient heterosis is available and seed production issues can be tackled economically if the GMS system could be replaced with cytoplasmic genic male sterility (CGMS) system.

#### (b) Development of CGMS Systems — a Breakthrough

Considering the limitations in large-scale hybrid seed production in GMS hybrids, the development of CMS became imperative. The strategy was to induce CMS by placing pigeonpea genome in wild cytoplasm through hybridization. It was believed that the interaction of wild cytoplasm with cultivated nuclear genome would produce male sterility.

Seven cytoplasmic male sterile (CMS) systems (given in table) have been developed from different wild *Cajanus species*. Of these, A<sub>2</sub> and A<sub>4</sub> systems derived from crosses involving wild relatives of pigeonpea and cultivated types have shown promise because of their stability under various agro-climatic zones and availability of good maintainers and fertility restorers.

**Table-2 :** List of CMS sources derived from different wild relatives of pigeonpea.

| Sr. No. | Wild relative           | Designation    | Investigators                                                                                                                  |
|---------|-------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1.      | <i>C. sericeous</i>     | A <sub>1</sub> | Ariyanayagam <i>et al.</i> (1993, 1995), Saxena <i>et al.</i> (2006), Wanjari <i>et al.</i> (2003)                             |
| 2.      | <i>C. scarabaeoides</i> | A <sub>2</sub> | Ariyanayagam <i>et al.</i> (1993), Tikka <i>et al.</i> (1997), Saxena and Kumar (2003)                                         |
| 3.      | <i>C. volubilis</i>     | A <sub>3</sub> | Wanjari <i>et al.</i> (1999)                                                                                                   |
| 4.      | <i>C. cajanifolius</i>  | A <sub>4</sub> | Rathnaswamy <i>et al.</i> (1999), Saxena <i>et al.</i> (2005)                                                                  |
| 5.      | <i>C. cajan</i>         | A <sub>5</sub> | Rathnaswamy <i>et al.</i> (1999), Mallikarjuna and Saxena (2002), Mallikarjuna and Moss (1995), Mallikarjuna and Saxena (2005) |
| 6.      | <i>C. lineata</i>       | A <sub>6</sub> | K. B. Saxena, (Unpublished data)                                                                                               |
| 7.      | <i>C. platycarpus</i>   | A <sub>7</sub> | Mallikarjuna <i>et al.</i> (2006)                                                                                              |

As a result, first A<sub>2</sub> based hybrid GTH1 was developed at S D A U, S K Nagar, Gujarat and released by ICAR in 2004 for cultivation in Gujarat state. Parents of this hybrid are GT 288 A (CMS line/female with cytoplasm of *Cajanus scarabaeoides* and GTR-11 (restorer/male). Based on yield trials GTH 1 (1830 kg ha<sup>-1</sup>) gave 57.40% yield superiority over the best GMS hybrid AKPH 4101 and 32% yield superiority over the best local variety, GT 100. This hybrid is early in maturity duration (140 days) and very much stable for its fertility restoration.

Later on three A<sub>4</sub> CMS-based hybrid namely ICPH 2671 produced by crossing ICPA 2043 with ICPR 2671, was released in 2010 for Madhya Pradesh which recorded 35–69% superiority over the best local cultivars. In 2012, ICPH 2740 was released for cultivation in Andhra Pradesh (Saxena and Tikle, 2015); while the third hybrid ICPH 3762 was released in Odisha in 2014 (Saxena *et al.*, 2014a). The hybrids ICPH 2740 and ICPH 3762 also out-yielded the control by a big (40–50%) margin.

The performance data of the hybrid have shown that in pigeonpea significantly high productivity levels can be achieved by farmers and the persistent yield plateau can be cracked.

#### (a) Two-Line Hybrid Breeding Systems

Since three line based hybrid technology is technically demanding and incurs cost in commercial hybrid production. These issues have raised significant concerns that led to explore a much simpler technology that would enable accessibility to the farmers growing hybrids in their fields, i.e., two-line hybrid breeding system. Very recently, in pigeonpea a temperature sensitive male sterile line was identified based on field evaluations. This line was developed by crossing a wild relative, *Cajanus sericeus* with a cultivar namely, ICPA85010 (Saxena, 2014).

The perennial nature of the plant and the natural out crossing ability of the crop allows the possibility to evaluate these lines under controlled conditions for their male sterility to fertility transitions with different temperature regimes. These lines could be invaluable for establishing a two-line hybrid system in pigeonpea. Toward this, fertility transition behavior is being studied for more than 20 different combinations of day temperatures, night temperatures, photoperiods, humidity, and light intensities under controlled environment chambers.

Preliminary analysis has shown that these lines are responding to day temperature, converting to male sterile with more than 24°C and to male fertile with less than 23°C.

In addition, various cytological studies and transcriptome profiling of the male sterile and fertile anthers are also being carried out to identify the putative candidate genes and to understand the molecular mechanism. The identification of candidate



gene(s) and/or the trait locus controlling this reversion will play an important role in breeding, ultimately lead to developing a stable two-line system and also making use of elite lines into the hybrid breeding program.

Understanding the mechanism will also allow the prediction of performance of F<sub>1</sub>s of the two-line hybrids during different climatic conditions. Transcript profiling and proteomics analysis could be utilized to postulate the possible molecular mechanisms underlying the fertility transition in thermo sensitive genic male sterile (TGMS) lines as in case of *Oryza sativa* (Song et al., 2015).

A similar approach could also be devised for pigeonpea which will lead to breeding, development and utilization of TGMS lines for a potential two-line hybrid breeding. Breeding of this trait involves identification, cloning and transferring of the major sterility gene. Genetic analysis and fine mapping of this gene has already been carried out in rice (Lee et al., 2005) and wheat (Guo et al., 2006). Using a similar approach, segregating progenies are being developed at ICRISAT to dissect this trait in pigeonpea.

#### **(b) Advantages of Hybrids**

1. Increased grain yield: Results of the trials conducted over three years and several locations indicated that sufficient local of heterosis is available in pigeonpea
2. Enhanced seedling vigour: Hybrid pigeonpea plants produce substantially greater biomass than those of pure line varieties of the comparable duration. Hybrids utilize inputs such as sunlight, water, and nutrients more efficiently, while maintaining their partitioning at par with the pure lines leading to higher grain yield. In an experiment conducted at ICRISAT, 30-days old seedlings produced 44% more shoot mass and 43% more root mass compared to the pure line cultivars (Saxena et al., 1992).
3. Reduced seed rates: Pigeonpea hybrids produce more number of primary and secondary branches with wider canopy. This suggests that seed rate of hybrids can be reduced by 40 - 50% without losing yield per unit area. Reduced seed rate will offset the higher seed cost which the farmer may have to incur while purchasing hybrids
4. Greater drought tolerance: Hybrid pigeonpea, by virtue of its greater root mass and depth, have greater ability to draw water from deep soil profiles. This also helps hybrids to tide over intermittent drought conditions prevailing during different phases of growth.
5. Greater disease resistance: Results of limited experiments show that hybrids offer more resistance to disease attack than pure lines by virtue of their greater resilience (Saxena et al., 1992). Also the hybrids recover faster and assimilate greater biomass

#### **(c) Constraints in Breeding New Hybrids**

The major constraints in pigeonpea hybrid breeding as recognized now are :

1. Long generation turnover time that slow down the breeding and selection speed,
2. Challenges in identifying fertility restorers
3. Determination of genetic diversity is another factor that limits selection of heterotic hybrid parents,
4. Maintaining three lines (CMS, maintainer and restorer lines).
5. Ascertaining hybrid seeds purity
6. To deliver the benefits of hybrid technology to farmers, it is imperative that the process of breeding new hybrids be enhanced and seed technology is simplified
7. It is envisaged that the new developments in genomics science can help in solving these issues.

#### **(d) Genomics for Accelerated Hybrid Breeding Program**

During recent years, various genomic resources have been developed including a draft of the nuclear and the complete mitochondrial genome sequence in pigeonpea (Varshney et al., 2012; Tuteja et al., 2013), in addition to the large repertoire of molecular markers (Saxena et al., 2014b), high throughput genotyping platforms (Varshney et al., 2010), transcriptome assembly (Kudapa et al., 2014) and genetic maps (Saxena et al., 2010b; Bohra et al., 2012).

As a result of the recent advances in the next generation sequencing (NGS) based approaches, large numbers of molecular markers including SSRs (>54,000; simple sequence repeat), ISRs (>29,000; intron spanning region) and SNPs (>12,000; single nucleotide polymorphism) in addition to the 25,577 ESTs have become available in the public domain (Pazhamala et al., 2015).



Using genotyping by sequencing (GBS) and whole genome re-sequencing (WGRS) approaches, more and more variations such as SNPs, INDELs, CNVs, and PAVs are being identified which will be available and utilized in the near future for pigeonpea improvement programs.

Apart from these resources, many inter- and intra-specific genetic maps were developed, some of which utilized mapping populations with CMS lines segregating for fertility restoration (Saxena et al., 2011).

All these genomic resources along with the recent approaches will be utilized for consolidation and strengthening of the pigeonpea hybrid breeding technology in the near future. Furthermore, a number of efforts have been initiated toward rapid solutions to hybrid production systems and unlocking the mystery of heterosis using various genomics approach. Additionally, efforts have also been directed toward diversification of CMS sources in the pigeonpea genepool and answering the biological questions such as molecular basis of cytoplasmic male sterility. Also, various sets of molecular markers have been identified for fertility restoration and purity assessment.

## CONCLUSIONS

Pigeonpea can play a major role in providing food security especially to the semi-arid tropics, where it can be grown under marginal environment with limited resources. To achieve quantum jumps in the productivity level, which has remained unchanged and low over decades, a good beginning has been made by ushering in to an era of Pigeonpea hybrid. The exploitation of hybrid vigour is feasible and advantageous. ICRISAT, ICAR and SAUs took this challenge and succeeded in developing CMS systems by crossing wild relatives of Pigeonpea as female parent with the cultivated type as male parent. This technology has given us hope that the genetic barrier of stagnated yield could be broken. The development of stable CMS system in Pigeonpea is a real boon to the breeders. To enhance the pace of research and development of hybrid Pigeonpea ICRISAT and ICAR Institutes is actively involved in technology transfer to national research system, public and private seed sector. We believe that a good beginning has already been made with CMS-based hybrid Pigeonpea technology and now it is just a few steps more to break the yield plateau in pigeonpea.

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## **GLOBAL CLIMATE CHANGE : SCENARIO AND CHALLENGES GLOBAL CLIMATE CHANGE ITS IMPACT ON FOOD SECURITY AND AGRICULTURE**

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One of the greatest fears of the 21<sup>st</sup> century is global warming. The fears are visible in the sense that the Millennium Development Goals address environmental sustainability as one of the factors that can reduce its effects. The United Nations has come out to warn about a looming food crisis as from 2013, and this is an imminent threat to food security (Vidal, 2012). Over the past decades, various scholars, scientists, governments and policy makers across the world have raised concerns over the adverse effects that globalization may have on food security. In addition, societies today are more concerned about how they will go about sustaining the environment and ensuring that the future generations do not face the consequences of our own mistakes. Global warming is a serious concern, and since the future depends on an environment that is less polluted, that has ample food supply, and can sustain the present and future generations. This explains why globalization has received this attention and why researching about the topic is relevant in order to enhance food security in the 21st century. This research paper will look into the aspects of global warming and address the fears that the present generation has on food security.

### **Association between Food Security and Global Warming**

Today, people continue to be vulnerable and food insecure and with global warming, they are likely to face more adverse effects of climate change and globalization. For instance, the current agricultural-based livelihood systems are vulnerable to food insecurity. The effects of climate change shall add to the pressing risks that emanate from failures in crops, arising patterns of pests and diseases, loss of livestock, and inadequate seeds and planting material (FAO, 2008). The climatic changes have a direct impact on agricultural production, which in turn influences the food security of nations.

The present initiatives that aim at identifying solutions to the current food insecurity program are available in the Millennium Development Goal 1. This goal specifically tries to mitigate on the challenges that the current food system is facing. At the same time, focus has been on how to strengthen the rural populations to cope with the immediate risks that global warming and climate change is causing. The current ways that have been put to curb the challenges of global warming include the development of clean technology, use of alternative sources of energy, education on the effects and how to tackle them, and support of lifestyles that can reduce the effects of global warming. Sustainable agricultural practices will be achievable if the governments put across measures that can eliminate the effects of climate change. The call for acclimatization and adaptation as some of the mitigation measures for climate change aims at reducing risks on people and their livelihoods (FAO, 2008). Thus, climate change mitigation policies that governments employ include reducing emission of greenhouse gases and developing the choices that will lead to reduction of emission in the long run.

Agriculture plays a significant role in food security as it is responsible for the production of food that people eat, and provide the elemental livelihood source. If climate change affects agricultural production in developing countries across Africa and Asia, the livelihoods of people will be at risk and increase vulnerability to food insecurity (FAO, 2008). Various reports indicate that, by the year 2020, rain fed agricultural will reduce by 50 percent in several African Countries (Godden, 2008). At the same time, it means that irrigation practices in the world will increase, and this will affect food production. Food security relies on agricultural production that is sensitive to climate change.

The most pressing concerns of global warming are the effects it has on several countries across the world. Today, food production in the United States has gone down due to droughts. In addition, China is facing some of the most adverse effects of global warming. If these remain uncontrolled, there shall be pervasive consequences on the current food situation across the developed and developing world. Global warming has posed threats on China's march to success. The effects of global warming had an impact on crop production; it has led to shrinking of rivers and has unleashed more floods and droughts in China. Thus, global warming effects on China will spread out to the entire world.

The whole world is likely to face grim environmental and ecological concerns, and under the impact and effects of global warming, it is likely to worsen the prosperity of the current and future generation's environmental sustainability. This is likely to make the Millennium Development Goal 7 of environmental sustainability a pipe dream. Other reports of the impact of global warming on food security indicate that it has negatively affected developing countries. At the same time, these countries rely on food to sustain their burgeoning population, and if these continue, hunger and malnutrition in many countries will be a constant problem.

The notable challenges of global warming are in terms of habitat destruction. This is because the resilience of the ecosystems





is going to change as a result of global warming and climate change. The associated global environmental disturbances such as flooding, wildfires, insects, drought, ocean acidification, pollution, and over-exploitation of natural resources will impact of the structure of the ecosystem. This will have pervasive consequences for biodiversity, water and food supply. The supply of food is likely to diminish with the rising environmental changes (IPCC, 2007). The impact of climate change on food production will affect food supply at local and international levels. For instance, high temperatures will affect production of food at the tropics. This is the same case for lower latitudes where global warming has led to increase of temperatures by approximately 1 to 2°C. This will increase the risk to hunger in the world. The impact of global warming on health will emanate from malnutrition, increase deaths due to diseases, injuries that arise out of the extreme weather conditions. At the same time, health effects will be on the cardio-respiratory diseases due increase in the concentrations of ground-level ozone in major urban areas (IPCC, 2007).

Global warming is the phenomenon of a gradual increase in the temperature near the earth's surface. This phenomenon has been observed over the past one or two centuries. This change has disturbed the climatic pattern of the earth. However, the concept of global warming is quite controversial but the scientists have provided relevant data in support of the fact that the temperature of the earth is rising constantly.

There are several causes of global warming, which have a negative effect on humans, plants and animals. These causes may be natural or might be the outcome of human activities. In order to curb the issues, it is very important to understand the negative impacts of global warming.

Global climate change has already had observable effects on the environment. Glaciers have shrunk, ice on rivers and lakes is breaking up earlier, plant and animal ranges have shifted, and trees are flowering sooner. Effects that scientists had predicted in the past would result from global climate change are now occurring: loss of sea ice, accelerated sea level rise and longer, more intense heat waves. Scientists have apprehensions that global temperatures will continue to rise for decades to come, largely due to greenhouse gasses produced by human activities. The Intergovernmental Panel on Climate Change (IPCC), which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century. According to the IPCC, the extent of climate change effects on individual regions will vary over time and with the ability of different societal and environmental systems to mitigate or adapt to change.

The IPCC predicts that increases in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above 1990 levels will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperatures increase. "Taken as a whole, the IPCC states, the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time" (IPCC, 2007).

Difference between climate variability and climate change are given below :

| <b>Climate Variability</b>                                                                                                                                                                                                                                                                                                                                                                                                  |  | <b>Climate Change</b>                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| It is a local/regional phenomenon<br>Year to year or season to season changes in rainfall and temperature<br>Examples:<br>2002- drought year over India<br>2007- flood year over India<br>2008- some regions experience floods while droughts in some regions within India<br>Short period weather changes – resulting into heavy crop loss.<br>It may be due to occurrence of floods and droughts and cold and heat waves. |  | It is a global phenomenon<br>Long-term changes in rainfall and temperature over a period of at least 30 years<br>Examples:<br>Global temperature – 15°C last century<br>Global temperature likely to be 18-19°C during 2100 A.D.<br>Temperature increase 3-4°C during 2100 A.D.<br>Long period climate change lead to:<br>* Decline in Production<br>* Change in cropping system |

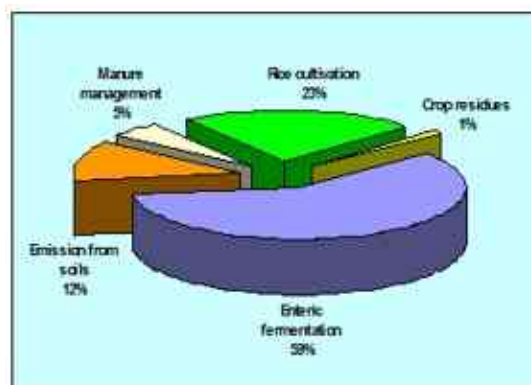
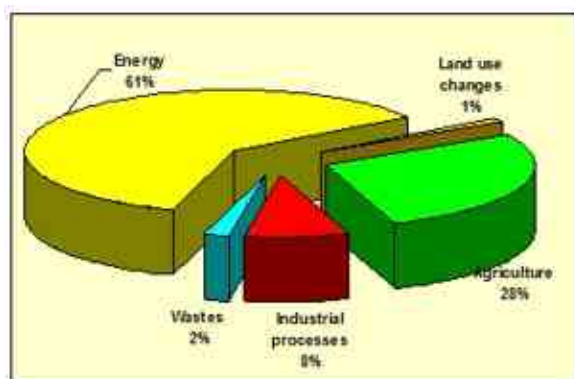
Climatic patterns are determined primarily by geographic factors including Land form, Latitude, Altitude, Longitude, Distance from large bodies of water, Ocean currents, Direction and intensity of wind, Air masses movement influenced weather pattern and vegetation type. Three geographic facts (altitude, latitude and longitude) are important for crop production these are embodied in the Hopkins Bioclimatic law: States that crop production activity (planting harvesting and morphological development) are delays 4 days for 1° latitude, 5° of longitude and 400 feet (122 meter) of altitude, as one move north word, east word and up word respectively. Geographic surface feature modify the meteorological factor in the region. The orographic effect is the modification on the climate in a region by the presence of a mountain range in the path of prevailing winds, resulting in wet conditions in wind word area and drier conditions on lee word part of the mountain. Global



warming: A general and gradual increasing trend in global average temperature suspected to have a role in the green house effect. EL Nino/southern Oscillation: A weather system responsible for the warming of the tropical pacific surface water. La Nino: A cold episode that periodically occurs across the tropical pacific and impacts surface atmosphere opposite of EL Nino.

Increase in atmospheric pollutants due to emission of greenhouse gases, including black carbon and burning of fossil fuels, chlorofluorocarbons, hydro chlorofluorocarbons, hydro fluorocarbons, perfluorocarbons, ozone depletion and UV-B filtered radiation, eruption of volcanoes, human hand in deforestation, forest fires for weather extremes. The loss of forest cover results in erosion of top soil, causing floods and droughts, the lack of trees also exacerbates drought in dry years by making soil to dry out more quickly. Among the green house gases, CO<sub>2</sub> is the predominant gas leading to global warming and it trap long-wave radiation and emits back to the earth, surface.

**Contribution of India to global warming :** The different sources of gases emissions from different sources in India are estimated as follows :



### Global Climate Change Predication and Impact

Gradual climate change may provide enough time for biota adjustment.

Rapid climate change harm agriculture (countries suffering due to poor soil and climate would further suffer).

The global mean temperature will increase 1 to 3°C by 2100 A.D. with double CO<sub>2</sub> production and 20% increase of decrease of rainfall.

Productivity will decrease for some cereal in low latitude and increase in high latitude.

Increase in arable land in high latitude due to reduction of frozen land.

Rainfed area warn of possible productivity losses and increase risk of drought.

Sea levels are expected to get up 1m higher by 2100 A.D.

South East Asia may lose Agricultural land, Increase salinity and rising water table.

Low laying area of Bangladesh, Vietnam and India Loss of rice crop.

India, China, Pakistan, Afghanistan, Bangladesh, Nepal and Myanmar could experience flood followed by drought  
C<sub>3</sub> plants: 36% increase in yield.

Increase Amylase content in rice under elevated CO<sub>2</sub>, lower concentration of Iron & zinc decrease protein content and knock-on effect on other part of eco-system.

Sine most weeds are C<sub>3</sub> plants they get benefit from CO<sub>2</sub> elevation, increase temperature decrease effectiveness of weed killers and increase pressure of insect and disease.

### GLOBAL TEMPERATURE INCREASE IMPACT ON AGRICULTURE

#### Positive Impacts

Increased productivity from warmer temperatures

Possibility of growing new crops

Longer growing seasons

Increased productivity from enhanced CO<sub>2</sub>



Accelerated maturation rates

Decreased moisture stress

#### **Negative Impacts**

Increased insect infestations

Crops damage from extreme heat

Planning problems due to less reliable forecasts

Increased soil erosion

Increased weed growth and disease outbreaks

Decreased herbicide and pesticide efficacy

#### **Combined Impacts**

Crop damage from more ground level ozone

More Climate Variability

Mono-Crop agriculture not adaptable

### **CLIMATE CHANGE IMPACT IN DIFFERENT COUNTRIES**

#### **Africa**

Area getting more rainfall will get further and getting less rainfall may suffer due to drought.

May lose more than 30% of maize crop and 10% rice and millet

#### **Asia**

East and South Asia : yield increase 20%

Central and South Asia : yield decrease up to 30%

Rice yield decrease 20% with increasing 1°C temp., if 35°C temp. at flowering no grain production is possible

#### **Australia and Newzeoland**

Southern and Eastern Australia experience decline of agriculture and forest production over Eastern Newzeoland.

Newzeoland get benefit close to their river basin in Western and Southern part.

#### **Europe**

Southern Europe : reduce productivity

Eastern and Central Europe : Forest productivity decline

Northern Europe : Incerase crop yield

#### **Latin America**

Drier area of Latin America : Crop/Livestock productivity decrease

Temperature zone : Soybean yield increase

#### **North America**

No effect on important crops.

### **CONCLUSION**

Global warming provides a foundation for the sustainability of food production and future generations. Global warming will shape individuals health and food patterns across the globe. In conclusion, food security and global warming are highly interrelated. The impact of global warming on agricultural production and this in turn affects food security. The effects will go further to affect peoples' health as it largely depends of food. It is clear that, with food insecurity, people will face serious problems on their livelihoods and health patterns. For instance, the productivity of cereals will reduce accentuating food insecurity in many regions.

Temperature increase by end of this century lead to more frequent heat extremes, floods, drought, cyclones and global recession of glaciers, which intern would result instability in food production. Dynamics of pests and diseases will be significantly altered. Adoptive measures are required to reduce the emission of green house gasses. Strategies for adoptive



capacity to mitigation of climate change includes development of adverse climate tolerant genotype and land use systems, providing value added climatic risk management services to farmers and improved land use policies and risk management.

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## CULTIVATION AND ECONOMICS OF OYSTER MUSHROOM (*PLEUROTUS* SPP.)

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### INTRODUCTION

The *Pleurotus* Mushroom is generally referred to as 'Oyster Mushroom' or 'Dhingri' in India. It is a basidiomycete and belongs to the genus '*Pleurotus*'. It is a lignocellulolytic fungus and grows naturally in the temperate and tropical forest on dead and decaying wooden logs or sometimes on dryings trunks of deciduous or coniferous woods. It can also grow on decaying organic matter. The fruit bodies of this mushroom are distinctly shell, fan or spatula shaped with different shades of white, cream, grey, yellow, pink or light brown depending upon the species. However, the colour of the sporophores is extremely variable character influenced by the temperature, light intensity and nutrient of the substrate. The name *Pleurotus* has its origin from greek word, 'Pleuro' means formed laterally or lateral position of the stalk or stem.

Oyster mushroom is the 3<sup>rd</sup> largest cultivated mushroom in the world and its annual world production is around 876,000 tonnes (Chang, 1999). China alone contributes 88% of the total world production. At present India Produces only small quantities (5000 tonnes) of oyster mushroom in the states of Orissa, Karnataka, Maharashtra, Andhra Pradesh, Madhya Pradesh, West Bengal, Kerala, Tamil Nadu and in the North-Eastern States of Meghalaya, Manipur, Mizoram and Assam.

### 2. Advantages of growing oyster mushroom

**(a) Variety of substrates :** *Pleurotus* mushroom can degrade any kind of agricultural or forest waste which are containing lignin, cellulose and hemicellulose.

**(b) Choice of species :** Among all the cultivated mushrooms *Pleurotus* has maximum number of commercially cultivated species suitable for round the year cultivation. Moreover, variation in shape, colour, texture, aroma are also available as per consumers choice.

**(c) Simple cultivation technologies :** *Pleurotus* mycelium can grow on fresh straw and it does not require selective substrate for growth. Substrate preparation for oyster mushroom is very simple. Moreover it does not require controlled environmental conditions like *A. bisporus* for cultivation because most of the species have very wide temperature, relatively humidity and CO<sub>2</sub> tolerance.

**(d) Longer shelf-life :** Unlike white button mushroom, the oyster mushroom fruit bodies can be easily dried and stored. Dried oyster mushrooms can be instantly used after soaking in hot water for 5 to 10 minutes or it can be used in powdered form for several preparations. Fresh mushrooms have a shelf life of 24-48 h even at room temperature.

**(e) High productivity :** The productivity is very high as compared to all other cultivated mushrooms. One can harvest minimum of about 500 to 700 kg of fresh oyster mushroom from one ton of dry wheat or paddy straw in 45-60 days, while with the same quantity of straw only about 200-250 kg of white button mushrooms are obtained in 100-120 days.

### 3. History of oyster mushroom cultivation

The history of oyster mushroom cultivation is of recent origin in comparison to *Auricularia* (600 A.D.), *Lentinula edodes* (1100 A.D.) and *Agaricus bisporus* (1650). The present day cultivation technology of oyster mushroom is a result of various successive steps evolved throughout the world during 20<sup>th</sup> century. A very primitive form of growing *Pleurotus* spp. was adopted by lumberman in Europe during 19<sup>th</sup> century. First successful experimental cultivation of *Pleurotus ostreatus* was achieved in Germany by Falck in 1917. He inoculated tree stumps and wooden logs with mycelium of *P. ostreatus* (*Agaricus ostreatus*) and could harvest fresh oyster mushroom. Etter in 1929 produced fruiting bodies of *P. ostreatus* in culture. On saw dust medium sexual spores of *P. corticatus* Fr. were reported by Kaufert (1935-36). Block et al., (1958) cultivated *P. osteratus* for the 1st time under laboratory conditions on saw dust medium. They used a mixture of oat meal and saw dust for cultivation and found best results on *Eucalypts* followed by pine saw dust. They observed some growth abnormalities in fruit bodies due to insufficient light conditions and no mushroom production when the temperature was less than 10°C and more than 32°C. In India Cultivation of *P. flabellatus* on paddy straw was reported by Bano & Srivastava in 1962 at CFTRI, Mysore. Corn cobs were used under sterile conditions for growing *P. ostreatus* (Toth 1969)/ the above method was modified by Gyurko (1969) under non-sterile conditions. Kaul and Janardhanan (1970) cultivated a white form of *P. ostreatus* on dried *Euphorbia royleana* (Thor) Stems. A Hungarian Method for growing oyster mushroom based on a sterile production was patented in 1969 (HTTV patent). Stanek and Rysava (1971) developed a method of application of thermophilic





microorganisms in the fermentation of substrate for the cultivation of *Postreatus*. Zadrazil in 1974 demonstrated a method for continuous preparation of substrate and industrial production of *Pleurotus* mushrooms. Jandaik and Kapoor in 1974 could grow *P.sajor-caju* on various substrates including wheat and banana pseudostems. Chang *et al* (1981) successfully developed a method for cultivation *P.sajor-caju* using cotton waste from textile industry. A lot of research work has been done in other countries for Zadrazil (Germany), Prof.Lelley (Germany), Kurtzman (USA), Delmas (France) and S.T. Chang (Hong Kong), Quimio, (Philippines).

#### 4. The biology of oyster mushroom

Visually the basidiocarp or fruit bodies of an oyster mushroom have three distinct parts – a fleshy shell or shell or spatula shaped cap (pileus), a short or long lateral or central stalk called stipe and long ridges and furrows underneath the pileus called gills or lamellae. The gills stretch from the edge of the cap down to the stalk and bear the spores. If a fruit body is kept on a paper directly (gills facing the paper) a dirty white or lilac deposition of powdery spores can be seen. The spore print colour may be whitish, pinkish, lilac or grey.

#### 5. Varieties of oyster mushroom

There are 38 species of the genus recorded throughout the world (Singer). In recent years 25 species are commercially cultivated in different parts of the world which are as follows: *Postreatus*, *P.flabellatus*, *P.florida*, *P.sajor-caju*, *P.sapidus*, *P.cystipdious*, *P.eryngii*, *P.fossulatus*, *P.opuntiae*, *P.cornucopiae*, *P.yuccae*, *P.platypus*, *P.djamore*, *P.tuber-regium*, *P.australis*, *P.purpureo-olivaceus*, *P.populinus*, *P.levis*, *P.columbinus*, *P.nembranceus* etc.

#### 6. Cultivation

The procedure for oyster mushroom cultivation can be divided into four following steps.

- 6.1. Preparation or procurement of spawn.
- 6.2. Substrate Preparation.
- 6.3. Spawning of substrate and
- 6.4. Crop management.

**6.1. Preparation of procurement of spawn :** One should have a pure culture of *Pleurotus* spp. for inoculation on sterilized wheat grain. It takes 10-15 days for mycelial growth on grains. It has been reported that Jowar and Bajra grains are superior over wheat grains. The mycelium of oyster mushroom grows very fast on wheat grains and 25-30 days old spawn starts forming fruitbodies in the bottle itself.

#### 6.2. Substrate preparation

**6.2.1. Substrates for oyster mushroom and their nutrition quality :** Oyster mushroom largely depends on the nutrition and nature of the substrate. The substrate should be fresh, dry, free from mould infestation and properly stored. The substrates exposed to rain and harvested immature with green chlorophyll patches inhibit the growth of *pleurotus* mycelium due to presence of competitor moulds. Oyster mushroom can utilize a number of agro wastes including straw of wheat, paddy and ragi, stalks and leaves of maize, jowar, bajra and cotton, sugarcane bagasse, jute and cotton waste, dehulled waste pea nut shells, dried grasses sunflower stalks, use tea leaf waste, discarded waste paper and synthetic compost of button mushrooms.

**6.2.2. Methods of substrate preparation :** The mycelium of *Pleurotus* is saprophytic in nature and it does not require selective substrate for its growth. The mycelia growth can take place on simple water treated straw but there are number of other cellulolytic moulds already present on straw. The popular methods of substrate preparation are as follows.

**(a) Steam pasteurization :** In this method prewetted straw is packed in wooden trays or boxes and then kept in a pasteurization room at 60-80°C for few hours. Temperature of the pasteurization room is manipulated with the help of steam through a boiler. Substrate after cooling at room temperature is seeded with spawn. The entire process takes 3-5 days.

**(b) Hot water treatment :** The substrate after chopping (5-10cm) is soaked in hot water (65 to 70°C) for one hour (Bano et al., 1978), or 60 to 120 minutes at 80°C (Singh and Dwivedi, 1991) or in case of paddy straw at 85°C for 30-45 minutes. After draining excess water spawn is added.

**(c) Sterile technique :** The chopped substrate after soaking in cold water is put in heat resistant polypropylene bags and sterilize in an autoclave at 20 lb. pressure p.s.i. for 1-2 hours followed by spawning under aseptic conditions.



**(d) Fermentation or composting :** Chop the substrate into 5-6 cm long pieces. Add ammonium sulphate or urea (0.5-1%) and lime (1%) on dry weight basis of the ingredients. Horse manure or chicken manure (10% dry weight basis) Can also be used instead of nitrogenous fertilizers. Addition of lime improves the physical structure of the compost. After mixing all the ingredients sprinkle water till it is completely wet. Prepare a triangular heap of 75-90 cm but not more than 1 meter high. After 2 days of fermentation turning of pile is done adding 1% superphosphate and 0.5% lime. The compost will be ready after 4 days of this turning. It can be spawned as such or used after pasteurization.

**(e) Chemical sterilization technique :** When wheat straw is treated by steeping in a chemical solution take ninety liters of water is taken in a rust proof drum (Preferably of galvanized Sheet) or G.I. tub of 200 liters capacity. Ten to twelve kg of wheat straw is slowly steeped in water. In another plastic bucket Bavistin 7.5 g and 125 ml formaldehyde (37-40%) is dissolved and slowly poured on the already soaked wheat straw. Straw is pressed and covered with a polythene sheet. After 15 to 18 h the straw is taken out and excess water is drained.

### 6.2.3. Substrate supplementation

Some of the common supplements are wheat bran, rice bran, cotton seedmeal, soybean cake groundnut cake and ammonium nitrate etc. wheat bran and rice bran should be used at the rate of 10% while cotton seed meal, soybean cake and ground nut Cake Should be tried @ 3-6% on dry weight basis of the substrate. The supplements should be treated with 25ppm carbendazim (250 mg in 10 lit. water) for 14-16 h. supplements are thoroughly mixed with straw while spawning. Addition of supplements increases to substrate temperature so it is very risky during summer season to supplement the straw.

### 6.3. Spawning of substrate

Freshly prepared (20-30 days old) grain spawn is best for spawning. Old spawn (3-6 months) stored at room temperature (20-30°C) forms very thick mat like Structures due to mycelium aggregation and sometimes young pinheads and fruitbodies start developing in the spawn bottle itself. The spawning should be done in pre-fumigated room (48 h with 2% formaldehyde). The spawn should be mixed @ 2 to 3% of the wetwt. substrate or 2.8 to 3 kg of dry substrate wt. Spawn can be mixed thoroughly or mixed in layers. Spawned substrates can be filled in polythene bags (60 x 45 cm) of 125-150 gauze thickness. Ten to 15 small holes (0.5-1.0 cm dia) should be made on all sides especially two to four holes in the bottom to leach out excess water.

### 6.4. Crop management

**6.4.1. Incubation :** Spawn bags can be kept on a raised platform or shelves or can be hanged in cropping room for mycelial colonization of the substrate. Although mycelium can grow from 10-30°C but the optimum temperature lies between 22-26°C. Higher temperature (more than 30°C) in the cropping room will inhibit the growth and kill the mycelium. Daily maximum and minimum temperature of cropping rooms and beds should be recorded. The bed temperature is generally 2-4°C higher from the room temperature.

**6.4.2. Fruitbody induction :** Once the mycelium has fully colonized the substrate and forms thick mycelial mat it is ready for fruiting. Contaminated bags with mould may be discarded while bags with patchy mycelia growth may be left for few more days to complete the mycelial growth. In no case bags should be opened before 16-18 days except in case of *P. membranaceus* and *P.djamorevar.roseus* which forms fruit bodies within 10 days even in closed bags from small holes. Various cultural conditions required for fruiting are as follows.

**Table-1 :** Temperature requirement of different *Pleurotus* spp. and their yield performance.

| Sr. No.                  | Species               | Opt. temp. of myc. grown on sub (°C) | Opt.temp. for fruiting | temp. range where it can grow | Yield perf BE (%) |
|--------------------------|-----------------------|--------------------------------------|------------------------|-------------------------------|-------------------|
| 1.                       | <i>P. flabellatus</i> | 25-28                                | 22 +2                  | 16-28                         | 60-90             |
| 2.                       | <i>P. sajor-caiu</i>  | 25-28                                | 24+2                   | 17-30                         | 50-70             |
| 3.                       | <i>P. sapidus</i>     | 25-28                                | 24+2                   | 17-30                         | 40-70             |
| <b>Winter cultivated</b> |                       |                                      |                        |                               |                   |
| 4.                       | <i>P. Ostreatus</i>   | 25-28                                | 20+22                  | 18-25                         | 30-50             |
| 5.                       | <i>P. Florida</i>     | 25-28                                | 20+2                   | 12-22                         | 60-90             |
| 6.                       | <i>P. eryngii</i>     | 18-25                                | 20+2                   | 12-24                         | 40-60             |



**7. Postharvest practices :** Mushrooms should always be harvested before spraying water. The right stage for picking can be judged by the shape and size for fruitbody. In young mushrooms the edge of the cap is thick and cap margin is enrolled while the cap of mature mushroom become flat and inward curling starts. It is advisable to harvest all the mushrooms at one time from a bag so that the next crop of mushrooms start early. Fresh mushrooms should be packed in perforated polythene bags for marketing. The dried produce with 2-4% moisture can be stored for 3 to 4 months after sealing properly.

**8. Medicinal and nutritional value of value for oyster mushroom :** Oyster mushroom are rich in vitamin-C and B complex. Protein content varies between 1.6 to 2.5%. It has most of the mineral salts required by the human body such as potassium, sodium, phosphorus, iron and calcium. The niacin content is about ten times higher than any other vegetables.

**9. Infrastructural requirements for growing oyster mushroom :** Following building structure are required for oyster mushroom production :

**(A) Storage shade :** A good quality, cheaper substrate is required for growing oyster mushroom. A cemented covered shade of 60'x20'x15' could store 200-250 quintals of straw. The storage shade should be well connected with main supply road.

**(B) Substrate preparation yard :** For commercial production of oyster mushroom, every time large quantity of straw is to be wetted and mixed with ingredients, which requires covered cemented floor or compositors' yard. The cemented platform is given a slight slope of 1 cm/m at the end of the yard, where run off water from the straw can be collected in a gummy pit (4'x4'x4').

**(C) Pasteurization chamber of tunnel :** A tunnel of 40'x10'x10', or 15'x7'x7' could pasteurize 20 and 4 quintals of wheat straw efficiently. The height of the straw in the tunnel should not be more than 5'. The pasteurization chamber has double floor.

**(D) Spawning room :** The spawning room should be near the tunnel and enclosed 40'x20' size. The spawning room should be fumigated with formaldehyde 2 days before the spawning.

**(E) Cropping room :** The mycelium of oyster mushroom can tolerate CO<sub>2</sub> conc. upto 20,000 ppm or 20%. For fruiting it requires light, fresh air, light and relative humidity or 70-75%. A cropping room of 60'x14'x12' can accommodate 20 racks of 5'x3' size. On each tier of a rack 8 bags of 2 kg substrate could be arranged. So on a single rack 32 bags could be kept. The total bags in a single room will be around 960 bags of 2 kg straw.

**(F) Post harvest room :** After harvesting mushrooms it is brought for cutting and cutting and packing in the post harvest room. It should have one or two mushroom dryers or hot air oven. The mushrooms which could not be sold is dried in hot air oven.

### **Economics of oyster mushroom cultivation by chemical sterilization technique**

#### **A. Economics of Oyster Mushroom Cultivation in Polyhouse (3.5 to 4TPA)**

| S. No. | Items                                                                                      | Quantity            | Rate           | Amount Rs. |
|--------|--------------------------------------------------------------------------------------------|---------------------|----------------|------------|
| (a)    | Non Recurring Expenditure                                                                  |                     |                |            |
| I      | Building Cost: High density polythene sheet growing room of 20 x 15x10 300 ft <sup>2</sup> | 300 ft <sup>2</sup> | 18000 per unit | 84000.00   |
| li     | Sprayer pump                                                                               | 01 no.              | 2000.00        | 3500.00    |
| lii    | Plastic Drum 200 lit Capacity                                                              | 03 no.              | 1200.00        | 3600.00    |
| Iv     | Nylon ropes for hanging bags                                                               | 10kg                | 200.00         | 2000.00    |
| V      | Digital Thermometers                                                                       | 02 no.              | 400.00         | 800.00     |
| Vi     | Industrial Coolers                                                                         | 02 no.              | 15000.00       | 30000.00   |
|        | Total Non –recurring expenditure                                                           |                     |                | 123900.00  |
| (b)    | Recurring expenditures (Cost of raw materials                                              |                     |                |            |
| I      | Wheat straw or paddy straw                                                                 | 8 quintal           | 500.00         | 4000.00    |
| li     | Cost of 800 polythene bags(125-150 gauze thick of 60x45 cm                                 | 12 kg               | 150.00         | 1800.00    |
| lii    | Cost of spawn                                                                              | 80 kg               | 130.00         | 10400.00   |
| Iv     | Labor wages 40 days                                                                        | 2 person            | 201.00         | 16080.00   |
| V      | Chemicals                                                                                  |                     |                |            |
| a).    | Bavistin @ 7g for treating of 10 kg straw                                                  | 560 gm              | 150.00/100 gm  | 840.00     |



|     |                                                                                                    |                     |       |          |
|-----|----------------------------------------------------------------------------------------------------|---------------------|-------|----------|
| b). | Formaldehyde 3.5 lit (100 ml for 10 kg straw) Commercial grade                                     | 3.5 lit             | 70.00 | 245.00   |
| Vi  | Miscellaneous charges (water, electricity, pesticides, small polythene bags for packing etc.       | 5000.00             |       |          |
|     | Total Rs.                                                                                          | 38365.00            |       |          |
| vii | Building depreciation 10% + interest 15% = 9000 and Machinery depreciation 10% + interest 15%=9975 | 30975.00<br>9975.00 |       |          |
| C.  | Total for one year                                                                                 |                     |       | 40950.00 |
| a.  | For one crop                                                                                       |                     |       | 6825.00  |
| b.  | Total expenditure for one crop Rs. 38365+62825                                                     | 45190.00            |       |          |
| c.  | Expected yield (70%BE) = 700 kg fresh mushroomsIncome from sale @ Rs. 130.00 kg x700=91000.00      | 91000.00            |       |          |
| e.  | Net profit from one crop                                                                           | 45810.00            |       |          |
| f.  | Annual Profit from 6 crops                                                                         | 274860.00           |       |          |

### B. Economics of Oyster Mushroom Cultivation in Mud House (7 to7.5 TPA)

| S. No. | Items                                                                                                                              | Quantity             | Rate Rs. | Amount Rs. |
|--------|------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------|------------|
| (a)    | Non Recurring Expenditure                                                                                                          |                      |          |            |
| i      | Cost of mud house (60'x20x10-13) for housing 1300 bags of 6 kg wet straw (1200 ft <sup>2</sup> )                                   | 1200 ft <sup>2</sup> | 40.00    | 48000.00   |
| ii     | Annual Maintenance                                                                                                                 | 01 no.               | 2000.00  | 2000.00    |
| iii    | Spray Pump                                                                                                                         | 03 no.               | 1200.00  | 3600.00    |
| iv     | Cost of plastic drum                                                                                                               | 03                   | 1200.00  | 3600.00    |
| v      | Digital Thermometers                                                                                                               | 02 no.               | 400.00   | 800.00     |
| vi     | Bamboo and rope for making racks                                                                                                   | 70 no.               | 140.00   | 9800.00    |
|        | Total Non –recurring expenditure                                                                                                   |                      |          | 67800.00   |
| (b)    | Recurring expenditures (Cost of raw materials)                                                                                     |                      |          |            |
| I      | Wheat straw or paddy straw                                                                                                         | 20 q.                | 500.00   | 10000.00   |
| ii     | Cost of polythene bags(125-150 gauze thick of 60x45 cm                                                                             | 20 kg                | 150.00   | 3000.00    |
| iii    | Cost of spawn                                                                                                                      | 200kg                | 130.00   | 30000.00   |
| iv     | Labor wages 60 days                                                                                                                | 2 person             | 250.00   | 15000.00   |
| v      | Chemicals                                                                                                                          |                      |          |            |
|        | Bavistin @ 7g for treating of 1.5                                                                                                  | 1.5 kg               | 1400.00  | 2100.00    |
|        | Formaldehyde                                                                                                                       | 20 lit               | 70.00    | 1400.00    |
| vi     | Miscellaneous charges (water, electricity, pesticides, etc.                                                                        |                      |          | 5000.00    |
| (c)    | Total recurring expenditure                                                                                                        |                      |          | 66500.00   |
| vii    | Annual maintenance (Rs. 10000+10%+interest(Rs. 6780) for 6 crops = 2796.66or 2800 Rs. 16780.00 maintenance + interest for one year | 2800.00              |          |            |
|        | Total expenditure for one crop 66500+2800 =69300.00                                                                                | 69300.00             |          |            |
|        | Expected yield (70%BE) = 1400 kg fresh mushrooms                                                                                   |                      |          |            |
|        | Income from sale @ Rs. 120.00 kg x1400=168000.00                                                                                   | 168000.00            |          |            |
|        | Net profit from one crop 168000-69300=98700.00                                                                                     | 98700.00             |          |            |
|        | Annual Income from 6 crops                                                                                                         | 592200.00            |          |            |

### C. Economics of Oyster Mushroom Unit (95 to100 TPA)

#### 1. (a) Total Infrastructure Required

| S. No. | Items                                                                                       | Quantity    | Rate Rs.   | Amount Rs. |
|--------|---------------------------------------------------------------------------------------------|-------------|------------|------------|
| 1.     | Fixed Capital                                                                               |             |            |            |
| A.     | Cost of land 1 acre                                                                         | 1 acre      | 300000.00  | 300000.00  |
|        | Civil works/buildings                                                                       |             |            |            |
| a.     | Cost of composting Yard 40'x40'                                                             | 1600sq.ft   | 130/ sq.ft | 208000.00  |
| b.     | Cost of construction of pasteurization Tunnel 25'x9'x14                                     | 225 sq.ft   | 600/sq.ft  | 135000.00  |
| c.     | Cost of construction of spawning area, Boiler room, packing room, storeroom and office room | 1000 sq. ft | 500 sq.ft  | 500000.00  |



|    |                                                                   |            |           |            |
|----|-------------------------------------------------------------------|------------|-----------|------------|
| d. | Cost of construction of poly house 75'x15'x12',                   | 8no.       | 150/sq.ft | 1350000.00 |
| e. | Cost of construction of raw material Shed, 100'x20'x14'           | 2000 sq.ft | 80 /sq.ft | 160000.00  |
|    | Total Cost Rs.                                                    | 2653000.00 |           |            |
| C. | Plant and Machinery cost                                          |            |           |            |
| A  | Modified heavy duty coolers                                       | 8 no.      | 15000.00  | 120000.00  |
| b. | Boiler 1 no. including ducting for tunnel                         | 1 no.      | 150000.00 | 150000.00  |
| c. | Bamboo racks and gratings in the tunnel                           | 1500 piece | 120.00    | 180000.00  |
| d. | Blower 1 no including ducting                                     | 1piece     | 70000.00  | 70000.00   |
| E  | Mushroom drier 1 no.                                              | 1piece     | 70000.00  | 70000.00   |
| F  | Miscellaneous-like sprayer, pumps, Buckets, harvesting trays etc. |            | 80000.00  | 80000.00   |
| G  | Total Cost Rs.                                                    | 670000.00  |           |            |
| H  | A. Land                                                           |            |           | 300000.00  |
|    | B. Buildings/Civil work                                           |            |           | 2653000.00 |
|    | C. Plant and machinery                                            |            |           | 670000.00  |
|    | Total Rs.                                                         |            |           | 3623000.00 |

#### D. Economics of the project

| S.No. | Items                                                                                                          | Quantity     | Rate         | Amount Rs.  |
|-------|----------------------------------------------------------------------------------------------------------------|--------------|--------------|-------------|
| II    | Recurring Expenditure                                                                                          |              |              |             |
| A.    | Manpower requirement of the Project                                                                            |              |              |             |
| a.    | Manager -1 no.                                                                                                 | 1 no.        | 12000/month  | 144000.00   |
| b.    | Total man-days required for substrate Preparation and spawning, 20 man-days/outing total 48 outings in a year. | 960 man-day  | 201/day      | 192960.00   |
| c.    | Labour requirement for harvesting, spraying, drying and packing.                                               | 200 man-days | 201/day      | 40200.00    |
|       | Total Rs.                                                                                                      | 377160.00    |              |             |
| B.    | Raw materials required                                                                                         |              |              |             |
| a.    | Wheat Straw 120 tons                                                                                           | 120 tons     | 5000 tons    | 600000.00   |
| b.    | Water requirement                                                                                              |              |              |             |
|       | Substrate preparation approx. 600 k. lit<br>For spray, cleaning approx. 1000 k.lit                             | 600k.lit     | 1000k.lit    | 600000.00   |
| c.    | Polythene bags (25q.)                                                                                          | 25 q         | 15000.00     | 375000.00   |
| d.    | Pesticides                                                                                                     | 50 kg        | 400.00       | 20000.00    |
| e.    | Energy and Fuel                                                                                                | 2500 lit     | 95/lit       | 237500.00   |
| f.    | Cost of spawn: 7.5 tons                                                                                        | 7.5 tons     | 130000/ tons | 975000.00   |
| g.    | Selling expenses/freight etc.                                                                                  |              |              | 90000.00    |
|       | Total Rs. 2897500.00                                                                                           |              |              |             |
| C.    | Depreciation and interest                                                                                      |              |              |             |
| a.    | Land 15% interest                                                                                              |              |              | 45000.00    |
| b.    | Buildings and civil works 5% depreciation and 15% interest                                                     | 430600.00    |              |             |
| c.    | Machinery (10% depreciation and 15% interest)                                                                  | 167500.00    |              |             |
|       | Total Rs.                                                                                                      | 643100.00    |              |             |
| D.    | Total Recurring Expenditure (cost of production)                                                               |              |              |             |
| a.    | Raw materials                                                                                                  |              |              | 2897500.00  |
| b.    | Wages and salary                                                                                               |              |              | 377160.00   |
| c.    | Depreciation and interest                                                                                      |              |              | 643100.00   |
| d.    | Total Rs.                                                                                                      |              |              | 3917760.00  |
| e.    | Total production taking 80%B.E. of the straw 96 tons                                                           | 96 tons      |              |             |
| f.    | Sale price of fresh mushrooms                                                                                  |              |              | 120000.00   |
| g.    | Total sale 96x12000=11520000.00                                                                                |              |              | 11520000.00 |
| h.    | Net Profit (Rs. 11520000.00-3917760.00)=7602240.00                                                             | 7602240.00   |              |             |
| i.    | Cost of production /kg                                                                                         |              |              | 79.19       |





## NUTRITIONAL AND FOOD SECURITY : WAY AHEAD

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### Introduction

Between 1950 and today, the world's population grew with the pace of 1-2% each year, with the number of individuals rising from 2.5 to around 7.5 billion. As per UN Department of Economics and Social Affairs, 2019, if it follows the same trend, then by 2100, the world's population is projected to reach approximately 10.9 billion (figure 1). The world's median sustainable age is thirty one and it is expected to increase up to 42 years at the end of this century, though it was 24 years in 1950. Sub-Saharan African region alone is expected to have more than triple increase in their population by 2100. And it is projected that India will surpass China in terms of population and would be the most populous country of the world. This is an alarming situation and compels us to think about our persistence of coming generations. Therefore it is important to pay attention towards nutritional and food security for sustainable future.

### Defining Food and Nutrition

The saying "You are what you eat" seems to be proven true in present time where the COVID-19 pandemic has resulted in somewhat natural screening on the basis of immunity levels. Those with stronger immunity were able to keep the corona virus at bay while people with lower immunity levels and with co-morbidity were not spared. Food and Nutrition, in fact, are two sides of the same coin. They are, therefore, inseparable. Health depends to a large extent on nutritional status of an individual, and nutrition depends on the food intake. So food is the most important single factor for health and fitness. According to Food and Drug Administration (1999) Food Code, food is defined as a raw, cooked, or processed edible substance, beverage, or ingredient used or intended for use or for sale in whole or in part for human consumption. It is the basic necessity of life. Besides giving energy, food provides protection from disease and regulates body's functions. In addition, Nutrition is defined as the "branch of science which deals with all the inclusive factors of which food is composed and the way in which proper nourishment is brought about". While this summarises the physiological dimensions, nutrition has psychological, social and economic dimensions too.

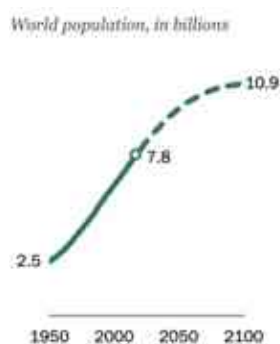


**Fig.-1** : Projection of world's population (in billions). Source: UN Department of Economics and Social Affairs, Population division, 2019.

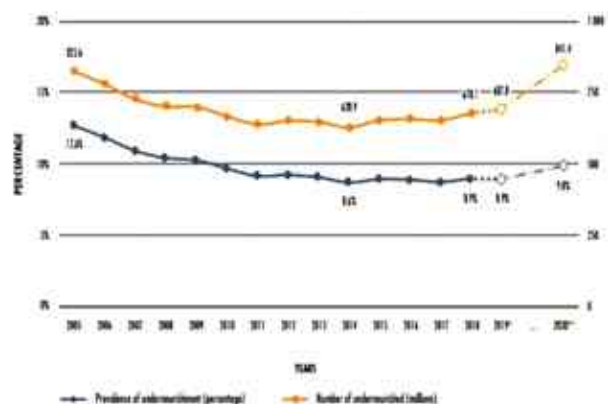


**Fig.-2** : Prevalence and number of undernourished people in the world (Source : WHO, 2020)

### What would be the impact of increasing population on nutritional and food security?

Naturally, population burden which is expected in times to come will increase the demand for food. That would in turn attract additional investment in the agricultural sector. It would be difficult to manage these additional inputs when economy is itself in reviving phase. Extent of competition for natural resources is also rising. There is an urgent need to value forests, water, oceans, land and soil and promote an ecosystem approach to extract greater agricultural yield with fewer inputs. Generation nutrition (2020) in a report stated that the impact of nutritional and food insecurity is complex and multidimensional, and include conflict and insecurity, natural disasters due to climate change (droughts, floods, water scarcity, higher temperatures, etc.), environmental degradation, economic instability or other stressors like desert locusts as witnessed in western part of India from last 2-3 years. Emission of green house gases would increase for which agriculture practices should transform so that it contributes to lesser fossil fuel reduction. Adoption of holistic approaches, like agro-ecology, agro-forestry,



climate-smart and conservation agriculture should be the choice. Increasing prevalence of malnutrition is another impact of food insecurity (Figure 2). Majority of people cannot afford healthy, diverse, and nutritious food (SOFI report, 2020). Healthy diets are unaffordable to nearly 03 billion people worldwide.

### Levels of Food Insecurity Severity

The global crisis induced by the COVID-19 pandemic even has impact on European and American countries, which have traditionally been more food secure. Based on Food Insecurity Experience Scale (FIES) which is a global reference scale for determining extent of food insecurity, there are three levels of food insecurity severity (Figure 3).

First level *i.e.* Food security level means where people have adequate access to food in terms of both quality and quantity.

Second level *i.e.* of moderate level insecurity, here people face uncertainties about their ability to obtain food so they are forced to compromise either on the quality or on quantity of the food.

Third level is of severe food insecurity where people experience severe food insecurity. They actually run out of food for a day or even days.



Fig-3 : Levels of Food Insecurity severity.

### Way Ahead....

#### Pulses : Key to achieve Nutritional And Food Security

Pulses are a low fat alternative for healthy protein, enriched with high fiber content. They possess low glycemic index (Rizkalla et al 2002) and contain nearly twice the amount of protein found in whole grain cereals like wheat, rice, oats and barley. Fibrous content contains both soluble and insoluble fibers, where former reduces blood cholesterol levels and later improves digestibility and regularity. In many countries meat, dairy and fish products are not affordable and thus remain out of the reach of many. Plant based protein diets are therefore necessary for such deprived population. Protein energy malnutrition (PEM) is a manifest for such underprivileged groups with prevailing stunting or wasting. Additionally, the iron bioavailability of pulses and the protein quality of the diet are enhanced when pulses are supplemented with cereals and vitamin C-rich foods in diet. There are many drought-resistant pulses, like pigeon pea (*Cajanus cajan* (L.) Huht) that can grow in arid ecosystems where rainfall pattern is often erratic or between 300 to 450 mm per year. Pulses have longer shelf life than other protein rich sources; therefore the proportion of food waste at the consumption stage due to spoilage is very low (FAO report 2013). If properly stored, pulses remain edible for several years.

#### Nuts and Oilseeds

Nuts and oilseeds are rich in fats and hence are a concentrated source of calories. A handful of nuts can supply a large amount of energy. They also contain protein, vitamins and minerals (iron, zinc, magnesium and selenium), fiber and other phytochemicals. Almonds are highly nutritious and a concentrated source of energy as they have 60% fat. It possesses low carbohydrate content but is a fairly good source of B-vitamins and contributes to vitamin E content. It is extensively used in skin care products. Brain nut or walnut is grown in Kashmir, Himachal Pradesh, Uttar Pradesh and in hilly areas of Punjab in India. It is rich in omega-3 fatty acids and manganese. It is of great commercial value. Omega-3 fatty acids are found to be protective against certain cancers and cardiovascular diseases, as they become part of cell membranes and thus maintain membrane fluidity. Groundnuts are particularly rich in thiamine and nicotinic acid. Its protein lacks methionine amino acid but is rich in the antioxidant flavonol. Protein isolate from groundnut flour is used in milk, baby foods, confectionery and as coffee/tea whiteners. Mustard oil is one of the highest yield oils; containing nearly 45% to 55% oil, proteins, minerals, erucic acid (Verma et al 2019) and oilcakes produced after crushing are high in protein and used as animal feed.

#### Reducing the Anti-nutrients

Anti-nutrients are natural or synthetic compounds that interfere with the absorption of nutrients. Lipase inhibitors (e.g., tetrahydrolipstatin) interfere with enzymes, such as lipases, which catalyze hydrolysis of some lipids and fats. Phytic acid in the legumes, nuts, and seeds grains, has a strong binding affinity for divalent cations like calcium, magnesium, iron, copper,



and zinc, preventing their absorption (Singh et al 2020). Reports are there where water soaking has reduced phytic acid content in groundnut (Verma et al 2019). Glucosinolates (e.g. mustard, although widely recognized for their medicinal value, also interfere with the uptake of iodine and flavonoids, and chelate metal ions (iron and zinc) thus reducing their absorption. Oxalic acid and oxalates, are present in many plants, particularly in spinach family, bind calcium to prevent its absorption. Many traditional preparation methods (e.g., fermentation) reduce antinutrients, such as phytic acid, increase the nutritional quality of plant foods.

### **Enhancing nutritional components**

Removing undesirable food components is essential to their quality improvement. Food processing at small or large scale or even at house hold (e.g. soaking, cooking, fermentation, radiation, germination) can bring change in the nutritional status of foods. The combination of several of the above mentioned methods may be more effective in removing antinutrients than using a sole technique. One of the studies conducted at ICAR-DGR, Junagadh showed that roasting of groundnut kernels can increase resistant starch content. Many studies have shown that RS is a linear molecule of  $\alpha$ -1,4-D-glucan, essentially derived from the retrograded amylose fraction, and has a relatively low molecular weight (1.2 10<sup>5</sup> Da). Like dietary fibers, RS is not digested in the small intestine and thus, is fermented by habitat microflora of the colon to produce short chain fatty acids and thus promotes bowel health. RS is the fraction of starch which is not hydrolyzed to D-glucose by  $\alpha$ -amylases, glucoamylase and sucrase-isomaltase in the small intestine within 120 min of being consumed, but is fermented in the colon. Benefits of RS include reduction of the glycemic index and cholesterol level. It was shown to be protective against colorectal cancer.

### **Biofortification**

Alleviation of malnutrition has been known as one of the goal for achieving hunger-free world. It is recognized as Sustainable Development Goals-2 (SDG-2) out of 17 identified goals. The importance of nutritional and food security can be realized by the fact that out of 17 SDGs, 12 are related to nutrition signifying its value in health, education, employment and female empowerment sectors. SDG-2 is achievable if food diversification approach is followed in all senses or nutrients are added artificially in basic food products such as iodized salt (food fortification).

Both the approaches are not feasible for longer terms, where resources are not sustainable. Bio-fortification is an alternative where the nutritional quality of a crop is enhanced through genetic manipulation that includes both classical breeding and transgenic methods. Table 1 gives an insight about the popular biofortified crops of India. Biofortified crops hold great promise for health and wellbeing of increasing human population.

### **CONCLUSION**

For achieving nutritional and food security, sustainable food systems are required through multiple strategies with better aiming and co-ordination between different programs and policies. In India, these strategies need to focus on improving diet diversification, reducing postharvest losses, bio-fortification of main/staple crops with its inclusion in safety

net programs, women's empowerment and hygiene. In future, nutritional and food security initiatives will have to be adopted in keeping with changing livelihood patterns, climate change, and health-specific generic demands.

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## IMPACT OF TILLAGE PRACTICES ON INSECT-PEST AND THEIR NATURAL ENEMIES IN RICE-WHEAT CROPPING SYSTEM

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### Abstract

Tillage has the potential to change the soil habitats where many insect pests and their natural complete at least a part of their life stages. Now a days farmers have been encouraged to use conservation agriculture (CA) strategies to increase production and productivity and mitigate the consequences of climate change. However, information is very barely relating to the impact of zero tillage on the abundance of and damage by insect pests. Major insect pests are (Wheat: aphids, termites and pink stem borer, Rice: Stem Borers, Leaf folder, Gundhi bug and plant hoppers) associated with rice-wheat cropping system managed under zero tillage practice with or without chemical control. Many studies shows that the incidence of sucking pest in rice as well as wheat crop recorded very low or we can say below the level cause economic injury to the crop and borers damage in both crops were significantly higher in the zero-tillage cropping system. whereas the natural enemies of these major insect pests of rice and wheat crops showed variable trends under zero tillage systems. Population (insect pest and their natural enemies) dynamics in rice -wheat cropping system directly affected by tillage practices as well as crop growth or indirect effect through changes in vegetative growth of crops. Conservational practices enhance the population of natural enemies which directly corelated to suppress the insect pest population in rice-wheat cropping system.

**Keywords:** Cereals; Crop residues; Insect pest and their natural enemies: Rice-wheat cropping system : Soil manipulations and zero tillage

### INTRODUCTION

Rice-wheat cropping systems provide staple food to 15% of the world's population. The economic benefits of conservational agriculture have been identified in rice-wheat cropping system, which fulfill food (80%) and nutritional (60%) requirement of the Indian population (Timsina and Connor, 2001). Rice-wheat cropping system (RWCS) is a prominent cropping system in Indo Gangetic Plains (IGP) (Garg and Pathak, 2002). Conservational/zero tillage practices have been widely adopted in the IGP, which occupies nearly about 13.5 Mha in India. Conservational agriculture practices can be divided into three groups based on the amount of soil disturbance caused by ploughing: conventional tillage, which causes high whereas, zero tillage which causes the least soil disturbance (Busari et al., 2015). Soil health is one of the major contributing factors to enhance crop productivity, and thus its improvement is considered as an important step towards achieving food security. Tillage is used extensively and frequently in traditional farming systems, Which leads to soil degradation through erosion, compaction, decreased water-holding capacity, and loss of soil carbon, besides disturbing habitats of natural enemies of insect pests (Henneron et al., 2015; Bhardwaj et al., 2019). Since the late 1990s, more sustainable cropping system like conservational agriculture have been include to promote with the aim of improving smallholder farmers' livelihoods. On the contrary, zero tillage system endorses for residue retention on the soil surface, which provides a favourable habitat for natural enemies along with enhance soil quality and also reduces environmental degradation.

The impact of changing management on insect-pest abundance and damage in RWCS is one of the most difficult challenges to solve. It is reported from farmers' fields in rice wheat cropping system that management of insect pest is one of the challenging issues in this region but such type of interaction have yet to be documented.

**Table-1 :** Rice, wheat and rice-wheat systems in South Asia.

| Country    | Area under RWCS (million ha) | Share of crop area under RWCS (%) |       | Contribution of rice & wheat (%) |                               |
|------------|------------------------------|-----------------------------------|-------|----------------------------------|-------------------------------|
|            |                              | Rice                              | Wheat | Total cereal production          | Total national calorie intake |
| India      | 10.3                         | 23                                | 40    | 85                               | 60                            |
| Pakistan   | 2.2                          | 72                                | 19    | 92                               | 62                            |
| Bangladesh | 0.5                          | 5                                 | 85    | 100                              | 94                            |
| Nepal      | 0.6                          | 35                                | 84    | 71                               | 63                            |

Source : Adapted from Timsina and Connor 2001





### Major insect-pest associated with rice-wheat cropping system

Changes in tillage and residue regimes can have a noticeable impact on population dynamics of insect pest because soil is such a crucial habitat for them. In Indo Gangetic Plains, the pressure of insect pest and disease has increased on crops due to continuous cropping of rice and wheat. For example if we talk about wheat crop the incidence of foliar aphid complex under irrigated conditions, root aphids in loose soils, pink stem borer in fields that contain rice stubble, cutworms in crop residues, termites in raised beds, and brown mites in rainfed conditions have been reported (Katara et al., 2018). The major insect-pests of rice crop are Rice Stem Borer, Leaf Folder, Brown Plant Hopper and Gundhi bug while the major diseases are Bacterial Leaf Blight, Sheath Blight and Blast (Sehgal *et al.*, 2001).

The different insect pests, depending on their feeding behaviour and favourable edaphic conditions, appear at different stages of crop growth. Grasshoppers have also been noted to cause serious damage to wheat and rice crop. Pink stem borer, which was earlier found in the drier western part of India, has emerged as a serious pest of wheat as well as rice. Amongst major insects, foliar aphids, *R. maidis*, and termites are regular and major pests of wheat; however, pink stem borer and root aphids are emerging pests and have shifted from rice (*Oryza sativa*) to wheat (Jasrotia et al., 2018).

### Natural enemies in rice-wheat cropping system

In zero tillage practices a huge range of wild grass and other flora found around fields of rice wheat cropping system which gives shelter to natural enemies in adverse condition. Keeping rice straw in paddy fields and growing the floral weed plants after the rice harvest around fields can provide hosts and shelters of native natural enemies to safely overwinter. The numbers of species, individuals and diversity index of natural arthropod enemies are found to greater in floral weeds fields in rice-wheat cropping system in winter fallow fields.

**Table-2 :** Predators collected in rice ecosystem of northern Indo-gangetic plains of India.

| Common Name             | Scientific Name                | Order      | Family          | Host          |
|-------------------------|--------------------------------|------------|-----------------|---------------|
| Dragon flies            | <i>Crocothemisservilia</i>     | Odonata    | Libullulidae    | SB, LF, PH    |
| Damsel flies            | <i>Ischnurasenegalensis</i>    | Odonata    | Agrionidae      | SB, LF, PH    |
| Lady bird beetles       | <i>Harmoniaoctomaculata</i>    | Coleoptera | Coccinellidae   | LH, PH, LF    |
| Ground beetles          | <i>Ophioneanigrofasciata</i>   | Coleoptera | Carabidae       | LH, PH, LF    |
| Long horned grasshopper | <i>Conocephaluslongipennis</i> | Orthoptera | Tettigonidae    | LH, PH, LF    |
| Sword bearing crickets  | <i>Anaxiphalongipennis</i>     | Orthoptera | Trigoniidae     | LH, PH, LF    |
| Ripple bug              | <i>Microveliadouglassi</i>     | Hemiptera  | Veliidae        | LH, PH, LF    |
| Plant and leaf bugs     | <i>Cyrtorhinuslividipennis</i> | Hemiptera  | Miridae         | LH, PH, LF    |
| Wolf spider             | <i>Lycosapseudoannulata</i>    | Araneida   | Lycosidae       | SB, LF, LH,PH |
| Lynx spider             | <i>Oxyopesjavanus</i>          | Araneida   | Oxyopidae       | SB, LF, LH,PH |
| Orb spider              | <i>Argiopecatenulata</i>       | Araneida   | Araneidae       | SB, LF, LH,PH |
| Long jawed spider       | <i>Tetragnathamandibulata</i>  | Araneida   | Tetragnathidae  | SB, LF, LH,PH |
| Sac spider              | <i>Clubionajaponicola</i>      | Araneida   | Clubionidae     | SB, LF, LH,PH |
| Crab spider             | <i>Thomisusssp.</i>            | Araneida   | Thomisidae      | SB, LF, LH,PH |
| Earwig                  | <i>Euborelliaastali</i>        | Dermaptera | Carcinophoridae | SB, LF, LH,PH |
| Rove beetles            | <i>Paederusfuscipes</i>        | Coleoptera | Staphylinidae   | SB, LF, LH,PH |

**Source :** Mahesh Pathak et al., 2011

LF - Leaf folder, LH - Leafhopper, PH - Plant hopper, SB - Stem Borer

**Table-3 :** Natural enemies recorded in wheat ecosystem.

| Common name               | Scientific name                 | Order       | Family        | Host        |
|---------------------------|---------------------------------|-------------|---------------|-------------|
| Seven spotted lady bug    | <i>Coccinellaseptumpunctata</i> | Coleoptera  | Coccinellidae | Aphids      |
| Lady beetle               | <i>Menochilussexmaculatus</i>   | Coleoptera  | Coccinellidae | Aphids      |
| Black spotted lady beetle | <i>Hippodamiavariegata</i>      | Coleoptera  | Coccinellidae | Aphids      |
| Cotesia wasp              | <i>Cotesiaspp.</i>              | Hymenoptera | Braconidae    | Army worm   |
| Marmalade fly             | <i>Episyrphusbalteatus</i>      | Diptera     | Syrphidae     | Aphids      |
| Ground beetle             | <i>Abacetusspp.</i>             | Coleoptera  | Carabidae     | Polyphagous |

**Source :** Ranjith, M. et al., 2018

### Impact of conservational agriculture on soils, insect, pest and their enemies

Soil quality is often improved in various dimensions, including soil structure, soil fertility, and soil biological features. Soil organic carbon levels in rice-wheat systems are often low. conservational tillage soils are said to have more organic carbon than Conventional tillage soils, although they also have a lower pH due to nitrification) Chauhan et al. 2002. The improved stability





of soil aggregates under zero tillage (owing to organic matter build-up) leads in reduced soil erosion (due to wind and rain). According to studies, the upper soil surface for zero tillage was softer and had a higher moisture content, and there was no significant change in bulk density under both tillage systems. The entire farming system would need to convert to aerobic and zero tillage conditions with sufficient residue management to improve structural soil quality. With the adoption of zero tillage in rice-wheat cropping systems, comparatively less weeds were found in the wheat crop. Early emergence of wheat and minimal soil disturbance in the uncropped area resulted in less effect on soil with minimum effect of weed, insect and disease in zero tillage system. Conservation tillage also altered the growth of selected insect pest and disease and reportedly no harmful effect on the natural enemies population. In fact, zero tillage system enhanced the population of natural enemies (predators and parasitoids) in the rice-wheat cropping system.

Conservation tillage and crop residue management system would result in changes in soil organic matter, soil moisture, and nutrient regimes, as well as the insect pest and their natural enemies that live in the soil. Changes in the microclimate under crop canopy as a result of these soil changes favour some forms of natural enemies while discouraging insect pest in rice wheat cropping system. Due to changes in ecological conditions, switching from conventional to conservation tillage techniques may change the entire insect-pest scenario. Conservation tillage and residue management practices were introduced to conserve biological resources and carbon in soil, with a fair amount of success. The modifications that bring these benefits will very certainly have an impact on microclimate, with implications for insect pest populations and their natural that co-exist in an agro-ecosystem. Major factor to determine the strength of pest control in micro-environment is pest-predators interaction. There are so many findings that tells about impact of tillage system on the population of insect pest and their natural enemies.

## CONCLUSIONS

Conservation tillage and zero tillage practices had higher concentration of natural enemies. The strategies for the management of insect-pest would need to be revised for zero tillage practices to deliver the full benefits of conservation agriculture. Now a days, calendar based pesticides spray is used for the management of pest population in rice as well as wheat crop in rice-wheat cropping system. Whereas there is a different scenario of insect pest infestation in zero tillage system. The population of sucking insects such as aphids, hoppers and bugs reduced in zero tillage practices in rice wheat cropping system due to the abundance of natural enemies population. The usual insecticide control strategies such as canopy sprays may not be very effective, and may be harmful for natural enemies of these insects, therefore better control strategies may be needed before large scale adoption of such cropping systems. First of all we have to change our management strategies for making successful of biological control.

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## **ISSUES AND SUGGESTIONS IN ANIMAL HUSBANDRY SECTOR**

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### **Abstract**

Animal Husbandry and Dairying activities, along with agriculture, continue to be an integral part of human life since the process of civilization started. These activities have contributed not only to the food basket and draught animal power but also by maintaining ecological balance. They play a significant role in generating gainful employment in the rural sector, particularly among the landless, small and marginal farmers and women, besides providing cheap and nutritious food to millions of people.

**Key words :** *Animal Husbandry, Dairying*

### **INTRODUCTION**

Animal Husbandry and Dairying activities, along with agriculture, continue to be an integral part of human life since the process of civilization started. India has vast resources of livestock and poultry, which play a vital role in improving the socio-economic conditions of rural masses. There are about 300 million bovines, 65.10 million sheep, 135.2 million goats and about 10.3 million pigs as per 19th Livestock Census in the country.

### **Issues and suggestions in Animal Husbandry Sector**

Major challenges of animal husbandry sectors are breed improvement while preserving diverse genetic resources, shortage of feed and fodder, effective control of animal diseases and dissemination of technology, skills and quality services to farmers for improving productivity, which need to be addressed on priority basis. Further, improving the access of small livestock holders to efficient markets is necessary for fast tracking growth of the livestock sector. Detailed account of the issues along with suggestions is given here under :

1. Declining bovine population with increasing milk and meat production ushers in paradigm shift in productivity enhancement. Further focused attention and continuous efforts are needed in this direction. Declining sheep and goat population is major cause of concern as they are going to emerge as a major source of meat producing animals. Special policy focus is needed for putting back sheep and goat population on growth path and to ensure sustainable meat production in future.
2. Transformation of dairy husbandry into main occupation and substantial value of output of manure together with increasing demand for organic agriculture needs a special development framework. Clean biogas option addresses a problem of methane emissions from manure while slurry from biogas plants provides organic input to crop husbandry.
3. Keeping in view the equitable distribution of livestock resources and the fact that contribution of livestock to farmer income is significantly increasing with the decline in farm size, there is a need for supporting allied activities to improve cash flow of small and marginal farmers and it can play a major role in our efforts for doubling of the farmers income by 2022.
4. Productivity across various livestock species is a major issue especially in case of dairy animals. Field progeny testing programme offers excellent scope for enhancement of productivity of milch animals. Incentives may be made available to milk unions, farmer producer organizations, etc., for implementing such programmes.
5. India has a broad spectrum of native breeds of cattle, buffalo, goats, sheep, swine, equine, camel and poultry with merits of adaptability to climate and nutrition, and resistance to diseases and stress. Populations of most of these breeds have alarmingly gone down due to comparative preferences for high producing exotic breeds. This calls for an immediate action for systematic conservation, genetic improvement and sustainable utilization of indigenous livestock breeds.
6. Poor coverage of breed able bovine population, inadequate supply of AI doses found to be stumbling blocks in increasing the productivity of milch animals. There is an urgent need for expanding existing breeding farm capacities or for establishment of new breeding farms along with corresponding strengthening of semen production stations and its delivery mechanism. Special attention is needed in states where the AI services are highly deficit. Such deficit states may avail the assistance available under Rural Infrastructure Development Fund (RIDF) and NIDA.
7. Small ruminants provide much needed livelihood support to the landless and weaker sections and hold considerable potential for commercialization. A stable sheep population in the last two decades produced around 43 million kg wool



annually, of which only 10% is of fine quality. Goat population grew faster than any other species of livestock and has been a major source of meat. Therefore, there is need to strengthen the existing breeding farms of small ruminants for ensuring the availability of good breeding stock at field level to support the scientific rearing with high quality feed and fodder and other inputs.

8. Deficiency of feed and fodder results in low productivity. There is a need to promote the private investment for augmenting feed and fodder resources through technologies like hydroponics, cultivation of improved varieties, silage making, enrichment of crop residues by alkali treatment etc.

9. Conservation of forest grasses, especially in rainy and winter seasons, by making hay to meet the demand during summer seasons.

10. The fodder seed production is only 25% of requirement. The state fodder seed farms must augment the supply of fodder seed of improved varieties.

11. Shrinking and degrading pastures coupled with severe short supply of green fodders during summer season needs to be addressed. Common property resources may be used by milk unions for establishing silvipasture system.

12. Frequent outbreaks of diseases like FMD, BQ, PPR, Brucellosis, Swine fever and Avian Influenza etc. continue to reduce productivity and production. However, the available veterinary support in terms of infrastructure (for hospitals) is qualitatively insufficient. Moreover, most of the existing dispensary and hospital buildings are very old and in dilapidated condition.

13. Disease diagnosis, reporting, epidemiology, surveillance and forecasting mechanisms are to be strengthened. Several diagnostic kits required for disease surveillance and monitoring are imported at a huge cost. The limited diagnostics available in the country are produced by few laboratories and are not of desired quality. Managing livestock diseases through prophylactic controls with strong laboratory diagnostic system is the option before all the concerned stakeholders.

14. Microbial contamination, antibiotic residues and adulteration in milk, meat and animal feed is rampant. Quality control setup for veterinary drugs and vaccines is to be strengthened. There is a need to establish food testing laboratories duly accredited by the Food Safety and Standards Authority of India (FSSAI) to check adulteration.

15. Although, major concentration of pigs is in NE and eastern states, it is not able to meet the pork requirement of NE states. Predominantly non-descript pig populations there have poor productivity. High cost of concentrate feed, non availability of swine fever vaccine and quality germplasm, lack of organized slaughter and market facilities have been the major constraints. The opportunities available under NLM have to be made use for proper development of piggery in NE states.

16. Indian poultry industry is well equipped and organized to achieve target growth rate of 11% for commercial broilers and 7% for layers although it failed to diversify in favor of duck, quail and turkey production. Strategic diversification efforts are need of the hour. Further, rural poultry sector needs financial, infrastructure and technological support to raise its share in total poultry production.

17. Rearing of desi birds on scientific lines also made a beginning. Few private hatcheries are supplying improved desi broiler as well layers. Adequate awareness is necessary to capture potential under rural poultry production by rearing desi improved birds.

18. Apart from meat, inedible offal's and animal wastes from the meat plant have large export potential as they can be used as valuable proteins/materials. There is also huge demand of Indian ethnic meat products in the international market. However, lack of international processing standards is the hindrance.

19. Lack of access to organized markets and meagre profits distract farmers from investing into improved technologies and quality inputs. Informal market intermediaries often exploit the producers. Activity specific Farmer Producer Organizations may be formed on the lines of milk cooperatives for acting aggregators and to participate in modern electronic marketing infrastructure being created by GoI and State Governments.

20. In spite of large number of centrally sponsored schemes along with participation of states, Livestock sector receives lesser budgetary allocation for supporting capital formation. During last 4-5 years there is a considerable increase in term credit flow reflecting increase in private investment in agriculture sector. However, overall capital formation in terms of % Agri GVA is declining. This holds good in case of animal Husbandry sector also. State Govt. may enhance their budgetary provision for capital formation in Agriculture and Animal Husbandry sector to give further stimuli to private investments.



21. Livestock insurance provided by the public sector insurance companies could cover only about 6% of the animal heads (excluding poultry). Cooperatives and agribusiness firms (in case of contract farming) should facilitate provision of insurance cover by providing premium on behalf of the farmers, which may be recovered in installments or lump sum from their sale proceeds. Innovative and acceptable insurance models may be designed to evolve a suitable scheme for various species/states.

22. Livestock extension services needs improvement. The extension format, methodology and set-up established for agriculture is inadequate to cater to the needs of the livestock sector. Consequently, only 5% of the farm households were able to access any information on animal husbandry against 40% for crop farming. Therefore strengthening of livestock extension services either under private or public sector has to be attempted.

23. The major challenges in export of livestock products are much lower yields (milk or meat), quality issues with small size of animal holding, huge domestic demand with growing incomes and sporadic outbreaks of FMD leading to disease perception. Further, high import tariffs together with high export subsidies of developed countries are some of the concerns. Large share of buffalo milk and international demand for cow milk based products is also standing in the way of milk products export. Further, physical infrastructure and logistics remain key concern for livestock products' export. Creation of modern livestock based food processing plants, cold chain infrastructure along the value chain, improved packaging, building of the market channels and brand building must be focus for promoting the exports of milk and meat products.

24. Least technology adoption, failure to tap value chain potentials, limited contract farming operations are some of the challenges for livestock sector. Use of sexed semen for rapid improvement of dairy animal productivity, value chain approach and contract farming system may be adopted for small ruminant and pig farming for ensuring faster growth of these sectors.

25. Climate change has become major threat and impacting livestock productivity and also food security of most vulnerable rural population. Climate Smart Livestock farming must be on the top of the agenda for future initiatives on livestock development.

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## EMERGENCE OF BLACK FUNGUS AND THE COVID-19 PANDEMIC

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### Abstract

The first case of Coronavirus disease 2019 (Covid-19) in China was a hidden alarm for the upcoming pandemic all over the world. Covid-19 breaks all the records of deaths that have happened in the last 100 years. COVID-19 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been associated with a wide range of opportunistic bacterial and fungal infections. Mucormycosis caused by members of mucorales became prevalent in covid-19 patients after recovery. However, mucormycosis was found in different countries but only India accounts for more than 70% of the total cases worldwide. The present review is focussed on mucormycosis, causal organism, symptoms, diagnosis, pathogenesis and its relationship with Covid-19 disease.

### 1. Introduction to Black Fungus

Coronavirus disease 2019 (Covid-19) is an infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Since the first case was detected, in December 2019 in Wuhan, China, there have been various turns and twists in terms of its pathophysiology, diagnosis, management, sequelae and complications (1). Mucormycosis infection of the sinuses is a form of life-threatening invasive fungal sinusitis that typically affects immunocompromised individuals with an impaired neutrophilic response (2). Clinically, five major forms of mucormycosis have been recognized which include the rhino cerebral (44%–49%), which is the most common form, followed by cutaneous (10%–16%), pulmonary (10%–11%), disseminated (6%–11.6%), and gastrointestinal (2%–11%) forms (3). Patients can include those with uncontrolled diabetes mellitus, acquired immunodeficiency syndrome, iatrogenic immunosuppression and haematological malignancies, and those who have undergone organ transplantation (Petrikos et al., 2012). Unfortunately, patients infected with SARS-CoV-2 also become one of the easiest target for these fungi (4).

Mucormycetes, the members of the order Mucorales (phylum-Zygomycota) are fast-growing saprotrophic molds who can grow in different niches like soil, dust, food, compost, stored crops, etc (5,6,7). The previously used term zygomycosis encompassed both mucormycosis and entomophthoromycosis but after the elimination of Zygomycetes from fungal taxonomy the term zygomycosis was replaced by mucormycosis. The most common genera of mucormycetes involved in human diseases are *Rhizopus*, *Mucor*, and *Rhizomucor*; *Cunninghamella*, *Lichtheimia*, *Saksenaea*, and *Apophysomyces* etc. (less common) (8). These members are found to cause severe, fatal infections in humans, especially in the immunosuppressed hosts and progress locally via direct extension into adjacent tissues but rarely are angioinvasive or become disseminated (9). Paltauf reported the first report of human mucormycosis in 1885 in a patient that he termed “Mycosis mucorina”. Later on Baker used the term Mucormycosis for the first time in 1957 (10). Initially *Mucor* and *Mortierella* species (Order-Mucorales) have become synonymous with the clinical term mucormycosis. Later on, advanced characterization techniques showed *Rhizopus* as a predominant genus not *Mucor* for cause of human infections (11). Globally, the prevalence of mucormycosis varied from 0.005 to 1.7 per million population, while its prevalence is nearly 80 times higher (0.14 per 1000) in India compared to developed countries, in a recent estimate of year 2019–2020 (12).

**Table-1 :** Taxonomic Organization of the Most Common Agents of Mucormycosis.

| Genus                                 | Species                                                                            |
|---------------------------------------|------------------------------------------------------------------------------------|
| <i>Rhizopus</i>                       | ● <i>arrhizus</i> ( <i>oryzae</i> )<br>● <i>microsporus</i><br>● <i>stolonifer</i> |
| <i>Mucor</i>                          | ● <i>circinelloides</i><br>● <i>velutinosus</i>                                    |
| <i>Rhizomucor</i>                     | ● <i>pusillus</i>                                                                  |
| <i>Actinomucor</i>                    | ● <i>elegans</i>                                                                   |
| <i>Lichtheimia</i> ( <i>Absidia</i> ) | ● <i>corymbifera</i>                                                               |
| <i>Cunninghamella</i>                 | ● <i>bertholletiae</i>                                                             |
| <i>Apophysomyces</i>                  | ● <i>elegans</i>                                                                   |
| <i>Saksenaea</i>                      | ● <i>vasiformis</i>                                                                |
| <i>Syncephalastrum</i>                | ● <i>racemosum</i>                                                                 |
| <i>Cokeromyces</i>                    | ● <i>recurvatus</i>                                                                |
| <i>Mortierella</i>                    | ● <i>wolfii</i>                                                                    |



## 2. Structure and reproduction in Black fungus

As one of the largest orders in the basal Fungi, the Mucorales is also one of the most studied groups in the early diverging fungi. Mucorales grow at temperatures of 25–55°C with an optimal temperature of 30°C. Mucorales are characterised by a usually abundant, branched (tapering to fine points), rapidly growing coenocytic mycelium. The mycelium is typically non septate or may be irregularly septate to cut off chlamydospores. In the presence of CO<sub>2</sub>, some *Mucor* species grow reversibly in a yeast like morphology. The cell walls of Mucorales are made up of chitin microfibrils along with poly-D-glucuronides, polyphosphates, proteins, lipids, purines, pyrimidines, magnesium and calcium etc. The yeast like *Mucor*'s cell wall have five times mannose sugar in comparison to filamentous cell (13).

Anamorphic sporangiospores are produced in multi-spored sporangia, few-spored sporangiola or merosporangia. Chlamydospores, arthrospores and yeast cells are, in most species, rarely formed. Sporangia are characterised by the inclusion of a variously shaped columella. This well developed columella counts as a synapomorphic character for the Mucorales. Conjugation in homothallic species or between compatible mating types of heterothallic species results in the formation of zygospores. Zygospores often display a specific exospore ornamentation (smooth, rough, warty) and protecting appendages (finger-like, antler-like) born on the supporting cells (suspensors) (14). Some species of the Mucorales exhibit dimorphism, possessing the ability to switch between a filamentous, multi-cellular state to a yeast-like state (15).

## 3. Symptoms and Diagnosis

The 1950 Smith and Krichner (16) criteria for the clinical diagnosis of mucormycosis are still considered to be gold standard and include :

- (i) Black, necrotic turbinate's easily mistaken for dried, crusted blood,
- (ii) Blood-tinged nasal discharge and facial pain, both on the same side,
- (iii) Soft peri-orbital or peri-nasal swelling with discoloration and induration,
- (iv) Ptosis of the eyelid, proptosis of the eyeball and complete ophthalmoplegia and, (v) Multiple cranial nerve palsies unrelated to documented lesions.

Along with upper symptoms based diagnosis, it is done by making a cotton swab from the nose and examining it under a microscopic examination of the sample taken from the nose are also used. With some routine analysis such as blood, kidney function, CT scans, and if required, MRI is done to prove the injury made by black fungus (17).

## 4. Pathogenesis of Mucormycosis

The major risk factors for mucormycosis include uncontrolled diabetes mellitus in ketoacidosis, other forms of metabolic acidosis, treatment with corticosteroids, organ or bone marrow transplantation, neutropenia, trauma and burns, malignant hematologic disorders, and deferoxamine therapy in patients receiving hemodialysis. The major route of infection is via inhalation of conidia; other routes include ingestion and traumatic inoculation. Ingestion leads to GI disease and occurs primarily among malnourished patients but can also occur after ingesting non-nutritional substances (pica). As the spores reach to the air sinuses, the fungus starts to germinate/grow and the disease begins as a skin infection in the air sinuses located behind the forehead, nose, and between the eyes and teeth. Later the infection spreads to the eyes, the lung, and may reach to the brain. Black fungus harms the organs due to the inability of blood to reach it, so it dies and results as necrosis. Because of this necrosis, the organ turned black and at this stage, it must be removed to prevent further spreading of infection (17,18).

## 5. The Link between COVID 19 and Black Fungus

However mucormycosis does not appear in a healthy person but immunocompromised people are found at high risk. Immunocompromising causes include uncontrolled Diabetes mellitus (DM) with or without (diabetic ketoacidosis) DKA, malignancies, organ transplantation, neutropenia, AIDS, severe burns, immunosuppressive and corticosteroid therapy, iron overload or hemochromatosis, deferoxamine or desferrioxamine therapy, voriconazole prophylaxis for transplant recipients, and trauma (19). In a recent systematic review conducted until April 9, 2021 by John et al. reported that people with COVID-19, DM was reported in 93% of cases, while 88% were receiving corticosteroids (20). The use of corticosteroids have often been found associated with aspergillosis and mucormycosis, especially people facing diabetes. Prednisone dose (>600 mg) or total methylprednisolone dose (2–7 g) given during the month before, predisposes immunocompromised people to mucormycosis (21,22). COVID-19 often causes endothelialitis, endothelial damage, thrombosis, lymphopenia, and reduction in CD<sup>4+</sup> and CD<sup>8+</sup> T-cell level and thus predisposes to secondary or opportunistic fungal infection. Free available iron is an ideal resource for mucormycosis. Hyperglycemia causes glycosylation of transferrin and ferritin, and reduces iron binding allowing increased free iron. Moreover, increase in cytokines in patients with COVID-19 especially interleukin-6, increases free iron by increasing ferritin levels due to increased synthesis and decreased iron transport. High glucose, low pH, free iron,



and ketones in presence of decreased phagocytic activity of WBC, make the environment favorable for the growth of mucor resulting in mucormycosis (17).

## CONCLUSION

Black fungus cases rise very fast with covid-19 disease as it attacks primarily people with compromised immune systems. The treatment prescribed by doctors containing steroids became the predominant reason. Along with excess doses of steroids, high blood sugar in DM patients was also a common cause of fast growth of pathogens. Patients with other serious diseases also become soft targets because of the compromised body defence. Till now, the data is very limited to conclude the exact reason behind the fast emergence of mucormycosis and covid-19.

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# Abstracts

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## **DIETARY AND HORMONAL MANIPULATIONS IN ADVANCING GONADAL MATURATION FOR QUALITY SEED PRODUCTION OF INDIAN MAJOR CARPS AND CATFISH**

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### **ABSTRACT**

The steadily growing importance of culture fisheries has stimulated to improve the technique necessary for securing young ones (fry and fingerlings) for stocking. The artificial propagation technique needs constant refinement for obtaining quality fish seed at the desired times of the year. Recent advances in fish endocrinology have led to a better understanding of the hormonal factors involved in the gamete production, mode of their action and regulation of their secretion during different stages of reproductive cycle. Environmental stimuli like photoperiod and temperature are perceived by the brain which releases gonadotropin-releasing hormone (GnRH) that binds specifically to receptors in the pituitary gonadotrophs and stimulates secretion of gonadotropic hormone (GtH-I, II). The circulating GtH enhances gonadal development and final maturation. GtH regulates ovarian and testicular function by producing maturation inducing steroids, 17 $\alpha$ , 20-dihydroxyprogesterone (17,20-P). The GtH-I functions at the target site in two ways - it induces synthesis and secretion of estradiol-17 $\alpha$  during pre-vitellogenic phase which, in turn, induces vitellogenesis or yolk production during post-vitellogenic phase, GtH-II triggers synthesis of 17 $\alpha$ , 20-dihydroxyprogesterone (17,20-P) which is responsible for the final maturation leading to ovulation and spermiation. Role of nutrition in broodstock management for quality seed production in fishes has been appreciated during the recent years. Success of induced breeding depends on proper gonadal maturation because fishes reared without adequate food supply do not show full maturity. Also, the breeding of females and males do not synchronize under improper rearing conditions. Dietary as well as hormonal manipulations have resulted in the advancement of maturity in the Indian carps and catfish by 2 months under pond conditions giving scope for re-maturation and multiple breeding of the same fish for better gamete output. Modern fish industry is highly specialized exploring more and more possibilities to manipulate reproduction. With all the recent advances in the reproductive physiology, we are still far behind to understand the basic mechanism (s) involved in the process of fish propagation in nature. The knowledge on nutrition and reproductive endocrinology periodically refines the technology of production of quality gametes for the expansion of aquaculture. Altering sexual cycles, induction of advanced and delayed maturation, ovulation and spermiation as well as artificial fertilization are to be practiced where nutritive and reproductive physiology might help for faster progress in aquaculture.

## **RAPID DEPLOYMENT OF RECENT WHEAT VARIETIES THROUGH PUBLIC PRIVATE PARTNERSHIP FOR STRENGTHENING SEED CHAIN**

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### **ABSTRACT**

Seed is a basic and vital input in crop production and quality seed availability determines the efficiency of other agronomic inputs (irrigation, fertilizers and pesticides) in increasing crop productivity. Generally public sector cultivars take 4-5 years to reach the farmers field after notification. ICAR-Indian Institute of Wheat and Barley Research, Karnal has developed a unique model of inter-institutional collaborative large scale production of breeder seeds followed by public private partnership through technology licensing to the private seed growers for rapid multiplication and deployment of recently released varieties. Through this model, the institute has increased >3 times its seed production capability in last 3 years (2500q (2018-19) to 8000q (2020-21) in collaboration with NDRI, Karnal CPRI-RS & ICAR-IIFSR, Modipuram. The licensing approach helped in establishing partnership with more than 424 seed growers for DBW187 (Karan Vandana) and DBW222 (Karan Narendra). The feedback from the seed growers indicated the seed producers were highly satisfied with the system. Wheat variety DBW 187 was released in 2019 for NEPZ and 2020 for NWPZ. During 2018-19 IIWBR, Karnal produced 796.0q; during 2019-20, 1220.0q and during 2020-21, 3380.0q breeder seed of DBW 187. In the year 2019 institute has signed 163 agreements with private seed companies/growers of different state and supplied one quintal breeder seed to each company similarly in the year 2020 total 76 agreements were signed. During the years 2020, 185 agreements were signed for DBW222 with private seed growers. In additions to the agreements with private seed companies breeder seed of this variety was also supplied to >50 public sector seed producers viz., NSC, state seed corporations, KVK, SAUs, etc. The varieties registered the high demand among the farmers in short span of time. In the DAC indent DBW187 appears on the third rank with the breeder seed indent of 1617.35q and DBW222 at 8th rank with the indent of 506.30 q for the year 2021-22.



## **EFFECT OF SITE-SPECIFIC NUTRIENT MANAGEMENT ON RICE GRAIN YIELD, STRAW YIELD AND NUTRIENT UPTAKE**

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### **ABSTRACT**

A field experiment was conducted at Regional Agricultural Research Station, Maruteru, Andhra Pradesh during kharif seasons of 2017 to study the site-specific nutrient management approaches for enhancing productivity and profitability in rice (*Oryza sativa* L.) under rice-rice cropping system. Nutriexpert is a decision support tool developed by the International Plant Nutrition Institute (IPNI). Application of fertilizers based on the Nutriexpert was assessed and found that (112-31-58) higher nitrogen, lower phosphorus and potassium than the recommended dose of fertilizers (90-60-60) during kharif season. The treatments included recommended fertilizer (T1), SSNM based on Nutrient expert (T2), SSNM based on LCC (50% N as basal and rest 50% based on LCC (T3), T2 minus N (T4), T2 minus P (T5), T2 minus K (T6), Absolute control (without N, P and K) (T7) and Farmer's Practice (T8). The results revealed that the highest grain yield of rice (5138 kg ha<sup>-1</sup>) and straw yield (7156 kg ha<sup>-1</sup>) was recorded in T2- SSNM (NE) being significantly superior over all other fertilizer treatments. But remained at par with the grain and straw yield obtained under recommended dose of fertilizer and fertilizers applied based on Nutriexpert using LCC treatments. Compared with fertilizer application using nutriexpert, reduction in rice grain yield was 36 %, 17% and 15% in -N, -P and -K plots, respectively. Control plot recorded a grain yield loss of 53% as compared to the fertilizer application using nutriexpert. Application of major nutrients based on nutriexpert recorded higher uptake of nitrogen (114.53 kg ha<sup>-1</sup>), phosphorus (20.61 kg ha<sup>-1</sup>), and potassium (106.61 kg ha<sup>-1</sup>). Nutrient omission and control treatments recorded significantly lowest nutrient uptake. Hence, nutriexpert not only saves the fertilizers but also helps in increased grain and straw yield of rice.

## **DRAMATIC LOSS OF HUMAN LIFE DURING COVID PANDEMIC: A SPECIAL EMPHASIS ON FISHERIES SECTOR**

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### **ABSTRACT**

Fisheries and aquaculture provide nutritious food for hundreds of millions of people around the world and livelihoods for over 10% of the world's population. In India, fisheries and aquaculture is an important source of food production, nutritional security, employment, and income. The fisheries sector is a direct source of livelihoods for more than 20 million fishers and fish farmers which contributes INR 1.75 trillion annually to the gross value added to Indian economy as a major export earner. The outbreak of COVID-19 and the sudden India-wide lockdown severely affected India's fisheries sectors. Fishers, hatchery owners, fish processors, sea-food exporters, traders, fish vendors, vehicles carrying fish— all involved in fisheries and allied activities have been badly impacted. As the COVID-19 pandemic continues to spread globally, many countries are putting in place unprecedented lockdown measures designed to contain its impact on public health. However, such measures are having significant impacts on other domains of human activity, including food and nutrition security, jobs, livelihoods, gender equality, and potential social unrest. Lockdown in the landing centres and harbours has severely affected the fisher folks in all nine coastal states and four coastal union territories of the country. According to FAO, 2021, Global aquaculture production is expected to fall by 1.3 per cent, the first fall recorded by the sector in several years. Loss of work and income especially for women (processors and fish vendors) created a big issue. Proactive changes have been made by the government. The fishing ban period was adjusted for loss of fishing days during the lockdown. The economics of aquaculture for the last quarter of the year 2020 has shown a significant decline, which affected the livelihood for millions of people worldwide. Proactive changes have been made by the government in fisheries sector. The fishing ban period was adjusted for loss of fishing days during the lockdown. The lockdown period was adjusted in the fishing ban period by the DOF-GOI to alleviate hardship of fishers and to protect livelihoods. The wide informality in the sector constitutes an added barrier for fishers and fish farmers to access protection from labour market policies and contributory social protection mechanisms. These might exacerbate the secondary effects of COVID-19, including poverty and hunger.



## MICROBIAL DIVERSITY IN RELATION TO SOIL HEALTH

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### ABSTRACT

“Soil health is defined as the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation” (Soil Science Society of America Ad Hoc Committee on soil quality (S-581)). Microbial diversity is an unseen natural resource encompassing microscopic organisms like bacteria, fungi, algae, Protozoans and archaea. These groups of microorganisms colonize soil, water and air that surround us and unusual habitats such as thermal springs, cold deserts, deep ocean trenches, salt lakes etc., where they play an essential role in recycling of nutrients, produce and consume gases that affect global climate, destroy pollutants and treat our wastes. Microbes are important component of nitrogen cycle fixing, known to play an important role in phosphorus uptake by plants, mobilize important plant nutrients and an integral part of composting and bioremediation. They are also endowed with various other plant growth promoting traits along with suppression of plant pathogens and parasitizing on several insect pests and nematodes. Since they are known to play various roles in sustainable agriculture, there is a possibility that microbes can be used as indicators of soil health and management practices being followed. Microbial activities of soil are mostly influenced by farm management practices like tillage, crop rotation, residue burning and application of manures, fertilizers and other agro inputs. A study on microbial diversity analysis in contrasting management practices revealed GP1 group of Acidobacteria phylum as indicators of good and sustainable management practices (Figuerola et al. 2012 PLoS ONE 7(11)). The Bureau has started work on indicator microorganisms and has identified indicators based on microbial identity and activity for management practices and lindane contamination. Based on the definition of soil health better microbial indicators of soil health would be to quantify specific functional group of microorganisms and correlate them to the respective functions. Main criterion should be to look for those members of the soil microbiome that play major roles in the promotion of the growth and health of plants like N fixers; P solubilizers and the pathogen suppressing organisms. Based on available literature, a framework of parameters can be developed to capture the ecosystem services provided by the microbial resources in the terrestrial soils which includes, Microbial biomass, microbial diversity, Potential net nitrogen mineralization, concentration of Ammonium, NO<sub>3</sub> and inorganic P, Plant productivity and Disease incidence.

## MORPHOLOGICAL CHARACTERS & GENETIC VARIABILITY ANALYSIS OF INBREDS OF QPM MAIZE(ZEA MAYS L.)

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### ABSTRACT

A study was undertaken to characterize and evaluate eighteen locally adapted inbred lines of maize for various morphological characters to estimate the extent of genetic diversity among these maize inbred lines using morphological characterization. The present investigation field research work was undertaken during *kharif* 2020 in Randomized Block Design (RBD) with 3 replications having plot size of 1.5 x 4.0 = 6 m<sup>2</sup> at TCA Dholi farm, R.P.C.A.U, Pusa, Samastipur, Bihar. The characters studied were Days to 75% tasseling, Days to 75% silking, Days to 75% brown husk, Plant height(cm), Ear height(cm), Ear length(cm), Ear girth (cm), Tassel length (cm), Number of kernel rows per ear, Number of kernels per row and Grain yield (Kg/ha). The morphological characterizations include biometrical analysis of genetic divergence using D<sup>2</sup> statistic by Tocher's method. Analysis of variance revealed highly significant differences among the inbred lines for all the parameters. All the 25 QPM inbred lines were grouped into 7 clusters using D<sup>2</sup> statistics using Tocher's method. The maximum intra cluster distance was observed in cluster IV and minimum intra cluster distance was observed in cluster III. The highest inter cluster distance was observed in between Cluster I and VI. Genotype from these clusters may be selected as parents for hybridization programme for developing new hybrid combinations. Among 299 combinations, ear length ranked 1st followed by grain yield, ear height, plant height, days to 75 % tasseling, tassel length, no. of kernels per row, ear girth, days to 75 % silking and No. of kernel rows per ear, The maximum cluster mean was observed in cluster III and minimum cluster mean was observed in cluster VI. Therefore, selection of parents from different clusters might be done for desired traits on the basis of higher cluster mean values, suggesting scope for Improvement in these characters.



## EVALUATION OF NEEMAstra, AGNIastra AND BRAHMAstra FOR THE MANAGEMENT OF ROOT-KNOT NEMATODES, MELOIDOGYNE SPP. IN TOMATO

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### ABSTRACT

Three different organic inputs viz., *Neemastra*, *Agniastra* and *Brahmastra* were evaluated for the management of root-knot nematodes, *Meloidogyne* spp. in tomato. All three organic inputs were prepared by using indigenous cow urine and dung. Total three different concentrations of each organic input were used and applied 500 ml water solution as drenching per plant near root zone area at the time of transplanting and repeated it after 15, 30 & 45 days after transplanting. The results based on the data the root-knot index (RKI), the minimum RKI was found in *Agniastra* @ 800ml/10 l water followed by in *Neemastra* @ 400 l/acre and in *Brahmastra* @ 800ml/10 l water as compared with all other treatments. These organic inputs were found effective to manage root knot nematodes and reduce RKI significantly. Whereas, the data on fruit yield showed that these organic inputs were not found effective and the result was found non-significant.

## GENETIC DIVERSITY IN LEAFY MUSTARD (*BRASSICA JUNCEA* VAR. *RUGOSA*) AS REVEALED BY AGRO-MORPHOLOGICAL TRAITS AND SSR MARKERS

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### ABSTRACT

Leafy mustard (*B. juncea* var. *rugosa*) constitutes an important group of vegetable mustard crops in India and is mainly cultivated in home-backyard and hilly regions of Uttarakhand and some North-eastern states. In the present study, various agro-morphological traits, physiological and biochemical traits along with SSR markers were used for genetic diversity evaluation in a germplasm collection of leafy mustard. This study revealed a significant variation among 59 accessions of leafy mustard in both qualitative and quantitative agro-morphological traits indicating the accessions' promising potential for consumption purpose and for use in breeding programs. Maximum variability was recorded for leaf area elongation rate (CV = 53.12%), followed by total plant weight (TPW) (CV = 50.63%) and seed yield per plant (CV = 44.33%). In molecular analysis, 155 SSRs evaluated resulted in 482 alleles and the number of alleles varied from 1 to 8 with an average of 3.11 alleles per marker. A total of 122 (78.70%) SSRs resulted into polymorphic amplicons. PIC value varied from 0.32 to 0.77 with an average value of 0.44 per SSR locus. The unweighted neighbor-joining-based dendrogram analysis divided all the 59 accessions into two major groups on the basis of both agro-morphological traits and SSR markers, whereas, three subpopulations/subgroups were predicted by population STRUCTURE analysis. AMOVA indicated the presence of more variability within population than among population. Overall, agro-morphologically better performing and genetically diverse genotypes have been identified which could be further used as donors for leafy mustard improvement programs.

## IMPACT OF SELF-HELP GROUP PROMOTING INSTITUTES ON KNOWLEDGE & ADOPTION OF SCIENTIFIC LIVESTOCK FARMING PRACTICES AMONG BENEFICIARIES

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### ABSTRACT

Livestock production and processing is largely in the hands of women in our country. Women generally play a major role in managing and caring for animals. Women through livestock based Self-help Groups have involved themselves in different types of income generating activities. The current study was conducted in Ludhiana district of Punjab to assess the knowledge and adoption level of scientific livestock farming practices (SLFPs) among the women beneficiaries of Self-Help Group





Promoting Institutes (SHGPIs) viz., dairy cooperative, government and NGO. Total 120 respondents i.e. 40 from each SHGPI were selected randomly and subjected to structured interview schedule. The findings revealed that majority of beneficiaries of dairy cooperative SHGs had high level of knowledge (45.00%) and adoption (52.50%) about SLFPs followed by medium level among beneficiaries of NGO regarding knowledge (62.50%) and adoption (45.00%). The mean difference in knowledge and adoption between beneficiaries of different SHGPIs was found statistically significant ( $P < 0.01$ ). In case of overall knowledge and adoption about SLFPs, significant difference was observed among the beneficiaries of dairy cooperative, government and NGO based SHGs. Beneficiaries of dairy cooperative SHGs had relatively better knowledge and adoption for scientific livestock farming practices with high mean value as compared to beneficiaries of government and NGO based SHGs. This might be due to more dedication towards services offered by dairy cooperative officials as well as direct contact of beneficiaries of dairy cooperative SHGs with veterinary officers on regular basis as compared to the beneficiaries of government and NGO.

## SEROLOGICAL INVESTIGATION, ISOLATION AND IDENTIFICATION OF PESTE DES PETITS RUMINANT'S VIRUS IN THE TARAI REGION OF UTTARAKHAND

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### ABSTRACT

Peste des petits ruminants (PPR) are an economically important transboundary disease of sheep and goats caused by Peste des petits ruminants' virus (PPRV). In India, the disease is endemic and therefore, Government of India has initiated PPR control program (PPR-CP) under which kids more than 4 months of age are vaccinated. At the same time it is also important to know the seroprevalence of PPR in unvaccinated goats to know the virus circulation. Therefore, this study was conducted to know the seroprevalence of PPR in unvaccinated goats around the Pantnagar region of Uttarakhand and also to understand the virus distribution in the region. Total 148 serum samples from goats were collected randomly from various villages surrounding the Pantnagar region. Serum samples were tested for anti-PPRV antibody by a commercially available kit from IDvet. 34 animals from various villages were found positive with a prevalence rate of 22.97%. At the same time, PPR outbreaks were also reported from the Pantnagar area. Nasal, oral and rectal swabs were collected from the goats suspected/showing clear sign of PPR. RNA was extracted from the swabs and was subject to one step RT-PCR. The amplified PCR product confirmed PPR in two goats. The swabs were subjected to virus isolation in Vero cells. Swabs from both goats showed typical cytopathic effect of PPRV in the first passage and led to complete detachment of the cell monolayer in 48-72 hours in comparison to the vaccine strain Sungri 96 which showed complete cytopathic effect in 4-5 days without complete monolayer detachment. The present study signifies that PPRV is circulating in the Tarai region of Uttarakhand and there is an urgent need of mass vaccination to increase the herd immunity to substantial level.

## DETECTION AND DIAGNOSIS OF BUD NECROSIS AND STEM NECROSIS DISEASES OF GROUNDNUT : A WAY FORWARD

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### ABSTRACT

Groundnut (*Arachishypoagea*L.) cultivation is affected by viral diseases like bud necrosis, stem necrosis, peanut clump and peanut mottle. In the peninsular India, bud necrosis and stem necrosis respectively caused by *Groundnut bud necrosis virus* (GBNV) and *Tobacco streak virus* (TSV) are economically important. Depending on the extent of incidence and crop growth stage, losses may vary from 1.2 to 100%. GBNV transmitted by *Thripspalmica* cause 30-90 % yield losses Peanut stem necrosis disease (PSND) caused by TSV, Kadiri in Anantapur district of Andhra Pradesh was identified as hotspot and weeds like *Parthenium*, *Prosopisjuliflora* and *Chenopodium* were observed to harbor the virus. The severe outbreak of PSND in Anantapur during 2016 damaged the crop to the extent of 15 %. The early and accurate detection of these plant viruses is an essential component to minimize these yield losses. GBNV and PSND express different kinds of symptoms such as mild mosaic, mottling, chlorotic and necrotic spots etc. Hence symptomatic diagnosis may not be appropriate under field





conditions. Serological and PCR based techniques have been developed and established for the detection of GBNV and PSND. These methods are time-consuming, laborious and require special skills such as in prior information on taxonomy to detect the pathogen responsible for the disease. On-site methods of detection like Lateral Flow Immuno Assay (LFIA) and Loop Mediated Isothermal Amplification (LAMP) are not new but limited due to their limitation on robustness and lack of high-throughput nature. But recently lateral flow devices (LFDs) are being made available for a number of plant viruses. LAMP method is highly specific and requires less time to complete the virus detection. However, this technique is not used extensively unlike ELISA and PCR in plant virus detection possibly due to its specificity and viral variants that might escape from detection. Therefore, the future research must focus on development of rapid and more sensitive on-site detection techniques for groundnut plant viruses.

## **ECONOMIC EVALUATION OF DIFFERENT INTEGRATED FARMING SYSTEMS IN NORTH EASTERN HILL REGION**

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### **ABSTRACT**

Data have been collected from the farmers' field of Nongthymmai village, Ri Bhoi district, Meghalaya. Economic performance evaluation of two farming system models i.e Livestock based integrated farming system and pond based integrated farming system models were carried out. For the estimation of economic viability, net present value (NPV), pay-back period, internal rate of return (IRR) and benefit-cost ratio (BCR) were worked out. In livestock-based farming system, farmers kept the pig and poultry. Manures were recycled to field after composting at site. The area of the farmer was around 0.5 hectare and NPV of the System was found Rs. 1.72 lakhs. The benefit Cost ratio was found out to be 1.96 and cost of cultivation includes construction of poultry and pig shed. The internal rate of return was worked out to be 19.25% and pay-back period was 4 years. Fish culture forms an integral part of the people in the Ri-Bhoi district of Meghalaya and is one of the important sources of income for the farmers. Most of the farmers are having small size pond (500 to 600 m<sup>2</sup>) where fish is reared by conventional method. Constructed low-cost pig/goat houses near the pond dykes and duck sheds over the water bodies using locally available materials like bamboo, wooden logs, thatch grass, GI sheet etc. Vegetables like bottle gourd, lablab bean, lai patta were cultivated in the pond dyke, whereas crops like tomato and cole crops were cultivated in nearby areas. The NPV of the Pond or aquaculture-based farming system was found Rs. 144000. Internal rate of return was also found very high i.e. 22.5%. Benefit-cost ratio (BCR) of the system was worked out to be 2.7 and pay-back period was found 3.5 years. It was found that integration of aquaculture with crops, vegetables, fruits and livestock would efficiently utilize natural resources, reduce farmers risk and generate year-round employment and income.

## **ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES OF SOIL BY USING SPECTROSCOPIC TECHNIQUES- XRD, AAS, FTIR, AND FLAME PHOTOMETER.**

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### **ABSTRACT**

Knowledge of the composition and structure of the soil sample is requested to know the presence of elements on the molecular scale. With this objective, the characterization of the **two-soil** sample collected from Baratha and Parichha located in Jhansi district nearby ParichhaThermalPowerPlants, was carried out using various spectroscopic techniques like XRD, AAS, FTIR and Flame photometer. These techniques provide a piece of specific information about the soil sample. The recent advancements in the spectroscopic techniques have made them a powerful tool for identification, characterization of soil and allows us to understand a precise knowledge about its potential use. The fourier transform infrared spectroscopy (FTIR) is used for functional group identification of chemical species to shows the nature of soil sample, x-ray diffraction spectroscopy (XRD) provides the mineral phase of different elements and the crystal nature of sample, atomic absorption spectroscopy (AAS) used for micro elements detection as Cu, Mn, Fe and Zn which all plays essential role in plants growth and the flame



photometer used for detection of potash. Results are revealing that physico-chemical properties as pH, water holding capacity, potassium content in both samples were suitable for crop production. Spectral study of samples (by FTIR, AAS, and Xrd) also suggesting good carbon, Cu, Zn and silica contents. S-2 has a standard range of potassium.

## EFFECT OF ORGANIC AND INORGANIC SOURCES OF FERTILIZERS ON PRODUCTIVITY OF COTTON-WHEAT CROPPING SYSTEM IN NORTH INDIA

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### ABSTRACT

Cotton–wheat cropping system has become a dominant cropping system in northern India, particularly in cotton growing areas of Punjab, Haryana and Rajasthan. The existing system of fertilizer management is based on the nutrient requirement of individual crop, ignoring the carryover effect of the manure or fertilizer applied to the preceding crop. A judicious combination of manures and fertilizers depending upon the type of crops to be grown will improve the cropping system productivity. A field experiment was, therefore, conducted at ICAR-CICR, Regional Station, Sirsa, Haryana on a Gangetic alluvial soil during 2019-20 to determine the effects of organic and inorganic sources of fertilizers on productivity of cotton-wheat cropping systems under North Indian conditions. The field experiment was conducted in split plot design, keeping five cropping systems [(i) Bt cotton Hybrid – Wheat; (ii) Non-Bt cotton Hybrid – Wheat; (iii) Bt cotton variety – Wheat; (iv) Non-Bt cotton variety – Wheat and (v) Bt cotton Hybrid – Fallow] in main plots and five sources of nutrients [(a) Absolute Control (No fertilizer and no manure); (b) NPK Recommended dose of fertilizers (RDF); (c) NPK + Secondary nutrients (MgSO<sub>4</sub>) + Micro nutrients (ZnSO<sub>4</sub> + Borax); (d) Treatment (c) + FYM (5 t/ha) once in two years and (e) Nutrient through organics - FYM (5 t/ha) every year + Biofertilizers (Azophos) + Neem cake (250 kg/ha) + Dhaincha (*Sesbania*) incorporation in sub-plots (applied to cotton crop only) and were replicated thrice. In wheat crop, recommended doses of fertilizers were applied in (b), (c) and (d) treatments, whereas no manure / fertilizer was applied to (a) and (e) treatments. Other standard packages of practices were followed to raise the cotton and wheat crops. All the replicated data obtained from this study was statistically analyzed by the F-test. The least significant difference (LSD) values at P = 0.05 were used to determine the significance of differences between treatment means. Among the cropping systems, seed cotton yield was in the order; Bt cotton hybrid (2,408.1 kg/ha) – fallow > Bt cotton hybrid (2,107.6 kg/ha) – wheat > non-Bt cotton hybrid (1,986.9 kg/ha) – wheat > Bt cotton variety (1,809.5 kg/ha) – wheat > non Bt cotton variety (1,663.3 kg/ha) – wheat. Highest seed cotton equivalent yield of wheat was obtained with non-Bt cotton hybrid (1,417.3 kg/ha) – wheat cropping. However, no significant differences were observed in wheat grain yield with respect to cropping systems. Among the nutrient regimes, recommended dose of NPK + secondary nutrients (MgSO<sub>4</sub>) + micronutrients (ZnSO<sub>4</sub> + Borax) and FYM @ 5 t/ha once in two years out yielded other nutrient regimes including ‘nutrient through organics’ with respect to seed cotton (2,776.5 kg/ha), wheat grain yield (5,103.0 kg/ha) and seed cotton equivalent yield of wheat (1,770.0 kg/ha). Interaction between nutrient regimes and cropping systems was not significant for seed cotton as well as wheat grain yield.

## CURRENT INSIGHT TO THE USES OF INDIAN SNAKE ROOT *RAUWOLFIA SERPENTINA*

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### ABSTRACT

*Rauwolfia serpentina* is an important medicinal plant in the pharmaceutical world due to the presence of its immense therapeutic properties. The plant is known for curing various disorders because of the presence of alkaloids, carbohydrates, flavonoids, glycosides, phlobatannins, phenols, resins, saponins, sterols, tannins and terpenes. The plant parts, root and rhizome have been used since centuries in Ayurvedic medicines for curing a large number of diseases such as high blood pressure, mental agitation, epilepsy, traumas, anxiety, excitement, schizophrenia, sedative insomnia and insanity. The plant contains more than 50 different alkaloids which belong to the monoterpenoid indole alkaloid family. The major alkaloids are ajmaline, ajmalicine, ajmalimine, deserpidine, indobine, indobinine, reserpine, reserpiline, rescinnamine, rescinnamidine, serpentine, serpentinine and yohimbine. *R. serpentina* is also known for its antimicrobial, antifungal, anti-inflammatory, antiproliferative, antidiuretic and anticholinergic activities. The herbal medicine is still the basis of primary health care for



75–80% of the world population because of its cultural acceptability, better compatibility with the human body and lesser side effects. Therefore, there is a need for us to search alternative, naturally available remedies for curing million's of people worldwide. Due to all these properties, the present review aims to evaluate the various pharmacological, phytochemical and therapeutic properties of *R. serpentina*.

## EXTENSION STRATEGY FOR CABBAGE GROWERS: A RESEARCH INVESTIGATION IN TARAI REGION OF UTTARAKHAND

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### ABSTRACT

The study was conducted in Rudrapur block of Udham Singh Nagar district of Uttarakhand covering three villages and 60 respondents. The data were collected through personal interview method by the researcher himself with the help of pre-structured schedule specially. Cabbage (*Brassica Oleracea L. var capitata*) family of cruciferous originated over 15,00 years ago in the Mediterranean and Asia Minor region. China and India are the top producers of cabbage and broccoli. Results revealed that the majority of cabbage growers were middle age group, secondary level education, general caste and majority of respondents owned television and mobile phone. Majority of respondents were using social media. The constraints were lack of technical knowledge followed by lack of credit facility at time, costly critical inputs etc. Majority of respondents have less knowledge about the high yielding varieties of cabbage and the IPM facilities. Majority of respondents have less knowledge about the extension functionaries.

## PHYSICOCHEMICAL, TEXTURAL, RHEOLOGICAL AND SENSORY PROPERTIES OF REDUCED-FAT GOAT MILK PANEER AS AFFECTED BY SKIMMING AND GUAR GUM

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### ABSTRACT

In this study, the processing of reduced-fat goat milk paneer was attempted through the replacement of full-fat goat milk with skimmed goat milk and added guar gum (GG). A total of five treatments, i.e., FF (full-fat goat milk without GG), FFSMG11 (full-fat and skimmed goat milk in 1:1 ratio + 0.075% GG), FFSMG13 (full-fat and skimmed goat milk in 1:3 ratio + 0.075% GG), SMG (Skimmed goat milk + 0.075% GG) and SM (Skimmed goat milk without GG) were prepared and their quality characteristics were evaluated. The product yield for reduced-fat paneer was significantly ( $p < 0.05$ ) lower (10.95%) as compared to the full-fat counterpart (15.73%), and the guar gum in the treatments led to an improvement in the product yield. The reduced-fat paneer had significantly ( $p < 0.05$ ) higher moisture, protein and ash contents, while lower fat content (1.67%). The hunter colour coordinates (lightness and redness), textural (hardness, adhesiveness, gumminess and chewiness) and dynamic rheological (storage modulus and viscosity) properties of the products were significantly ( $p < 0.05$ ) varied with skimmed goat milk level and added guar gum. The treatments prepared with a combination of full-fat goat milk, skimmed goat milk and guar gum received higher ( $p < 0.05$ ) sensory scores. Thus, the present study offers the development of a highly acceptable reduced-fat goat milk paneer through the replacement of full-fat goat milk with skimmed goat milk and added guar gum.

## INNOVATIVE TECHNOLOGIES FOR WATER SAVING IN IRRIGATED AGRICULTURE

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### ABSTRACT

Water, a unique resource on the planet earth, is essential for sustaining all forms of life, food production, economic



development, and for general well-being of the life on the planet. The importance of water could be gauged from the fact that while looking for life on other planets, presence of water on the planet is first examined as an indicator of the presence of life on the planet. Civilizations have been developed along the rivers. Yet, it would not be an exaggeration of fact that civilizations doomed not because the water was not available but because the water was misutilized resulting in unsustainable use of the resources. Agriculture sector in India has been and is likely to remain the major consumer of water but the share of water allocated to irrigation is likely to decrease by 10 – 15 per cent in the next two decades. Current use efficiency or productivity of irrigation water is so low that most, if not all, of our future water needs could be met by increased productivity or efficiency alone, without development of additional water resources. Improving water use efficiency by 40% on rain fed and irrigated lands would be required to counter balance the need for additional withdrawals for irrigation over the next 25 years to meet the additional demand for food. Growing more crop per drop of water use is the key to mitigating the water crisis, and this is a big challenge to many countries. Vagaries of monsoon and declining water table due to over exploitation have resulted in shortage of fresh water supplies for agricultural use, which calls for an efficient use of this resource. Strategies for efficient management of water for agricultural use involves conservation of water, integrated water use, optimal allocation of water and enhancing water use efficiency by crops.

### INTEGRATED MANAGEMENT OF POWDERY MILDEW OF BHENDI CAUSED BY *ERYSIPHECICHORACEARUM*

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#### ABSTRACT

Bhendi powdery mildew caused by *Erysiphecichoracearum*DC. affects all the stages of the plant growth by causing premature defoliation and resulting 17.0 to 86.6 per cent yield loss in bhendi. A field experiment was conducted during *rabi*2019-20 and *rabi*2020-21 to find out the suitable fungicides, bio agents for managing the bhendi powdery mildew. Three sprays were given at an interval of fifteen days, results revealed that the treatment involving tebuconazole 50 % + trifloxystrobin 25 % recorded minimum disease severity of 6.16, 7.28 per cent after the third spray followed by hexaconazole 5 % + captan 70 % which recorded the disease severity of 9.76, 10.22 per cent while the treatment involving *B. subtilis*, *P. flourescens* have shown least disease control with the maximum disease severity of 34.18, 30.44 per cent and 35.06, 31.10 per cent respectively, while the control plot had recorded highest disease severity of 75.28, 72.20 per cent during *rabi*2019-20 and *rabi*2020-21. With respect to yield, among different treatments imposed, tebuconazole 50 % + trifloxystrobin 25 % has recorded highest yield of 110.54, 108.18 q/ha which was significantly superior compared to other treatments followed by hexaconazole 5 % + captan 70 % with a yield of 104.31, 103.23 q/ha. While, least yield of 56.56, 57.64 q/ha was obtained with *B. subtilis* compared to unsprayed control 49.18, 48.32 q/ha during *rabi*2019-20 and *rabi*2020-21, respectively. Therefore, it can be concluded that the three sprays of tebuconazole 50 % + trifloxystrobin 25 % (native) and three sprays of hexaconazole 5 % + captan 70 % were found to be effective in managing the disease with maximum per cent disease control and highest yield.

### THE INFLUENCE OF CLIMATE CHANGE VARIABLES ON SPORE GERMINATION OF *ERYSIPHECICHORACEARUM*DC.CAUSING POWDERY MILDEW OF BHENDI

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#### ABSTRACT

Bhendi (*Abelmoschus esculentus*(L.) Moench) is globally important annual vegetable belongs to family malvaceae, it is most broadly distributed vegetable all over the world. Plant diseases are one of the major constraints in crop production with drastic losses in the quality and quantity of the produce. Powdery mildew of bhendi caused by *Erysiphecichoracearum*DC. has become a major limiting factor affecting the economic production in North Karnataka. The disease is wide spread and most destructive to the crop under favourable conditions causing considerable yield loss. The study on response of powdery mildew disease to changing climate variables (CO<sub>2</sub> and temperature) scenario would help us to predict the outbreak of disease under changing climate conditions well before so that effective control measures can be taken. Hence, a lab experiment was conducted at Centre for Agroclimatic studies, University of Agriculture Science, in order to study the influence of elevated





CO<sub>2</sub> and temperature on conidial germination of *E. cichoracearum* under *in vitro* in various plant growth chambers by applying different temperatures and CO<sub>2</sub> levels. The results obtained revealed that among the five different treatments, maximum spore germination of 50.21 per cent was recorded in treatment T<sub>2</sub> (elevated CO<sub>2</sub> at 550 ± 25 ppm with 2 °C rise in temperature) as the accumulation of more amount of CO<sub>2</sub> coupled with increased temperature (T<sub>2</sub>) that might have triggered the spores to undergo for more germination it was further followed by treatment T<sub>1</sub> (elevated CO<sub>2</sub> at 550 ± 25 ppm with normal temperature) with spore germination of 46.82 per cent, treatment T<sub>3</sub> (Ambient CO<sub>2</sub> @ 410 ± 25 PPM with 2 °C rise in temperature) with spore germination of 44.23 per cent and least spore germination was observed in lab condition (35.90 %).

## **PER SE PERFORMANCE AND HETEROSIS FOR GRAIN YIELD AND ITS COMPONENTS IN DUAL PURPOSE SORGHUM [SORGHUM BICOLOR (L.) MOENCH]**

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### **ABSTRACT**

Line x Tester mating design was used to generate 30 hybrids from ten male sterile (A-lines) and three male fertile (R-lines) parents. Thirteen parents, thirty hybrids and three checks were evaluated in RBD with three replications. The analysis of variance revealed significant differences among the parents for all the traits except for days to 50% flowering. This showed the presence of sufficient amount of variability in parents (lines and testers) for most of the characters under study. *Per se* performance of parents and hybrids showed that the male SPV 245, female ICSA 29014 and hybrids ICSA 29003 x SPV 1822, ICSA 29012 x SPV 1822 and ICSA 29004 x SPV 1822 exhibited higher mean performance for grain yield (q ha<sup>-1</sup>) and some of the yield contributing traits. The cross combinations, ICSA 29011 x SPV 1822, ICSA 29006 x SPV 1822 and ICSA 29016 x SPV 1822 exhibited significant and positive heterobeltiosis for green fodder yield, dry fodder yield and some of the yield contributing traits. In case of standard heterosis over best check CSH 23, the topmost level hybrids viz., ICSA 29003 x SPV 1822, ICSA 29012 x SPV 1822 and ICSA 29004 x SPV 1822 were found promising for grain yield (q ha<sup>-1</sup>) and its component.

## **SOIL BIOLOGICAL HEALTH INDICATORS AND RHIZOBIAL MICROBIOMES UNDER INTEGRATED PLANT NUTRIENT SYSTEM (IPNS) IN LATERITE SOILS**

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### **ABSTRACT**

IPNS is a concept and farm management strategy which embraces and transcends from single crop fertilization effects to planning and management of plant nutrients in crop rotation and farming systems on long term basis for enhanced productivity, profitability and sustainability. IPNS approach also aims to enhance soil and crop productivity through a balanced use of mineral fertilizers combined with organic and biological sources of plant nutrients to ensure sustainability of the production systems. A study entitled "Soil biological health indicators and rhizobial microbiomes under Integrated plant Nutrient system (IPNS) in laterite soils" was undertaken in the Dept. of Soil Science and Agril Chemistry, College of Agriculture, Vellayani with the objective to assess the conjugal effect of manures and chemical fertilizers on dynamics of major agriculturally significant soil enzymes, Biological Fertility Index and Enzyme Activity Number. Field experiment using bhindivar. Varshaupharas test crop consisted of 15 treatments replicated thrice with various combinations of enriched vermicompost in combination with chemical fertilizers. Enrichment of vermicompost was carried out using *Azospirillum*, PSB and PGPR mix-1 at the rate of 2% and neem cake at a rate of 5%. Treatments imposed were: T<sub>1</sub>. Package of practice recommendation (KAU), T<sub>2</sub>. N (25 %) as neem cake enriched vermicompost + N (75%), P & K, T<sub>3</sub>. N (25 %) as *Azospirillum* enriched vermicompost + N (75%), P & K, T<sub>4</sub>. P (25 %) as PSB enriched vermicompost + P (75%), N & K, T<sub>5</sub>. NPK (25 %) as PGPR mix-1 enriched vermicompost + N, P & K (75%), T<sub>6</sub>. N (50%) as Neem cake enriched vermicompost + N (50%), P & K, T<sub>7</sub>. N (50%) as *Azospirillum* enriched vermicompost + N (50%), P & K, T<sub>8</sub>. P (50 %) as PSB enriched vermicompost + P (50%), N & K, T<sub>9</sub>. NPK (50 %), PGPR mix-1 enriched vermicompost + N, P & K (50%), T<sub>10</sub>. N (75 %) as Neem cake enriched vermicompost + N (25%), P & K, T<sub>11</sub>. N (75 %) as *Azospirillum* enriched vermicompost + N (25%), P & K, T<sub>12</sub>. P (75%) as PSB enriched vermicompost + P (25%), N & K, T<sub>13</sub>. N, P, K, (75 %) as PGPR mix-1 enriched vermicompost + N, P & K (25%), T<sub>14</sub>. N, P, K alone as inorganics, T<sub>15</sub>. Absolute control. From the study, it was observed that treatment T<sub>9</sub> with the combination of 50 % enriched vermicompost (PGPR mix-1) + 50 % Chemical fertilizers increased available micro nutrient status (Fe, Cu, B), macro nutrient (N&K) biological properties of soil viz., urease, dehydrogenase, cellulase and protease



activities; and biometric characters of bhindi i.e., plant height and no. of fruits. With respect to phosphatase activity, treatment T<sub>8</sub> (P (50 %) as PSB enriched vermicompost + P (50%), N & K) recorded the highest value in the rhizosphere soil. For soil respiratory activity, treatment T<sub>12</sub> (P (75%) as PSB enriched vermicompost + P (25%), N & K) registered the highest value. For bacteria in the rhizosphere soil, T<sub>8</sub> (P (50 %) as PSB enriched vermicompost + P (50%), N & K) recorded the maximum bacterial count while in the non- rhizosphere soil, highest value of bacterial colonies was recorded by T<sub>12</sub> (P (75%) as PSB enriched vermicompost + P (25%), N & K). Treatment T<sub>9</sub> (NPK (50 %), PGPR mix-1 enriched vermicompost + N, P & K (50%)) recorded maximum number of fungal colonies in rhizosphere soil and actinomycetes in the non-rhizosphere soil. Enzyme kinetic parameters viz. V<sub>max</sub> and K<sub>m</sub> for each enzyme at fortnightly intervals were recorded and it was observed that highest V<sub>max</sub> values for urease, phosphatase, protease, dehydrogenase and cellulase were recorded at 6<sup>th</sup> week, 6<sup>th</sup> week, 8<sup>th</sup> week, 2<sup>nd</sup> week and 6<sup>th</sup> week respectively. A highest value of Enzyme Activity Number, which is an index of biological fertility, was registered by the treatment T<sub>9</sub>, revealing its superiority over other treatments. Thus, it was confirmed that the treatment T<sub>9</sub> i.e. application NPK as 50% PGPR mix-1 enriched vermicompost in combination with inorganics as the best both in sustaining soil biological activity and economic returns.

## FIELD EFFICACY OF INSECTICIDES AND BIOPESTICIDES AGAINST SUCKING PESTS COMPLEX IN GREEN GRAM, *VIGNA RADIATA* (LINNAEUS) WILCZEK DURING SUMMER AND KHARIF

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### ABSTRACT

Green gram, third most important pulse crop of India is known to be attacked by black bean aphids, *Aphis craccivora* Koch; jassids, *Empoasca kerri* Pruthi; whitefly, *Bemisia tabaci* Gennadius, thrips, *Thrips palmi* Karny, flower thrips, *Megalurothrips usitatus* Bagnall; mites, *Tetranychus urticae* Koch; green bug, *Nezara viridula* Linnaeus; spiny brown bug, *Clavigralla* spp. with an annual yield losses (30 %) and quantitative avoidable losses (7 – 35 %). There is a need to investigate the tools for the sucking insect pests of green gram to develop an effective management strategy. In sustainable farming, biopesticides have received much practical attention as substitutes to synthetic chemicals. In case of chemical insecticides, they are used as the frontline defense sources against insect pests in India. Among the various biopesticides viz., azadirachtin 0.15 EC, neem oil, *Beauveria bassiana* (1 x 10<sup>10</sup> CFU/ g), NSKE, *Lecanicillium lecanii* (1 x 10<sup>10</sup> CFU/ g), tobacco decoction (Hot water extraction), tobacco decoction (cold water extraction) evaluated for their field efficacy against sucking pests, tobacco decoction (2 %) extracted either with hot or cold water found to be more effective followed by *B. bassiana* (0.1%, 1 x 10<sup>10</sup> CFU/ g). Neem oil @ 0.5% and NSKE @ 5% were found mediocre; *L. lecanii* @ 0.1% and azadirachtin @ 0.0006% were found inferior. Among the various synthetic insecticides evaluated, thiamethoxam 25 WG @ 0.01% and imidacloprid 70 WG @ 0.014% proved more effective in suppressing aphids, jassids, whitefly, thrips and flower thrips population under field conditions. Diafenthiuron 50 WP @ 0.05%, flonicamid 50 WG @ 0.015% and dimethoate 30 EC @ 0.03% followed by profenophos 50 EC @ 0.05% and acephate 75 SP @ 0.075%, while clothianidin 50 WDG @ 0.02% and dinotefuran 20 SG @ 0.008% were comparatively less effective against these sucking pests. Further, all the tested chemicals and biopesticides were comparatively safer to natural enemies viz., coccinellids (grubs and adults) and *Chrysoperla* spp. (grubs) with no any significant adverse effect. The effectiveness of these treatments also reflected on green gram yield.

## COMPARISON OF DIFFERENT STORAGE METHODS IN GANGETIC PLAINS FOR EVALUATION OF POST-HARVEST LOSSES IN POTATO

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### ABSTRACT

Potato is one of the major non-cereal food crops after maize, wheat and rice. In India, 85 per cent of potato is produced in winter and stored during long hot summer. In gangetic plains its harvest coincides with rising temperature during February and March. Special attention is required for potato tubers being bulky and perishable for its storage and marketing point of view. Storage of potatoes in cold stores at 2-4°C involves substantial cost and also leads to accumulation of reducing sugar in the



potato tubers resulting in sweetening of potatoes. Processing is a fast-growing sector in the potato in India and it can also play important role to increase economy. Due to increased urbanization, rise in per capita income and expanding tourism, the demand for processed potato products in India has risen at a fast pace. For processing purpose, the potato tubers should be stored at 10-12°C with CIPC (isopropyl-N-chlorophenyl carbamate) to avoid sweetening. Hence, the need was felt to carry out region specific trials on evaluation of post-harvest losses for potato storage practices. To compare management systems for storage of potatoes for estimation of post-harvest losses, an experiment using potato variety, Kufri Chipsona-3 was conducted during 2018-19 at ICAR-CPRI Campus, Modipuram that falls in western Uttar Pradesh. To carry out the study, potato was harvested, graded and stored in heaps, at 2-4°C and 10-12°C (CIPC). Potato at 2-4°C were removed after six months to know the post-harvest losses, whereas, potato stored in heaps and elevated temperature (10-12°C) were sampled twice after three and six months, respectively. It was observed that per cent number of rotting was maximum in heaps at 3 months storage (11.77) followed by storage after 6 months at 2-4°C (3.34). None of the diseased tubers were found during storage in 3 months (10-12°C), six months (10-12 °C), whereas, 0.08% of the diseased tubers were present in heap. The number of sound tubers 92.19 and 91.52 were noticed during three and six months of storage (10-12°C), respectively. Data pertaining to physiological loss was also monitored in same variety by weight as well. Weight loss in heap was also assessed after 3 months indicated that rotting was highest (10.69). The rotting was of the order of 7.70(10-12°C) and 5.13(2-4°C) within 6 months. It was concluded that the weight loss was found to be the highest in heaped potatoes, followed by 10-12 °C after six months and three months, and it was the least in 2-4°C.

## **CASHEW APPLE VALUE ADDITION IS A PROMISING LIVELIHOOD SECURITY**

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### **ABSTRACT**

Cashew (*Anacardium occidentale* L.) is an evergreen important crop of drylands of many states in India. The kidney shaped nut is the real fruit while apple attached to it is the juicy peduncle having rich reserve of vitamins and minerals. The typical colour of the apple at full ripe stage varies generally yellow, golden yellow, cherry colored or red. India being the largest producer (60%) and exporter of cashew kernels in the world has 9,23,000 ha area and produces 6,13,000 t of cashew with an average national productivity of 695 kg/ha. Karnataka is a prominent state in cashew production occupying 5th position in area (1,18,000 ha) ranking 6th in production (53,000 t) with an average productivity of 461 kg/ha which is much less than the national average. Dakshina Kannada district has the highest area of cashew in Karnataka, followed by Udupi, Belgaum, Chickballapur, Uttara Kannada, Kodagu and Kolar. The state is bestowed with many research stations working on cashew including the Directorate of Cashew Research, Puttur, Horticulture Research Station, Ullal and AICRP on Cashew at Chintamani dedicated for research, establishment and growth of cashew industry in Karnataka by releasing several high yielding cultivars suitable for both coastal and plain regions. In spite of being highly nutritious, consumption of cashew apple has been very limited due to certain drawbacks, such as high perishable and astringent in taste. Various methods have been developed to improve the shelf life and sensory properties of whole cashew apple and its juice. It is also essential to create awareness among farmers about cashew apple processing for better economic returns. Processing of cashew apple is an economically viable enterprise in cashew growing tracts especially for Women Self Help Groups. These products are also useful for strengthening of present processing industries.

## **SCREENING OF DUAL-PURPOSE LINSEED GENOTYPES FOR YIELD AND FIBRE**

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### **ABSTRACT**

Ten genotypes were tested for “Screening of dual purpose linseed genotypes for yield and fibre” The experiment was conducted at Farm No 15 of All India Coordinated Research Project on Linseed, College of Agriculture, Nagpur during rabi



season of 2020-21. Ten genotypes of linseed i.e., PratapAlsi 2, Indira Alsi 2, Tiara, Parvati, Ruchi, Meera, PKV NL 260, Neealm, RLC 92 and Padmini were evaluated for yield and fibre. All genotypes were significantly influenced with each other regarding seed yield and fibre yield. Among the genotypes tested PKV NL 260 recorded highest seed yield and fibre yield i.e. seed yield 954 kg/ha and fibre yield 56 kg/ha. Therefore, this genotypes found better for dual purpose among the screened genotypes. It is concluded that the linseed genotypes PKV NL 260 recorded first among all the genotypes for both seed yield as well as fibre yield and has technical height of more than 50 cm.

## **STATUS OF AQUACULTURE PRODUCTION AND BIODIVERSITY STATUS, AND IMPACT OF COVID 19 ON AQUACULTURE AND FISHERIES**

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### **ABSTRACT**

Bangladesh has an inland water area of about 45,000 km<sup>2</sup> and about 710 km long coastal belt. The fisheries sector contributes 3.52% to the national GDP, 26.37% to the agricultural GDP and more than 1.35% to the total export earnings. The total production was 4.552 m.mt fish in 2019-2020. Fisheries sector contributes significantly about 60% (62.58 g/day/capita) of animal protein in daily dietary requirement. Aquaculture and fisheries sector of country is severely affected by pandemic corona virus (COVID-19). Data and information sources were used a mixed-method including online questionnaire surveys, face-to-face and telephonic interviews and focus group discussions (FGD) during June 2020 to May 2021 and secondary data collected publication of the Department of Fisheries (DoF) and online grey literature. This study exposes a positive impact on ecosystem and increased fish stock due to stop of industrial influents and decrease fishing pressure. The demand of spawn production decreased at the rate of (25-30) and number nursery practice was also decreased at (22-26) %. Finally, about (28-34) % fish farmer are not continued fish culture practice due to less demand and lower price of fish. All export and import based business is slowdown globally and nationwide lockdown situation imposed the supply chain, and processing and exporting of shrimp, crab and exportable other fish item hampered due to pandemic situation. Out of 12%, about (20-25) % fisheries people somehow directly or indirectly related with fisheries sector are going to work less due to pandemic and a negative impact resulted a worsened livelihood. So, a long-term policy and action plan is needed to recover aquaculture sector from the pandemic considering enhance production, economic, social and environmental sustainability.

## **CHARACTERIZATION OF MORPHOLOGICAL CHARACTERS OF KARPOORAM MANGA: AN INDIGENOUS MANGO (*MANGIFERA INDICA* L.) VARIETY OF SOUTHERN KERALA**

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### **ABSTRACT**

‘Karpooram’, the traditional mango variety was found mainly in the homesteads of southern Kerala. The fruit of this variety has a characteristic flavor of ‘Karpooram’ or camphor. This is a table variety with medium to large fruit size, high pulp content, less fibrous flesh compared to other traditional mango varieties. The study was conducted at the Farming Systems Research Station, Sadanandapuram, Kerala Agricultural University during 2018 – 2020, to evaluate the various accessions of traditional mango variety ‘Karpooram’ in Southern Kerala. During the survey, a good number of Karpooram mango trees were located in Kollam district. Fruit weight varies from 250g to 675g. The tree is moderately vigorous with spreading habit. Inflorescence length varies from 12.6 cm - 38.6 cm, inflorescence width varies from 7.4 cm - 31.2 cm, petiole length varies from 1.7 cm - 6.5 cm, leaf length varies from 13.5 cm - 27.9 cm, leaf width varies from 3.2 cm - 7.2 cm, tree height varies from tall to medium (6.2 m - 12.4 m). Fruit bearing type is solitary. Highest TSS (20° brix) was reported from accession KLM 35 and KLM 36, lowest acidity of 0.32 % was reported from KLM 21, KLM 22, KLM 32, KLM-33 and PTA -2. Highest carotenoid content of 4.89 mg 100g<sup>-1</sup> was reported from KLM 26, highest ascorbic acid content of 30 mg 100g<sup>-1</sup> was reported from KLM -32. Highest total sugar content of 18.6 % was reported from KLM-21. Reducing sugar content (3.6%) was highest from KLM-33. Highest fruit number of 800 was reported from accession KLM-21.





## BIOACTIVE AND CYTOTOXIC PROPERTIES OF ASTAXANTHIN-SHRIMP HEAD OIL COMPLEX

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### ABSTRACT

Astaxanthin-head oil complex (AX-HO) was co-extracted from shrimp processing waste and characterised for its optical and thermal properties, cell toxicity and bioactive properties viz., antioxidant properties, anti-inflammatory property, ACE-inhibitory activity and UV- protective properties. Further, accelerated storage studies were carried out to assess the stability of AX-HO complex during storage. The result indicated, absence of toxicity on L929 mice fibroblast cell line and HOS (Homo sapiens bone osteosarcoma) cells, significant *in vitro* antioxidant potential against DPPH and ABTS radicals, and higher extent of membrane stabilisation of red blood cells in comparison with aspirin and diclofenac. The anti-hypertensive activity of AX-HO was found to be moderate as compared to synthetic reference captopril. The photoprotective activity of AX-HO was assessed on viable microbial cells and the results indicated greater extent of photo-protection over the entire range of UV and far UV region. The properties AX-HO extract was affected to a greater extent during accelerated storage study. The superior bioactive properties of astaxanthin coupled with the high degree of unsaturation of shrimp lipid, observed in the present study suggest the potential of using astaxanthin-shrimp head oil complex as a functional adjuvant for alleviating oxidative stress and thereby improving the immunity responses, particularly during the incidences of pandemics, once delivered together with medication. Also, the unique UV-protective properties exhibited by the extract advocates its use as a natural functional ingredient in sunscreen formulations.

## RNA-SEQ ANALYSIS AND IDENTIFICATION OF BRASSINOSTEROID BIOSYNTHETIC PATHWAY IN SAFFLOWER

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### ABSTRACT

Safflower (*Carthamus tinctorius* L.) is known for its oil quality and ability to grow in drought conditions. The threat to global food security posed by challenges of climate change has stressed the use of functional genomics in current plant breeding approaches. Plant steroid hormones called brassinosteroids (BRs) are at the nexus of regulating plant growth and development, and plant stress responses. Enhanced BR levels or signalling have increased crop yields by up to 40% while also conferring broad range stress tolerance. Currently there is no information on the BR biosynthesis and signalling pathways in safflower. A *de novo* transcriptomic analysis of untreated and 24-epibrassinolide (EBR)-treated safflower leaves was conducted using the Illumina sequencing platform. Approximately 5 GB clean data was generated from untreated and EBR-treated samples that assembled into 34,456 and 36,997 transcripts (combined 50630), and 30,180 and 32,333 CoDing Sequences (CDS) (combined 43,637), respectively. More than 71% of the CDS were annotated with majority of hits against *Cynara cardunculus* var. scolymus, a thistle in the safflower family. A total of 74 KEGG pathways were identified in safflower. Six genes, including *DWF4* that codes for a rate-limiting enzyme in BR biosynthesis, were mapped to the BR biosynthesis pathway using the KEGG mapper.

## GLOBAL STATUS OF INSECTICIDE RESISTANCE IN *SPODOPTERA FRUGIPERDA* (J.E. SMITH)

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### ABSTRACT

Fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) is a highly polyphagous and invasive lepidopteran pest. Being a long-distance migratory pest, outbreak of this pest has been reported from several countries in the world causing considerable yield loss in several crops. Chemical pesticide plays an important role in management of this pest. But continuous use of chemicals and increasing selection pressure will ultimately lead to development of resistance against insecticides. Hence, resistance monitoring of this pest is crucial for its successful management. Due to recent outbreak of this pest in many



countries, it has exposed to several insecticides. Therefore, its susceptibility status against different insecticides may vary in different countries. Extensive studies of available literature revealed that information on resistance status of *S.furgiperda* is scattered and a compiled work on global status of insecticides resistance in *S.furgiperda* is lacking. Therefore, an effort was made to bridge this gap. The present article discussed the current status of insecticide resistance in *S.furgiperda*. This will help to formulate integrated resistance management (IRM) strategies of this menacing pest.

## DIFFERENTIAL FUNCTIONAL ANALYSIS OF THE PLANT NUCLEAR FACTOR GENES IN *SACCHARUM* SPECIES UNDER ABIOTIC STRESSES

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### ABSTRACT

Many stress-responsive genes which trigger complex adaptive and defensive mechanisms in plants are regulated by transcription factors. TFs act like molecular switches turning on and off various genes thereby regulating their expression. Drought and salinity induce many stress-responsive mechanisms regulated by various genes which include genes that encode transcription factors (TFs). Plant nuclear factor (NF-Y), one of the transcription activating factors, consisting of three subunits, plays a key regulatory role in many stress-responsive mechanisms which include drought and salinity stress. NF-Ys function both as complex and as individual subunits. Considering the importance of sugarcane as a commercial crop with high socio-economic importance and the crop being affected mostly by water deficit stress and salinity stress causing significant yield loss, plant nuclear transcriptional factors were focused in this study. NF-Y is a heterotrimeric CCAAT box binding plant transcription factor comprising three subunits viz., NF-YA (CBF-B), NF-YB (CBF-A) and NF-YC (CBF-C). In animals, NF-Ys are encoded by a single gene whereas in plants NF-Ys are encoded by multiple gene members. Apart from modulating stress response, NF-Ys are also reported to play a crucial role in many vegetative, developmental and reproductive processes in plants. There are 51 NF-Y genes (9NF-YA, 18 NF-YB and 24NF-YC) in *Saccharum* species. These identified NF-Y gene members were located on different chromosomes of sugarcane genome. As many as 13 NF-Ys were present in a chromosome while some chromosomes harbored a single gene. Phylogenetic analysis of NF-Y genes predicted the orthologies which would assist in determining functional conservation and translation between species. Subcellular localization analysis of a selected NF-YB2 in onion epidermal cells and sugarcane callus revealed its expression to be localized at nucleus that was further evidenced to be a transcription activation factor. Expression analysis of NF-Y genes under drought stress treatment envisaged the role of these NF-Y gene members in drought tolerance. Therefore, NF-Ys could be potential candidate genes for sugarcane improvement through marker assisted selection and biotechnological approaches.

## INTEGRATED NUTRIENT MANAGEMENT MODULES MEDIATED MAIZE YIELD POTENTIAL AND SOIL PROPERTIES UNDER MAIZE-CHICKPEA CROPPING SEQUENCE

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### ABSTRACT

Long-term sustainability concerns are growing in agriculture as a result of over- and under-application of fertilizers, as well as inadequate resource management, which is causing soil health to deteriorate and crop output to decline. A field experiment was done at the Research Farm, ICAR-Indian Institute of Soil Science, Bhopal to investigate the influence of long-term manuring on maize crop performance in a Vertisol under various nutrient management modules. The field experiment was laid out in RBD consisting of 12 different integrated nutrient management (INM) modules in three replications. The maize and chickpea were grown as a test crop. The crops performance under these treatments was assessed in terms of yield, quality, nutrient content and nutrient uptake by maize as well as soil parameters. The results revealed that the INM modules positively influenced the performance and productivity of maize crop as compared to the sole inorganic fertilizer application. Besides the superior crop performance, the integrated nutrient management modules significantly ( $p=0.05$ ) enhanced and improved soil health in terms of soil physico-chemical properties. Among the various modules, i) application of 75% STCR dose + FYM @



5 t ha<sup>-1</sup> to maize, ii) application of FYM @ 20 t ha<sup>-1</sup> to maize increased the crop growth and seed index in maize, improved soil health and reflected as a viable technique in improving soil nutrient availability on a sustainable basis.

## ENHANCING SEED YIELD OF GREEN GRAM THROUGH FOLIAR APPLICATION OF MICRONUTRIENTS

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### ABSTRACT

Quality seeds in any crops play an important role in deciding the performance of the crops. Generally, balanced fertilizer is inevitable to boost crop productivity. In order to exploit yield potentiality of mung bean, adequate and balanced plant nutrition is must for enhancing the seed yield and seed quality per unit area and to improve the scale of economy. The experiment was designed to find out the influences of different doses of Zinc, magnesium and iron on seed yield and yield attributing characters of mung bean varieties Sweta and Virat. The crop was raised during Zaid 2019 at Crop Research Farm, Chandra Shekhar Azad University of Agriculture and Technology, Nawabganj, Kanpur. The physical and chemical properties of experimental plot was also analysed before conducting experiment. Three doses (0, 0.5 and 1.0%) of each micronutrient were sprayed twice at 20 & 35 days after sowing. Observations were recorded on days to flower initiation, days to 50 per cent flowering, primary branches per plant, no. of seeds per pod, pod length and seed yield. The data were analysed adopting the nested design.

Results showed that the foliar application of zinc, magnesium and iron affected significantly to the parameters studied. The dose 1.0% zinc reduced the days to flower initiation (36.83 days), days to 50% flowering (42.33 days) and also recorded highest seed yield (1.48 Kg plot<sup>-1</sup> and 1095.81 Kg ha<sup>-1</sup>) while dose of 1.0% magnesium produced highest no. of pod plant<sup>-1</sup> (50.17). The application of 1.0% iron resulted in highest no. of primary branches plant<sup>-1</sup> (2.33) and number of seed pod<sup>-1</sup> (11.37). Among the variety maximum pod length (7.41) was noticed in var. Virat (V<sub>2</sub>). However, variety did not influence seed yield. The interaction of variety and micronutrients had affected all parameters under study except seed yield Kg plot<sup>-1</sup> and seed yield Kg ha<sup>-1</sup>. The foliar spraying of 1.0 per cent zinc, magnesium and iron was found to enhance seed yield by 7-8 per cent. Hence, 1.0% foliar spray of zinc, magnesium and iron at 20 and 35 days after sowing may be recommended to seed growers for realizing maximum yield and seed quality of mung bean.

## STUDIES ON BODY CONDITION SCORING OF GANJAM GOATS UNDER FIELD CONDITION

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### ABSTRACT

The present experiment was designed to study the relationship between Body Condition Score and various physical attributes and it was conducted on Ganjam does which were maintained in the farmers home in the villages of Nayagarh district. A total of 250 does were scored for physical parameters and BCS. A BCS scale of 1 to 5 developed by Villaliquan *et al.* (2004) was used to score the does which is suitable in scoring of does under Indian conditions. This method considers the muscle and fat over skeleton and hollow in the flanks below the loin for assessing the fat cover. A score of '1' considered as emaciated (poor) condition and a score of '5' considered as obese (fatty) condition. The does were divided into groups according to their age (up to 3 yrs, above 3 yrs). The following physical parameters were studied: BCS, Body weight (BW), pin shoulder length (PS), height at withers (HW), heart girth (HG), and abdominal girth (AG) and thigh circumferences (TC).

The maximum and Minimum BCS of test flock were 2 and 4.5 with mean  $3.24 \pm 0.09$  whereas Body weights were 35.90 (max), 18.39 (min) with mean  $27.80 \pm 0.47$  Kg, for Pin to Shoulder length 68.00 (max), 52.5 (min), mean  $59.73 \pm 0.21$  cm, for Height at withers 73 (max), 52 (min), mean  $64.40 \pm 0.38$  cm, for chest girth 78 (max), 60 (min) with mean  $70.62 \pm 0.45$  cm. The BCS, BW, HW, HG, AG and TC were significantly ( $P < 0.05$ ) higher in above 3 yrs group. The mean BW, BCS, HW, HG, AG and TC were highest at BCS 4.5 group and lowest in BCS 2.0 group. The mean of BCS, BW, HW, HG, AG and TC were 2.45, 24.05 Kg, 57.45, 61.52, 67.18, 83.77, 26.9 cm. The corresponding data for age group above 3 yrs were 4.15, 32.18 Kg, 62.39, 67.76, 74.65, 93.55, 29.80 cm. All the physical parameters showed high correlation with BCS ( $P < 0.01$ ). The maximum



goats (170) showed higher BCS (<3.5) under field condition. This may be due to better management, plenty of grazing land, health care, deworming and vaccinations were followed by progressive farmers.

## SCREENING OF RESISTANT GENE AGAINST BACTERIAL WILT FROM LOCAL BRINJAL GENOTYPES THROUGH BACTERIAL INOCULATION

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### ABSTRACT

Bacterial wilt caused by *Ralstonia solanacearum* in brinjal is the most devastating problem for successful cultivation in north eastern region of India. In the present study, twenty genotypes of brinjal were collected from North Eastern Region of India and grown in Polly house at CHF, CAU, Pasighat, Arunachal Pradesh during 2020 along with two checks in sick soil which was inoculated with bacterial culture to screen out the resistant genotypes against bacterial wilt disease. The recommended procedure for inoculation of bacteria was follows to infect the soil. Observations were recorded to find out the resistant gene against bacterial wilt from local brinjal genotypes. Based on rating scale against bacterial wilt of brinjal (0-5), the minimum disease severity was recorded in CHFB-22, CHFB-29 and CHFB-33 (20%) indicated highly resistant against bacterial wilt out of these twenty-two genotypes. Nine genotypes such as CHFB-21, CHFB-23, CHFB-24, CHFB-26, CHFB-28, CHFB-30, CHFB-31, CHFB-34 and CHFB-35 grouped in moderately resistant, 4 genotypes CHFB-20, CHFB-25, CHFB-18 and CHFB-19 grouped in moderately susceptible, 3 genotypes CHFB-27, CHFB-32 and CHFB-37 grouped in susceptible while, one genotype CHFB-36 recorded highly susceptible at field level. Disease severity index observed minimum showed nil in Arka Nidhi and Arka Keshav used as checks under study. The lines CHFB-22, CHFB-29 and CHFB-33 observed resistant in field condition, can be used in breeding programme for development of resistant lines through hybridization.

## UTILIZATION OF MORINGA LEAVES POWDER AS VALUABLE FOOD INGREDIENTS IN IDLI PREPARATION

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### ABSTRACT

Nutritional problems like PEM, anemia and vitamin A deficiency continue to plague a large proportion of Indian children. *Moringa oleifera* leaves contains adequate amount of calcium, iron, vitamin C and fiber for the women, children and old age people. *Moringa oleifera* is widely used in India, since the Ayurveda medicinal systems, use it for the treatment of several ailments. The leaves have many therapeutic values for human beings. But it was less utilized by the people. Hence, the present study was undertaken to use the *M. oleifera* leaves for the development food product. The *M. oleifera* leaves powder was prepared by dehydration method and the food product such as idli was prepared by the incorporation of *M. oleifera* leaves powder at various concentrations (5%, 7% and 10 %). The sensory evaluation results revealed that, 5 % of *M. oleifera* leaves powder incorporated Idli were accepted by most of the people. The nutrient content of 100 gm of idli was analysed and was reported as 13.1 g of protein, 1.66 g of ash, 5.9 g of fibre, 145.6 mg of calcium, 3.26 mg of iron, 4.3 mg of vitamin C and 1379.85 µg of beta carotene. The present findings provide a new strategy to utilize the *M. oleifera* leaves powder as nutritional as well as functional ingredient for eradicating many of the diseases.

## VALUE ADDITION IN FLOWERS AND ORNAMENTALS

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### ABSTRACT

Floriculture is presently considered as the most lucrative agro-enterprise in terms of profit making. As the flowers are the





utmost perishable horticultural farm produce, there remains some hindrance in proper marketing following standard postharvest management practices by the common farmers. Hence, value addition by the agro-industries is another important arena for proper utilization of fresh ornamentals in either garden-fresh or processed form for marketing. Different kinds of value-added products are nowadays formulated and marketed by the companies which include essential oils, flavours, fragrance, pharmaceutical and nutraceutical compounds, insecticidal and nematocidal compounds, pigments and natural dye, vanilla-based products, gulkand, rose water, etc. which also gives employment for growing population in respective companies. Besides floristry items, flower arrangements and floral ornaments are important value addition with the fresh flowers and other ornamentals which uplift the livelihood and financial conditions and can offer tremendous opportunity of the rural population. Value addition in flowers and Ornamentals is a good source of income by self-employment. It includes fresh flower products from cut flower arrangements like bouquets, baskets, bunch, buttonaire, corsage etc. and secondly loose flower products like garland, floral strings, pomanders, wreaths, floral jewelry. Dry flower value added products includes dried flower arrangements, products of press dried flowers and pot pourries etc. Processed products include essential oils, absolutes, concrete, petal jam (rose, rhododendron), jelly, ready to serve beverages, wine, floral tea, rose hip juice, poultry feed, insect repellent, floral dyes, petal embedded handmade paper, cosmetics like calendula cream, rose water, rose cream etc. Value addition in floriculture also covers novel innovative products and technologies such as floral genes, novelty for molecular breeding, flower form, flower colour, floral fragrance and modern gardening.

## EVALUATION OF DIFFERENT INSECTICIDE USE STRATEGIES AS RESISTANCE MANAGEMENT FOR SHOOT AND FRUIT BORER *LEUCINODES ORBONALIS* IN BRINJAL

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### ABSTRACT

Brinjal shoot and fruit borer is the most destructive pest of brinjal and is considered as the main constraint as it damages the crop throughout the year. It is known to damage shoot and fruit of brinjal in all stages of its growth. The yield loss due to the pest is to the extent of 70-92 per cent. Due to increasing levels of resistance to different insecticides, new modules for the management of shoot and fruit borer were tested. An experiment was conducted to know the efficacy of different insecticide modules in a completely randomized block design with eight treatments and three replications. The treatments include T<sub>1</sub>: Rynaxypyr 20 SC @ 0.4 ml/l (sequential sprays), T<sub>2</sub>: Emamectin Benzoate 5SG @ 0.5g/l (sequential sprays), T<sub>3</sub>: Spinosad 45SC @ 0.5 ml/l (sequential sprays), T<sub>4</sub>: Chlorpyrifos 20EC @ 2ml/l (sequential sprays), T<sub>5</sub>: Cypermethrin 25 EC @ 0.5 ml/l (sequential sprays), T<sub>6</sub>: Rynaxypyr 20SC @ 0.4ml/l followed by Emamectin benzoate 5 SG @ 0.5g/l, Spinosad 2.5 SC @ 1.5ml/l, Chlorpyrifos 20 EC @ 2ml/l, Cypermethrin 25 EC @ 0.5 ml/l (IRM module), T<sub>7</sub>: Chlorpyrifos 50%+ Cypermethrin 5% EC @ 2ml/l (sequential sprays) and T<sub>8</sub>- Untreated Control. Among the eight treatments tested IRM module T<sub>6</sub> (Rynaxypyr 20 SC @ 0.4 ml/l followed by Emamectin benzoate 5 SG @ 0.5 g/l, spinosad 2.5 SC @ 1.5 ml/l, Chlorpyrifos 20 EC @ 2ml/l, Cypermethrin 25EC @ 0.5 ml/l) was effective with lowest damage percent (8.47%) followed by the sequential treatments T<sub>1</sub> (Rynaxypyr 20SC @ 0.4 ml/l), T<sub>2</sub> (Emamectin Benzoate 5SG @ 0.5g/l), T<sub>3</sub> (Spinosad 2.5 SC @ 1.5ml/l or Spinosad 45SC @ 0.5 ml/l), T<sub>5</sub> (Cypermethrin 25 EC @ 0.5 ml/l) and T<sub>7</sub> (Chlorpyrifos 50%+ Cypermethrin 5%EC @ 2ml/l). Lowest fruit damage was also recorded in IRM module T<sub>6</sub> (18.40%) with highest marketable yield (7.25 t/ha).

## CHARACTERIZATION OF INDIGENOUS/DESI AND EXOTIC POTATO VARIETIES FOR POTATO CYST NEMATODE RESISTANCE

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### ABSTRACT

Potato cyst nematode (PCN) is a pest of global significance. The estimated crop losses of 9% occur worldwide annually due to two species of PCN i.e. *Globodera rostochiensis* and *G. pallida*. Among various management practices, breeding for resistant



varieties is most durable, environmentally friendly and effective strategy. Potato is non- native crop of Indian sub-continent. Potatoes originated in Andes Mountains of South America. Potato was introduced in India from Europe in the beginning of seventeenth century by the British missionaries or Portuguese traders. Chance selection as survivors of early introductions or naturally occurring variants led to a group of varieties called *indigenous* or *desi* varieties, known by different nomenclature in diverse dialects and has distinguished characteristics of local adaptation and taste preferences. Seventy-one such *Desi* varieties and Exotic varieties, constituting potato DUS reference collection were screened for PCN resistance through root ball technique under glass house condition at Kufri. Based on cyst count at 55 days after planting, 8 accessions ie Memphis, Edony, Evora, Garlentic, Dolly, Santana, Taurus, Sagitta were highly resistant (HR) to both the species while only 2 accessions ie DeshlaLal and Lal Mutti-1 were HR to *G. rostochiensis*. Among the resistant (R) accessions, Phulwa red and JeevanJyoti were R to both species while Nainital, Burma Special, Deshla were R to *G. rostochiensis* and DeshlaLal, Ultimus, NJ-78 to *G. pallida*. Remaining accessions were either moderately resistant, susceptible or highly susceptible. Identified highly resistant or resistant genotypes can be used as parental lines in PCN resistance breeding to broaden the genetic base of existing resistance sources.

## IDENTIFICATION OF *MELOIDOGYNE INCOGNITA* REPELLENT SIGNALING CUES FROM LEMONGRASS

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### ABSTRACT

Plant-parasitic nematodes are a major problem for farmers it causes approximately 21.3% yield loss in crop cultivation. Among these *Meloidogyne incognita*, is a major threat in India. The utilization of chemical pesticides to control the nematode population may cause acute and delayed health effects in people and are also harmful to the environment and biodiversity. In India several botanical-based nematicides obtained from various plant sources are available but none of them can control *M. incognita* infestation completely. Thus, there is a great need for an eco-friendly, highly efficient sustainable control measure. In-depth understanding of interaction mechanism of the host plant and *Meloidogyne spp.* and identification of signaling molecules responsible for this interaction may help in achieving this goal. Therefore, in the present study to manage the *M. incognita* infestation lemongrass is selected. Signaling molecules are extracted by using primarily hexane as a solvent from leaves of lemongrass. After extraction, these cues were characterized by Gas chromatography-mass spectrometry (GC-MS). In the present study GCMS profile of hexane extract of lemongrass revealed the presence of 57 types of compounds in varying quantities. In this pool Alkane, alkene, alcohol, aldehydes and ketones were prominent. In the next step we will test the activity of compounds those are having a similarity matrix <95% individually towards larvae of *M. incognita*. Also, we will screen out the compound showing the strongest repellent activity and will formulate it in a suitable stable inert base. In future extract preparation by using other solvent systems and their identification also will be carried out. This study proclaimed that after activity testing with *M. incognita*, Actual nematode repellent and attractant will be recognized. In the pure form, the strong repellent molecule will be exploited for eco-friendly highly efficient formulation.

## COMMUNITY ANIMAL HEALTH CENTRE FOR ENHANCING THE ACCESS TO LIVESTOCK HEALTH SERVICES

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### ABSTRACT

The model was implemented in five scheduled tribe dominated villages with one Biotech KISAN hub village of Banka district in Bihar. From each of the selected villages, three youth were trained for developing skills to impart paravet services including vaccination, deworming, artificial insemination, diagnosis of common diseases and providing advisories regarding pre and



post-natal care of animal. The infrastructure of village panchayat in these villages was utilized to establish Community Animal HealthCentres wherein the basic veterinary facilities were established & products including travis, veterinary medicines, feed supplements etc. were stored. With mutual agreement, the livestock owners and paravet service provider of the village agreed up on to pay service charges to the trained paravet ranging between rupees 10 to 100 on the basis of type of service provided. However, initially, all the veterinary medicines and vaccinations were provided freely to the needy ones. The paravets were provided with appropriate registers to maintain the record of details of animal, diagnostics and treatment provided along with veterinary supplies utilized. The most frequently availed service was vaccination of animal ( $f=3394$ , 42.85%) followed by deworming ( $f=3033$ , 38.30%), disease treatment ( $f=1188$ , 15.00%) and Artificial insemination ( $f=83$ , 1.05%). Only 222 times livestock owners sought for other services including advisories related to animal feed and fodder related issues. Across five CAHCs, average 506 livestock owners availed deworming services, whereas average of 566, 198 and 14 livestock owner availed vaccination, disease treatment services and AI, respectively. The average distance covered by livestock owners to seek animal health services is reduced to 6.40 kilometers (71.97%) and ease of access to animal health services has increased by 43.96%. The average cost for each visit of the veterinary service provider has also drastically reduced from Rs. 320 to Rs. 64.92. The impact of CAHC was found that among poultry birds and goats, the mortality has reduced by 19% and 50 %, respectively. Further, it was observed that the inter-calving period has also decreased by six months in dairy animals and the average milk productivity has increased by 322 grams (27.97%).

## MANAGEMENT OF LENTIL WILT THROUGH BIOLOGICAL CONTROL AND ORGANIC AMENDMENTS

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### ABSTRACT

Wilt caused by *F. oxysporum* f. sp. *Lentis* is one of the major diseases affecting lentil production across the globe resulting in yield loss of up to 50% in farmer's fields. The disease appears itself in the initial growth phase of the crop (seedlings) or the reproductive phase (adult period). Although various fungicides have promising results in controlling the wilt, there is a problem of phytotoxicity and fungicidal residue leading to environmental pollution. As such in the present context, the use of biological control agents and organic amendments offers a great promise which is also eco-friendly as well as cost-effective for the management of the wilt of lentil. In the year 2014, Scientists have recorded disease incidence through *Trichoderma harzianum* (2.49) and Ps. fluorescence (2.92). In the case of organic soil amendments, disease incidence (1.69%) was recorded in case FYM (2.29%) and spent compost (2.71%). Bioagents and organic amendments indicate their important roles in the management of the wilt disease. A combination of Bioagents along with organic amendments was found cost-effective for overcome of wilt disease.

## ROLE OF ALLELOPATHIC PLANTS IN DISEASES MANAGEMENT

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### ABSTRACT

Allelopathy is derived from two Greek words 'Allelon' means each other and 'Pathos' means to suffer i.e., the injurious effect of one upon another. However, term was first used in 1937 by the Austrian professor Hans Molisch. He used the term to describe biochemical interactions (stimulatory and inhibitory) among plants, including microorganisms. In general Allelopathy is defined as the direct or indirect, harmful or beneficial effects of one plant on another through the production of chemical compounds that escape in to the environment. Allelopathic chemicals (allelochemicals) can be present in any part of the plant including leaves, flowers, roots, fruits or stems. Allelochemicals are mostly secondary metabolites, which are produced as by products during different physiological processes in plants. Some important secondary metabolites identified as allelochemicals are phenolics, alkaloids, flavonoids, terpenoids, hydroxamic acids, brassinosteroids, jasmonates,



salicylates, glucosinolates and amino acids etc. Target species are affected by these toxins in many different ways. Mode of action of Allelochemicals involves Inhibition of cell division, Alteration of membrane permeability, Interference with mitochondrial function and Reduction in protein synthesis. In crop production allelopathy can be used in Pest management (weeds, insects and pathogens), Stress signalling, resistance against Abiotic stresses, crop nutrition management and plant growth promotion. Furthermore, allelochemicals can act as environmentally friendly herbicides, fungicides, insecticides and plant growth regulators, and can have great value in sustainable agriculture. The incorporation of allelochemicals in agricultural crops management may reduce the use of pesticides and lessen environmental deterioration. Therefore, more scientific researches are required to understanding the mechanism of allelopathic plants.

## HARMFUL EFFECTS OF NANOMATERIALS ON SOIL FAUNA SPECIALLY EARTHWORMS

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### ABSTRACT

Nanotechnology has revolutionized the world. It is the science of particles at nanoscale. Engineered particles of nanoscale are referred to as nanoparticles. Applications of nanoparticles have been increasing since 1990s but it has grown rapidly from 2000 onwards. Use of nanoparticles ends up with their release in environment leading to many adverse effects in biosphere. They enter in terrestrial and soil fauna through skin, respiratory tract and digestive system and ultimately reach to different tissues and organs. Nanoparticles may also reach to brain and affect neurons. Some nanomaterials cause irreversible damages to cells due to oxidative stress and organelle injury. The hazardous effects of nanomaterials has raised a great issue as to how one can manage, reduce or counter the ill-effects of these materials. Soil fauna including earthworms play a key role in maintaining the structure and function of soil system, hence, efforts must be made to protect the health of these beneficial animals. Earthworms belong to megadrile group and they were one of the first animal group colonizing soil from the end of Palaeozoic era. Survival of megadrile soil bioresources is greatly affected by presence of nanoparticles in pedoecosystems. Earthworm is an excellent bioindicator and sentinel fauna for testing of toxicants in soils. A gradual decrease in LC50 values with exposure period of *E. fetida* to zinc oxide nanoparticles has been observed. The bedding temperature and pH affect the median lethal concentration of nanoparticles. Increase in mucus secretion and changes in body colour are seen after exposure to zinc oxide nanoparticles. Exposure of juveniles of *E. fetida* to zinc oxide nanoparticles declines body mass and length gain more in artificial soil as compared to natural substrate. These findings embark the need to understand potential risk of nanomaterials and mitigate their toxic effects for a sustainable agroecosystem.

## EFFECT OF FERTIGATION SCHEDULE ON GROWTH, YIELD AND ECONOMIC RETURNS OF CABBAGE (*BRASSICA OLERACEA*)

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### ABSTRACT

Front line demonstration was carried out by ICAR-Krishi Vigyan Kendra, at farmer's field of Chintamanitaluk, Chikkaballapura district, Karnataka, India during 2019-20 to 2020-21 to study the effect of fertigation levels and schedules on growth, yield and economics of cabbage. The treatments include T<sub>1</sub>- farmers practice 12 splits of RDF at every 7 days interval (Check), T<sub>2</sub>- IIHR practice 19 equal splits of RDF at every 3 days interval along with foliar application of micro nutrient spray (vegetable special) 5 g/l @ 30, 45 & 60 DAT (Demo). Adoption of IPM practices helped in managing the incidence of pest and diseases. The results indicated that fertigation of 100 per cent RDF of NPK in 19 equal splits at every 3 days interval upto 69 days after transplanting found that there was a significant improvement in regards with growth parameters (plant height 35.18 cm), yield attributes (Average head weight 1.47 kg) when compared to check (30.42 cm & 1.13 kg, respectively). The average yield i.e., 27.21 t/ha in demo plot (T<sub>1</sub>) while it was observed 24.10 t/ha in check plot (T<sub>2</sub>). The economic benefits of drip irrigation resulted in maximum gross return of Rs. 3,41,041/ha and B:C ratio was found to be 3.44 when compared with farmers practice.





## **SOIL FERTILIZATION OF DIFFERENT LEVELS AND SOURCES OF HUMIC ACID ON GROWTH AND YIELD OF MAIZE UNDER GREENHOUSE CONDITION**

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### **ABSTRACT**

To assess the effect of different levels and sources of humic acid extracted from different organic wastes pot culture experiment was conducted on growth, yield and nutrient uptake by maize under greenhouse condition. The humic acid extracted from ten different organic wastes was applied to soil at graded levels (30, 60 and 90 kg ha<sup>-1</sup>) along with recommended dose of fertilizer NPK (150: 75: 40 kg ha<sup>-1</sup>). The pots which received NPK alone and NPK+FYM were considered as control. The experiment was carried out for 60 days. The treatments were replicated thrice and the design was factorial CRD. Higher root dry weight (15.32 g plant<sup>-1</sup>) and shoot dry weight (70.54 g plant<sup>-1</sup>) was recorded with application of humic acid at 90 kg ha<sup>-1</sup>, which was on par with application of humic acid at 60 kg ha<sup>-1</sup>. Among the humic acid extracted from different organic wastes, humic acid of poultry manure (S<sub>7</sub>) was recorded significantly higher root and shoot dry weight (71.43 and 15.42 g plant<sup>-1</sup>, respectively) followed by humic acid of pressmud (S<sub>3</sub>), coffee pulp (S<sub>2</sub>) and urban compost (S<sub>9</sub>). Similar trend was observed in nutrient uptake. Higher NPK content in soil after harvest of maize was recorded @ 90 kg ha<sup>-1</sup> of humic acid application (312.99, 105.82 and 299.43 kg ha<sup>-1</sup>). Among the humic acid sources extracted from different organic wastes the buildup of N (314.84), P (111.3) and K (299.48) kg ha<sup>-1</sup> was considerably high on application of poultry manure humic acid (S<sub>7</sub>) compared to humic acid extracted from other organic wastes. The pots which received only NPK+FYM was on par with application of humic acid at 30 kg ha<sup>-1</sup> level.

## **ECONOMIC ASSESSMENT OF WASTEWATER FILTRATION TECHNOLOGY AND ECOLOGICAL HEALTH RISK IN PERI-URBAN WASTEWATER-IRRIGATED SOILS OF KAMPTEE BLOCK, NAGPUR DISTRICT**

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### **ABSTRACT**

The present study undertaken at Peri-urban area of Kamptee block in Nagpur district, where farmers were doing agriculture through wastewater irrigation. The major objective of study, to assess the economics before and after intervention of water filtration technology through suitable land use management practices has been worked out in study area. Ecological-health risk and performance of major crops grown in the peri-urban wastewater-irrigated soils of Kamptee Periurban areas has been carried out through collecting secondary data from various published sources on land use land cover, healthcare expenditure, environmental damage, cost of cultivation and price of commodities. The results showed that the environmental damage in study area observed as Rs. 42.14 lakh due to pollutants in Nag River. After intervention of the technology, it was reduced by 20% (33.71 lakh rupees). The technology generated employment of 52-man days per year and cropped area to be increased by 2 percent. The study further revealed that the technology found feasible for agricultural land use planning in terms of productivity and profit to the farmers. Table 2 revealed that, before the technology intervention average productivity of all the crops were observed as 13.12 q/ha, gross return arrived at Rs. 44.46 thousand per quintal with BC ratio 1.04. After the intervention, as shown in figure 1, average productivity of all the crops were 14.89 q/ha, gross return arrived at Rs. 52.64 thousand per quintal with BC ratio 1.20. The overall impact of technology showed that average productivity, gross return and BC ratio increased by 13.52%, 18.40% and 16.09% respectively (Fig. 2). This study found that the technology to treat the wastewater was significantly influenced on the health, environment, agricultural productivity and profitability of the farmers in study area through suitable land use management practices.



## COMBINING ABILITY ESTIMATES IN ROSELLE (*HIBISCUS SABDARIFFA* L.) FOR FIBRE YIELD AND YIELD CONTRIBUTING TRAITS

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### ABSTRACT

A study was conducted to identify the parents with good general combining ability and specific cross combinations for fibre yield and its nine attributing traits by utilizing 6 x 6 full diallel model in roselle at Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during *kharif*, 2014. Parents and F<sub>1</sub>'s were grown in randomized block design with two replications and analysis of variance for parents showed significant difference for all characters except base diameter, while for hybrids showed significant differences for all the traits except plant height. Significant differences for reciprocals were exhibited in the characters mid diameter, top diameter, internodal length, bark thickness, green weight, dry stick weight and fibre yield which suggested presence of maternal effect of parents in their offsprings for these characters. For most of the characters  $\sigma^2_{sca}$  was found to be greater than  $\sigma^2_{gca}$  except for days to 50% flowering and internodal length which could be suggested that all these characters were predominantly influenced by non-additive gene action. Among the six parents, R 225 was found to be a good general combiner for most of the fibre yielding characters followed by AR 14. The crosses, R-180 x R-225, AR-14 x AR-81, AR-81 x AS-80-6, AR-14 x R-225 and AR-14 x REX-45 had exhibited highly significant positive *sca* effects for fibre yield and its attributing characters.

## INTEGRATED COMMUNITY APPROACH: FOR SUCCESSFUL MANAGEMENT OF WHITE GRUBS IN PEANUT

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### ABSTRACT

The important species of white grubs which causing damage to groundnut belong to Melolonthinae, Rutelinae and Dynastinae. The genus *Holotrichia* includes the major species of white grubs inflicting serious damage to *Kharif* groundnut. *H. consanguinea* is pre-dominant in Rajasthan, Gujarat, Haryana, Punjab, Bihar and Uttar Pradesh whereas, *H. serrata* is most destructive in states like, Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra and later it has spread to western and peninsular India. The species of white grub those are endemic to Saurashtra region of Gujarat are, *Apogoniarauca*, *Schizonycharuficollis* and *Adoretus* sp. Outbreak of white grub damage started in the last few years and severe incidence was noticed during 2016 in many groundnut growing areas of Saurashtra region of Gujarat. Hence survey was conducted in the Saurashtra region where up to 90 per cent incidence was observed leading to complete failure of groundnut in many of farmer's field. Integrated community approach was formulated by ICAR-DGR to tackle the problem during 2017 and awareness program started before sowing itself. Technology was disseminated through pamphlets, field visits and conducting melas. Farmers by taking up timely white grub management during 2017 resulted in monetary gain around 10,000-15,000 rupees per ha compared to 2015 and 2016.

## A SUSTAINABLE WAY TO MITIGATE THE CLIMATE CHANGE AND PROVIDE FOOD SECURITY: BIOCHAR

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### ABSTRACT

In India, about 686 million tons of agro-residues are produced every year, out of which 84-114 million tons are surplus. Agricultural waste in the form of roots, stems, pods, leaves, skin (peels) and other byproducts of value addition processes are also available in abundant quantity. This agricultural waste is subjected to open field burning causing pollution in the



atmosphere. The burning of these crop residues, emits pollutant such as carbon dioxide, carbon monoxide, particulate matter which are harmful for the environment, thus affect our ecosystem in the form of ozone layer depletion and global warming. Efficient use of agricultural waste by converting it in the form of useful source of soil amendment/ nutrients is one way to manage soil health and fertility. One of the approaches for efficient conversion involves carbonization of material to highly stable carbon compound known as biochar. Bio-char is a black colored solid material obtained from the pyrolysis of biomass, when biomass is heated in absence of oxygen. It helps to enhance soil productivity and thus provides food security. Biochar application to soil may increase the yield of crop in the tune of 45-250%. Bio-char amendments to soil, may annually sequester an amount of C equal to 12% the current anthropogenic CO<sub>2</sub> emissions. It is estimated that the maximum sustainable technical potential for carbon abatement from bio-char is 1-1.8 Gt carbon per year by 2050. Thus, it acts as a tool for providing food security and mitigating climate change.

## **USE OF CERES-WHEAT MODEL FOR DEVELOPMENT OF IRRIGATION MANAGEMENT STRATEGIES FOR HIGHER YIELD AND WATER PRODUCTIVITY OF WHEAT**

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### **ABSTRACT**

In the present study, CERES-wheat model was calibrated and validated for predicting growth and yield of wheat by using three years' experimental data (2016-17, 2017-18 and 2019) under different irrigation treatments. Further the model was run with 20 years' weather data (2000/2001-2019/20) with optimum management practices under different irrigation scenarios for developing the irrigation management strategies for obtaining higher grain yield and irrigation water productivity (IWP) under dry, wet and normal rainfall conditions. The results indicated that the model overestimated slightly the maximum leaf area index (LAI) and consequently the grain yield in water stress condition; however, overall, model could excellently simulate anthesis and maturity with RMSE < 4 days, RMSEn < 10% and d > 0.90, as well as grain yield (RMSE = 163-204 kg/ha, RMSEn = 3-6%, d = 0.93-0.98) for three, four and five irrigations from CRI to jointing, CRI to anthesis and CRI to dough stage, respectively. The IWP was increased with the decrease in number of irrigations. The maximum yield was obtained when the four irrigations applied from CRI to Anthesis under all weather conditions (Dry, wet and normal), but it was as par with the three irrigations applied at CRI, Tillering and Jointing or CRI, Tillering and Anthesis stage for wet years. Under three irrigations scenario the maximum yield of 5050-5302 kg/ha and irrigation water productivity (IWP) of 33.7-35.3 kg/ha-mm was noticed when three irrigations applied at CRI, Tillering and Jointing followed by at CRI, Tillering, Anthesis stage and CRI, Jointing and Anthesis. Whereas under wet year there was no difference in yield and IWP noticed whether three irrigations applied at CRI, Tillering and Jointing or CRI, Tillering and Anthesis. While under two irrigations scenario, the maximum grain yield as well as IWP was obtained when applied at CRI and Tillering followed by CRI and Jointing stage.

## **DESIGN AND DEVELOPMENT OF SEED METERING MECHANISM FOR GINGER RHIZOME**

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### **ABSTRACT**

Ginger planting is very tedious and drudgery operation due to regular bending posture at the time of sowing. The manual ginger planting operation requires about 200-250 man-h per hectare. The major ginger growing states face labour shortages, during planting season, as it coincides with the field operations of other crops. The physical and mechanical properties of the ginger seed rhizomes were considered in the designing of a seed metering device. The mechanism consisted of a vertical rotating disc with cam and lever, seed box and agitator. The performance of the developed metering mechanism for ginger seed rhizome was evaluated in laboratory at three different forward speeds. The average seed spacing varied from 25.31 to 30.5 cm, missing index from 8.3 to 12.6%, multiple index from 18.5 to 37.9% and percent damage from 5 to 8.6% as the linear speed increased from 17.43 to 34 m/min. The performance of metering mechanism was found satisfactory to operate at an optimum speed of 26.21 m/min. The developed metering mechanism will be used for the development of the automatic ginger rhizome planting machine.



## EFFECTIVE CONTROL OF WEEDS WITH READYMIX HERBICIDES IN TRANSPLANTED RICE AT RANGAREDDY DISTRICT, TELANGANA STATE, INDIA

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### ABSTRACT

Agriculture is the soul of Indian economy as it brings home the bread to nearly 60% of the population and supplies it to the remainder. Rice is the most important cereal food crop for more than half of the world's population. Infestation of weeds in transplanted rice is a major problem resulting into yield reductions of 27-68%. Pre-emergence herbicides are most commonly used for the control of weeds in transplanted rice. Recently post-emergence herbicide is also used for control of weeds in transplanted rice. But single application of one herbicide is not that effective against complex weed flora throughout the crop season. Moreover, some of the broad-leaf weeds and sedges are not effectively controlled by alone application of these herbicides. To achieve satisfactory control of complex weed flora, more suitable option would be single shot application of ready-mix or tank-mix combination of herbicides as pre or post -emergence. One of the effective ready-mix combinations is penoxulam + cyhalofop butyl @ 1000 ml/acre as post emergence. Keeping this in view, front line demonstrations were conducted in farmers field during *kharif* 2017 and 2018 to bring awareness among the farming community, and average increase of 10% in yield and B:C ratio of 2.2 to 2.9 was recorded, as a result of effective control of grasses, broad-leaf weeds and sedges.

## ESTIMATION OF WATER REQUIREMENT OF DRIP IRRIGATED BELL PEPPER (*CAPSICUM ANNUUM* L.) UNDER POLYHOUSE

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### ABSTRACT

Bell pepper crop is widely cultivated in all the States throughout India. Bell pepper requires favorable climate for good growth and production. To determine the water requirement of Bell pepper, a study was conducted in the department of Soil and Water Conservation Engineering, AEC&RI, TNAU, Trichy during the year 2019. Bell pepper variety Indra was raised inside Naturally ventilated polyhouse. Raised beds were made inside polyhouse and drip irrigation systems were laid out. The uniformity coefficient of drip irrigation was worked out. The soil water content was assessed through soil moisture sensors were installed at the depth of 20 cm. From the soil water depletion rate on daily basis the water requirement of Bell pepper was assessed.

## STUDIES ON GENETIC DIVERGENCE IN CHILLI (*CAPSICUM ANNUUM* L.) UNDER SOUTHERN TELANGANA REGION

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### ABSTRACT

Thirty genotypes were evaluated in Randomized Block Design with three replications in *rabiseasons* of the year 2016-17 at the experimental, field of Sri KondaLaxmanTelangana State Horticultural University, Rajendranagar. Results indicated that in





the year 30 genotypes were grouped into eleven highly divergent clusters. Some of genotypes were so divergent in all the character; hence each single genotype formed a separate cluster. Thus seven clusters viz., IV (EC-391088), V (IC-255958), VI (IC-255944), VIII (EC- 390033), IX (IC-208591), X (EC-399569), XI (IC-255916) were solitary with one genotype in each cluster. The two genotypes were, hence they have formed two separate clusters viz., II (LCA-999, LCA-620), VII (IC25913, LCA-625). The remaining two clusters were having maximum number of genotypes. Cluster II was biggest with 10 genotypes followed by Cluster III was found with 9 genotypes. The intra cluster  $D^2$  values ranged from 0.00 (Cluster VI, V, VI, VIII, IX, X and XI) to 139.55 (Cluster III). The cluster III had the maximum  $D^2$  value (139.55) followed by Cluster VII (81.71) and cluster II (26.76). The inter cluster  $D^2$  values of the eleven clusters revealed that highest inter cluster generalized distance (10154.92) was between cluster I and II followed by cluster I and IV (8723.77). The per cent contribution of each character towards divergence. It was observed that capsanthin content contributed maximum (42.53 %) towards divergence followed by plant height (16.32 %), ascorbic acid content (8.74), oleoresin content (5.52 %), days to first flowering (5.29 %), total number of fruits per plant (3.91 %), days to first fruiting (1.38 %), capsaicin content (1.15 %), fresh fruit yield per plant, fruit length, fruit diameter, fruit pedicel length, fresh fruit weight (0.92 %), seed content (0.23 %). suggested exploitation of these two clusters by intermating genotypes in a definite breeding design to explore the fullest range of heterosis and to realize good recombinant lines.

## QUALITY AND SHELF-LIFE EVALUATION OF CUTTLE FISH (*SEPIA OFFICINALIS*) TREATED WITH COMMERCIAL ADDITIVES

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### ABSTRACT

Effect of commercially used additives on the quality and shelf life of cuttle fish (*Sepia officinalis*) were assessed and it was compared with tri sodium phosphate (2.5% & 5%) treated one. Fresh whole cleaned cuttle fish were procured from Industry and were divided into 4 lots. One lot was treated with commercially used additives in the seafood Industry, second lot was treated with 2.5% TSP, third lot was treated with 5% TSP and fourth lot was treated with 2% salt. After 18hrs treatment under chilled condition, all the samples were kept in ice and its quality analysis were carried out up to 14 days. Cuttle fish had 83.02% moisture, 13.89% protein, 1.2% fat and 2.3% ash. Moisture (86.54% -92.69%), pH (6.5-9.4) showed gradual increase during storage. TVB-N value showed increased trend during storage 2.8-22.5mg%. There is no significant difference in  $a^*$  value during storage.  $L^*$  and  $b^*$  showed increased trend in 5% TSP treated one during storage. Hardness, chewiness and Gumminess showed decreased trend during storage in 5% TSP treated one. Microbiology quality evaluation includes Total plate count, *Staphylococcus aureus*, *Pseudomonas* spp. and  $H_2S$  former were also analyzed. Results indicated that cuttle fish treated with tri sodium phosphate had a shelf life up to 14 days than control and commercial additives treated one (11 days).

## EVALUATION OF FUNGICIDES AGAINST *HELMINTHOSPORIUM ORYZAE* AND *CURVULARIA LUNATA* CAUSING GRAIN DISCOLORATION OF PADDY UNDER *IN VITRO* CONDITION

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### ABSTRACT

Grain discoloration disease of rice is gradually becoming a serious problem in rice cultivation. It is prevalent in almost all parts of the world where paddy is grown. Discolored rice seeds were collected from farmer's field at five districts. Seven fungi namely *Curvularia lunata*, *Helminthosporium oryzae*, *Fusarium moniliformae*, *Colletotrichum gloeosporioides*, *Alternaria* spp., *Aspergillus* spp. and *Rhizopus* spp. were isolated from diseased seed samples. Efficacy of systemic, non-systemic and combi products fungicides were evaluated against *Curvularia lunata* and *Helminthosporium oryzae* under *in vitro* conditions. Among all fungicides tested tebuconazole 250 EC, mancozeb 75 WP and tricyclazole (18 %) + mancozeb (62 %) recorded complete inhibition of growth of pathogens 100 per cent, 96.37 per cent and 100 per cent respectively.



## NUTRITIONAL AND MINERAL COMPOSITION OF SPECIALITY RABI SORGHUM GENOTYPES IN NORTHERN DRY ZONE OF KARNATAKA, INDIA

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### ABSTRACT

Speciality sorghum varieties have enormous genetic diversity that offers incredible opportunities for genetic enhancement despite the challenges. Speciality sorghum for hurda preparation, flaking, popping which are evolved and being cultivated in the Rabi sorghum belt of Karnataka and Maharashtra can find their place in international market due to their unique grain properties. The field experiment was conducted with six speciality sorghum genotypes for trait characterization at Regional Agricultural research station Vijayapur during 2020-21. The results indicated that, genotype KMJ-1 recorded significantly higher Protein content ( $12.00 \text{ g } 100\text{g}^{-1}$ ) and iron content ( $5.30 \text{ mg } 100\text{g}^{-1}$ ) followed by SMJ-1 ( $11.70 \text{ g } 100\text{g}^{-1}$ ). KMJ-1 was known to have a excellent popping quality compared to other genotypes. Among the sweet grain genotypes SMJ-1 and RSJ-1, higher amount of total sugars was recorded SMJ-1 ( $10.17 \text{ g } 100\text{g}^{-1}$ ) and calcium ( $35.30 \text{ mg } 100\text{g}^{-1}$ ). However, RSJ-1 (Hurda variety) recorded higher Zinc content ( $1.70 \text{ mg } 100\text{g}^{-1}$ ) and Magnesium ( $157 \text{ mg } 100\text{g}^{-1}$ ). Genotype AKJ-1 was known as red grain sorghum with carbohydrate ( $75.44 \text{ g } 100\text{g}^{-1}$ ), total dietary fiber ( $11.20 \text{ g } 100\text{g}^{-1}$ ), fat ( $1.97 \text{ g } 100\text{g}^{-1}$ ) and lignin ( $1.77 \text{ g } 100\text{g}^{-1}$ ). These speciality sorghum AKJ-1, SMJ-1, KMJ-1 and RSJ-1 are also rich in anti-oxidant properties and are confined as local landraces of Northern Karnataka. The local grain type genotypes Basvanapada recorded significantly higher energy K level ( $371 \text{ cal}/100\text{g}$ ) followed by M 35-1 ( $368 \text{ cal}/100\text{g}$ ). M 35-1 recorded calcium ( $25-90 \text{ g}/100\text{g}$ ), iron ( $3.20 \text{ g}/100\text{g}$ ), phosphorous ( $150 \text{ g}/100\text{g}$ ) and Magnesium ( $148 \text{ g}/100\text{g}$ ). Currently the mineral and nutritional aspects in speciality varieties need to be exploited further and used in breeding program in the view of nutrition security of the nations.

## OPTIMIZATION OF NPK DOSES INCULTIVARS TLG-45 AND GJG-22 FOR KHARIF GROUNDNUT PRODUCTION SYSTEM

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### ABSTRACT

The experiment was conducted in *kharif*-2020, with two groundnut genotypes TLG-45 (Bold seeded, Spanish Bunch) and GJG-22 (Virginia Bunch) with 12 treatments (T1-N<sub>40</sub> P<sub>40</sub> K<sub>50</sub>; T2-N<sub>40</sub> P<sub>60</sub> K<sub>50</sub>; T3-N<sub>40</sub> P<sub>80</sub> K<sub>50</sub>; T4-N<sub>40</sub> P<sub>40</sub> K<sub>80</sub>; T5-N<sub>40</sub> P<sub>60</sub> K<sub>80</sub>; T6-N<sub>40</sub> P<sub>80</sub> K<sub>80</sub>; T7-N<sub>60</sub> P<sub>40</sub> K<sub>50</sub>; T8-N<sub>60</sub> P<sub>60</sub> K<sub>50</sub>; T9-N<sub>60</sub> P<sub>80</sub> K<sub>50</sub>; T10-N<sub>60</sub> P<sub>40</sub> K<sub>80</sub>; T11-N<sub>60</sub> P<sub>60</sub> K<sub>80</sub>; T12-N<sub>60</sub> P<sub>80</sub> K<sub>80</sub>) having two combinations of N (40, 60 kg/ha), 3 combinations of P (40, 60, 80 kg P<sub>2</sub>O<sub>5</sub>/ha) and 3 combinations of K (50, 80 kg K<sub>2</sub>O/ha) in RBD design. In TLG-45, Pod yield at harvest was significantly high in T5-N<sub>40</sub> P<sub>60</sub> K<sub>80</sub> (1044 kg/ha), followed by T10, which was at par with T6 and T3 and it ranged from 835-1044 kg/ha between treatments. Haulm yield was found to be significantly high in T1-N<sub>40</sub> P<sub>40</sub> K<sub>50</sub> (2068 kg/ha) which was at par with T12 and T6. Nodule number plant<sup>-1</sup> and nodule dry wt. plant<sup>-1</sup> was significantly high in T5 (96.3, 171.3 mg). Mature pod no. plant<sup>-1</sup> and mature pod dry wt. plant<sup>-1</sup> were noticed to be significantly superior in T12 (8.5, 5.7g). In GJG-22, Pod yield at harvest was significantly high T11-N<sub>60</sub> P<sub>60</sub> K<sub>80</sub> (1753 kg/ha), followed by T9, which was at par with T7 and it ranged from 1246-1753 kg/ha between treatments. Haulm yield was found to be significantly high in T11-N<sub>60</sub> P<sub>60</sub> K<sub>80</sub> (3392 kg/ha) which was at par with T6 and T8. Nodule number plant<sup>-1</sup> and nodule dry wt. plant<sup>-1</sup> was witnessed to be significantly elevated in T3 (154.9, 268.9mg). Mature pod no. plant<sup>-1</sup> and mature pod dry wt. plant<sup>-1</sup> were noticed to be significantly superior in T3 (5.7, 4.2g).

## INFORMATION DISSEMINATION MECHANISM FOR MEETING INFORMATION NEEDS OF FARMERS OF HILL REGIONS OF UTTARAKHAND : IMPLICATIONS FOR EXTENSION

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### ABSTRACT

Farmers use different information sources and channels for seeking reliable, timely and relevant information on improved



agricultural practices. Developing appropriate farmer educational and marketing strategies will depend on how farmer groups differ in their information search behavior. Understanding what information farmers need, how they search for their information, which sources they depend for accessing information can help in designing effective extension programs. The study examined farmer's communication characteristics with an intent to assess farmer's accessibility and use of extension media and information sources for fulfilling their information needs pertaining to agricultural and allied activities in three hill districts of Uttarakhand state. A sample of 1318 farmers was selected through a stratified random sampling technique. Appropriate statistical analysis was done for interpreting results. Interpersonal communication sources were used more by farmers as these were more easily available and accessible to obtain information related to agriculture. Informal sources constituted the most regularly used and Panchayat meetings among formal sources were being used frequently indicating homophily in communication behaviour. Majority of farmers (43.93%) were categorised as low searchers. Gender, primary occupation, land size and education significantly affected search behaviour of farmers. Implications for policy and extension have been given for improving information dissemination among farmers of hill regions. Emphasis on extension system providing a context for the flow of authentic knowledge through authentic media among farming communities on an equal basis is emphasized. A mobile app was developed for information dissemination to hill farmers.

## EFFECT OF DIFFERENT MEDIA ON POTENTIAL FRESH WATER MICROALGAE *MONORAPHIDIUM* SP. FOR CHLOROPHYLL AND CAROTENOID PRODUCTION

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### ABSTRACT

Microalgae are rapidly growing autotrophic microbes found in marine, freshwater, and soil atmosphere and capable to produce numerous secondary metabolites. Green microalgae are considered as adequate source of chlorophyll, lipids, carotenoids, protein, carbohydrates, and other value-added products. These pigments and value-added bio-molecules are extensively utilized in several industrial sectors including pharmaceutical, cosmeceutical, nutraceutical, agricultural, fuel, textile, and so on. In microalgae cultivation, growth media composition plays a crucial role in the production of biomass and synthesis of secondary metabolites. *Monoraphidium* sp. (NCM 5585) is a potential microalgae that belong to the phylum Chlorophyta and taken in the present study. This study aims to evaluate the impact of three distinct media including BG-11 medium, Bold's basal medium (BBM), and Half Strength Chu-10 (HS Chu-10) medium on biomass production and pigments synthesis in *Monoraphidium* sp. The highest growth in *Monoraphidium* sp. of  $0.042 \pm 0.001$  g/L/day was obtained in BBM in contrast to  $0.032 \pm 0.004$  g/L/day in BG-11 and  $0.039 \pm 0.001$  g/L/day in HS Chu-10. The highest chlorophyll a, chlorophyll b and carotenoid content were also obtained by applying BBM for *Monoraphidium* sp. cultivation. Chlorophyll and carotenoid have numerous health and nutritive applications utilized in various industries including pharmaceutical, cosmeceutical, and nutraceutical.

## CHANGES IN BIOLOGICAL AND CHEMICAL PROPERTIES OF SOIL AMENDED WITH NUTRIENT ENRICHED COMPOST AND CHEMICAL FERTILIZERS

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### ABSTRACT

The influence of nutrient enriched compost with and without chemical fertilizers on soil biological and chemical properties was investigated in a field experiment. Thirteen treatment combination of chemical fertilizer and enriched compost was applied during the course of investigation. The analytical data showed that application of enriched compost had significantly higher amount of Walkley Black carbon (WBC) in comparison to recommended dose of chemical fertilizers (RDF). The WBC levels were higher in soil treated with a combination of chemical fertilizers and enriched compost than in other treatments. Results showed that significantly ( $p=0.05$ ) higher available nitrogen was reported with 25% RDF along with  $1.5 \text{ t ha}^{-1}$  enriched composts over alone use of composts and chemical fertilizers. When chemical fertilizers were combined with nutrient-rich compost, accessible nitrogen was much higher than when compost and chemical fertilizers were used separately. When chemical fertilizers were combined with nutrient-rich compost, the amount of ammonia-nitrogen and nitrate-nitrogen



was larger than when compost and chemical fertilizers were used separately. Application of 25% RDF along with 1.5 t ha<sup>-1</sup> enriched composts had higher Olsen-P in comparison to alone use of chemical fertilizers and composts. Biomass of microbes in comparison to chemical fertilizers, enriched compost had a greater impact on soil carbon. Microbial biomass carbon was significantly higher in soil treated with 25% RDF and 1.5 t ha<sup>-1</sup> enriched composts than in soil treated with compost and chemical fertilizers.

## MOLECULAR DIVERSITY ANALYSIS IN FIELDPEA (*PISUMSATIVUM* L.) USING SSR MARKERS

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### ABSTRACT

Field pea (*Pisumsativum* L.) often known as dry pea is one of the important pulse crops grown in India, famous for its protein-rich diet. Molecular markers are important tools for characterization and estimation of genetic diversity as they are reliable, numerous, provide high degree of polymorphism, do not depend on stage of the crop, independent of environmental interactions and hence preferred over other markers. The present experiment was carried out at Department of Biotechnology, College of Agriculture, Vijayapur during 2020 wherein genetic diversity among 160 field pea germplasm lines was assessed using Simple Sequence Repeat (SSR) markers. A total of 21 primers were employed for diversity studies and PCR products were analysed on automatic capillary electrophoresis. Out of 21 markers, 15 were found to be polymorphic. Fifty-three (53) marker alleles were obtained with size of amplification product ranging from 72-492 bp. Average number of alleles per primer was found to be 4.73 with maximum of 9 alleles for the primer AA446. The PIC values of primers ranged from 0.209 (Primer AA90) to 0.832 (Primer AA446). Out of 15 polymorphic markers, nine showed PIC value greater than 0.5. The genotypes were grouped in 25 different clusters with Cluster 16 being largest cluster with 24 genotypes and four clusters (Clusters 1, 8, 11 and 13) were solitary with only one genotype in each of them. Population structure analysis revealed four different structural groups. The diverse genotypes grouped into different clusters may be chosen for hybridization programme based on desired phenotypic values.

## GENOME-WIDE PROFILING OF SALINE RESPONSIVE MIRNA THROUGH SMALL RNA SEQUENCING APPROACH IN SUGARCANE

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### ABSTRACT

The comparative small RNA sequencing was carried out to identify the genome-wide profiling of saline responsive miRNA associated with salt-tolerant *Erianthus arundinaceus* genotype IND99-907 and salt-sensitive sugarcane genotype Co 97010. The experiment was carried out in pot culture experiment with three biological replicates. The genotypes were raised in pots containing FYM, sand and red soil in equal proportion. Salt stress imposed by irrigation with 175 mM saline water containing sodium chloride, calcium chloride and sodium sulphate in 2:2:1 proportion at formative phase (60 days after planting). The total RNA was isolated from the 10th day stressed and control root samples used for small RNA sequencing with three biological replicates to identify the ionic phase salt responsive miRNA associated with salinity tolerance in IND99-907 and sensitivity in Co 97010. The total small RNA was isolated by using TRIzol method and NEBNext® Multiplex Small RNA Library Prep Set used the Illumina small RNA library preparation as per the manufacturer instruction. All twelve small RNA libraries were loaded to Illumina HiSeq 2500 platform for sequencing in 50 bp single end format. The raw reads quality was assessed by using FastQC tool (Andrews, 2015), Cutadapt tool (Martin, 2011) was used for adapter sequences removal and high-quality reads (Phred score > 30) ranging from 18-30 bp were filtered using Trimmomatic (Bolger et al., 2014). The rRNA was removed by filtering reads after aligning to SILVA (<https://www.arb-silva.de/>), tRNA by aligning to GtRNAdB (<http://gtRNAdb.ucsc.edu/>) and sno RNAs by aligning to Rfam database (<http://rfam.sanger.ac.uk/>) with a maximum mismatch of 0 using bowtie2 (Langmead and Steven L Salzberg, 2013). Known miRNAs were predicted by aligning the reads against miRNA sequences from miRBase (<http://www.mirbase.org/>) using the bowtie program (Langmead et al., 2009) with a maximum mismatch (-n 2). Our studies showed that 129 miRNAs belong to 42 families abundant under control condition and 115 miRNAs belong to 37 families under the stressed condition in 907. Whereas in Co 97010, 110 miRNAs abundant in control condition were related to 36 families under control and 104 miRNAs abundant under stressed condition were related to





families under stress were abundant in Co 97010. Overall, a total of 156 saline responsive miRNAs belong to 48 families were identified from our studies.

## **TILLING AND ECO-TILLING : A REVERSE GENETIC APPROACH FOR CROP IMPROVEMENT**

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### **ABSTRACT**

With the fairly recent advent of inexpensive, rapid sequencing technologies that continue to improve sequencing efficiency and accuracy, many species of plants have annotated genomic information publicly available. The focus on genomics has thus been shifting from the collection of whole sequenced genomes to the study of functional genomics. Reverse genetic approaches have been used to advance from sequence data to the resulting phenotype in an effort to deduce the function of a gene in the species of interest. Many of the currently used approaches (RNAi, gene knockout, site-directed mutagenesis, transposon tagging) rely on the creation of transgenic material, the development of which is not always feasible for many plant species. TILLING is a non-transgenic reverse genetics approach that is applicable to all plant species which can be mutagenized, regardless of its mating / pollinating system, ploidy level, or genome size. This approach requires prior DNA sequence information and takes advantage of a mismatch endonuclease to locate and detect induced mutations. Ultimately, it can provide an allelic series of silent, missense, nonsense, and splice site mutations to examine the effect of various mutations in a gene. TILLING has proven to be a practical, efficient, and an effective approach for functional genomic studies in numerous plant species. Eco-TILLING, which is a variant of TILLING, examines natural genetic variation in populations and has been successfully utilized in plants to discover SNPs including rare ones. Eco-TILLING offers more advantages for breeding as it deals with the natural population of plants.

## **IMPACT OF WEATHER BASED AGRO ADVISORY SERVICES ON YIELD, ECONOMICS OF COTTON CROP AND FARMERS' PERCEPTION IN RAINFED REGIONS OF KURNOOL DISTRICT, ANDHRA PRADESH**

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### **ABSTRACT**

Customized advisory bulletins through last mile connectivity to farmers with personalized agromet advisory services were provided through District Agro Met Advisory Unit (DAMU), KVK, Banavasi. Forty Front Line Demonstrations were conducted each year from 2018-20 to study the impact of weather based agro advisory services on Yield, economics and farmers perception towards the usage at Hanupuram, Venkatagiri and Kalugotla villages. The results revealed that 7.5 % average yield increment was recorded in demonstration fields than the farmer's practice. The average cost of cultivation also reduced 5200 Rs ha<sup>-1</sup> in demonstration plot when compared with farmers practice with an average benefit cost ratio of 2.51 and 3.15 in demonstration and farmers practice respectively. The multiple regression analysis was employed to assess the factors influencing willingness to adopt the weather based agro advisories. Majority of farmers (67%) rated 'very good' on the scale of 'very poor' to 'very good'. Majority of non-following farmers were aware about weather based advisory services but lagged in adopting the service. Farming experience, education, land holding size and income were found to be most important factors influencing the farmer's willingness for following the weather based agro advisory services.

## **PLANT NUTRIENT MINERALIZATION KINETICS OF FYM AND PRESSMUD UNDER SALINE SOIL**

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### **ABSTRACT**

To feed a burgeoning population, rigorous soil health and crop management measures are required to increase the production capacity of existing arable land. The majority of Indian agricultural land is deficient in organic carbon and accessible nitrogen,



prompting researchers to focus on soil fertility issues in order to limit the need of chemical fertilizers. On the other hand, trash generated by sugarcane industry is posing significant challenges to long-term disposal. In this context, an incubation study was carried out to determine the kinetics of mineralization of FYM and pressmud in saline soil. For this, each of the four levels of FYM (0, 5, 10, 20 t/ha) and pressmud (0, 5, 10, 20 t/ha) were combined and the plant nutrient dynamics were examined. At laboratory temperature, the moisture level was kept at field capacity throughout the experiment. The findings of the experiment revealed that the rate of organic C mineralization increased with increasing time intervals, with the exception of 3 and 6 months in pressmud alone treatment four. In the presence of available N and P, the concentration was increased by expanding the incubation period to one year. The availability of sulphur is also increasing as the level of pressmud and FYM rises over time. This incubation study will aid in the management of saline soil fertility through the application of agricultural waste and organic inputs during crop production.

## QUANTITATIVE DETECTION OF MAIZE FLOUR ADULTERATION IN CHICKPEA FLOUR (*BESAN*) USING NEAR INFRARED SPECTROSCOPY COUPLED WITH CHEMOMETRICS

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### ABSTRACT

The present study was performed to develop Near-infrared spectroscopy-based prediction method for the quantification of the maize flour adulteration in chickpea flour. Adulterated samples of chick pea flour (*besan*) were prepared by spiking different concentrations of maize flour with pure chick flour in the range of 1-90% (w/w). The spectra of pure chick pea flour, pure maize flour and adulterated samples of chick pea flour with maize flour were acquired as the logarithm of reciprocal of reflectance ( $\log 1/R$ ) in the entire UV-NIR wavelength range of 400 to 2,500 nm. The acquired spectra were pre-processed by 1<sup>st</sup> derivative, standard normal variate (SNV), and detrending (DT). The calibration models were developed using modified partial least square regression (MPLSR), partial least square regression (PLSR) and Principal component regression (PCR). The optimal model was selected on the basis of highest values of the coefficient of determination (RSQ), an estimate of RSQ (1-VR) and lowest values of standard errors of calibration (SEC), and standard error of cross-validation (SECV). MPLSR model having RSQ of 0.999 and 1-VR value of 0.996 with SEC and SECV value of 1.092 and 2.047, respectively was developed for detection and quantification of maize flour adulteration in chickpea flour. Cross validation and external validation of the model showed RSQ and standard error of prediction (SEP) values of 0.999, 1.117 and 0.997, 2.075, respectively.

## OCCURRENCE OF STEM AND ROOT ROT DISEASE OF SESAME IN BUNDELKHAND REGION IN UP

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### ABSTRACT

Sesame (*Sesamum indicum*) is one of the oldest crops and is under cultivation from ancient times. It is mainly grown for its high economic value of seeds that contain approximately 52-57% oil and 25% protein. The sesame oil is most stable vegetable oils in the world due to the presence of natural antioxidants such as sesamol, sesamin and sesamol. The chemical composition of sesame oil characterized by a low level of saturated fatty acids (less than 15%) and the presence of antioxidants have been reported to have health promoting effects such as lowering cholesterol levels and hypertension in humans, neuro protective effects against hypoxia or brain damage and reducing the incidence of certain cancers. India ranks first in the area and production of sesame in the world. In India, at present sesame occupies an area of about 16.0 lakh hectares with an annual production of 7.56 lakh tonnes with an average productivity of 473 kg/ha. Banda district has an area of 7780 ha with total production of 685 MT and productivity 1.70 q per ha. The most of the sesame production in the country is used for oil extraction (70-75%) and a considerable proportion is consumed as food (20-25%) in various forms and a very small quantity (2.2%) is retained for the seed every year. Sesame is mainly grown in *Kharif* season under rainfed situation. It is also grown in Semi-rabi, rabi and summer seasons. The growing domestic demand for edible oil, coupled with the emergence of sesame as a



potential export crop, provides good opportunity for farmers to take up the cultivation of this crop and be assured of good market value. The productivity of sesame in India is low (473 kg per ha) and fluctuating. The yield variation is very wide. The yield potential of sesame has not been fully realized due to number of biotic and abiotic factors, among the factor's major constraints in the production of sesame is the colossal damage caused by various insect pests and diseases.

Despite the potential for increasing the production and productivity of sesame, there are a number of challenges inhibiting sesame production and productivity. Among the many production constraints, the most important include lack of availability of improved varieties and a poor seed supply system. In addition, there are severe biotic stresses, such as root rot /stem rot (*Macrophominaphaseolina*) (Tassi) Goid, Bacterial blight (*Xanthomonascampestrispv. sesame*), Phyllody (a Mycoplasma-like organism), Powdery mildew (*Oidiumersiphoides*), Alternaria leaf spot (*Alternaria sesame*) and Cercospora leaf spot (*Cercospora sesame*). Sesame diseases cause damage to seed, seedling, root, stem as well as foliage resulting in significant loss. KVK Banda had conducted farmers field survey and diagnostic visits during Kharif 2020-21 in major sesame growing blocks of Banda district viz. Tindawari, Mahua, Badhokharkhurd, Kamasin,. To generate required information a detailed questionnaire is prepared and randomly selected farmers are interviewed. Sesame crop was found severely infected by the stem and root disease and incidence of this disease was recorded about 22-32 percent. Tindawari and Badhokharkhurd blocks of Banda district were more influenced from this disease. Stem and Root rot are caused by *Macrophominaphaseolina* (Tassi) Goid. The symptoms were initiated from ground level instem and it becomes black, which extends upward rupturing the stem and black dots appear on the infected stem. The roots will become brittle. In disease infected plants, black capsules are seen which open prematurely exposing shriveled seed. The diversity of host species and the geographic range have suggested that *M. phaseolina* is quite hetero-geneous. The disease also causes severe losses right from seedling to maturity of the crop. The use of Ecofriendly pest control method has got tremendous scope since the diseases are management without putting any threat to the quality of produce and surrounding ecosystem.

## ASSESSMENT OF WATER TABLE FLUCTUATIONS UNDER DIFFERENT WATER MANAGEMENT TECHNOLOGIES

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### ABSTRACT

Sustainability of groundwater is a big issue in Rasoolpurjatan village of Western U.P. To develop a sustainable groundwater use plan, impact of various water management technologies on water table fluctuations needs to be assessed in the study area. MODFLOW model was calibrated and validated to simulate the water table behaviour under four scenarios for the period 2016 to 2025. The R<sup>2</sup> value for calibration was 0.94 and for validation it is 0.93. Sugarcane crop covered the maximum part of study area and irrigation is being done through open channel. When water is applied through open channel with 60% application efficiency, the water table would decline at 0.63 m/yr. When 6% water was saved due to seepage, water table would decline at 0.51 m/yr. when laser land leveller was used and saved 17% water then in this case also water table would decline at 0.16 m/yr but it is at slower rate and when, if we change the present cropping pattern as reducing the sugarcane area by 50% and increased kharif maize crop area by 50%, water table would rise at the rate of 0.46 m/yr. Groundwater level in the year 2025 under scenarios 1-4 will be forecasted as 216.10, 217.76, 222.24 and 230.46m respectively. The simulation results showed that the sustainability of groundwater could be ensured by adoption of change in cropping pattern in the study area.

## EFFECTIVENESS OF VILLAGE LEVEL ORGANIZATION (VLO) UNDER NATIONAL RURAL LIVELIHOOD MISSION, NAGALAND, INDIA.

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### ABSTRACT

National Rural Livelihood Mission (NRLM) is a poverty alleviation project launched in 2011 by Ministry of Rural



Development, Government of India. Nagaland State Rural Livelihood Mission (NSRLM) is the implementing agency of NRLM in Nagaland State, India. NSRLM promotes Community Based Organizations (CBOs) viz., Self Help Group, Village Level Organization (VLO) and Cluster Level Federation (CLF) and this study is on the effectiveness of VLO. As per NSRLM, a Village Level Organization (VLO) is an organization formed by a number of SHGs in-order to bring socio-economic changes and capacity building among the members of the groups and their respective SHGs at large. The research was conducted in Nagaland State covering three districts and two VLOs from each district whereby a total of eight respondents per VLO were interacted upon, thus making a total sample respondent of 48 respondents representing six VLOs. From the findings, it was established that, all the VLO were newly formed whereby one VLO out of six VLOs were found to be in their formation stage while majority were found to be in its normalizing stage. For measuring the effectiveness of Village Level Organizations (VLOs), the SHG Performance Measurement Tool devised by Sa-Dhan was adopted with necessary modifications. It was calculated using Frequency, Percentage, Mean and Standard Deviation.

## **A STUDY ON THE LIVELIHOOD OF SANTAL WOMEN RELATING TO LIVESTOCK FARMING IN WEST BENGAL**

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### **ABSTRACT**

The effect of devastating wave of COVID-19 changes massive and consequences on health and livelihood are experienced on 90% of Indian rural communities mostly on the backward classes depends on the agriculture and livestock farming, wage labour etc. The Schedule tribes include the Santal's are the largest recognized tribes and most backward population in the state of West Bengal. Livelihood portrays a complex web of activities and interactions that emphasize the diversity of ways, people make a living, and livelihood analysis helps to improve our understanding of what is really happening in people's lives what enables some but not others escape the poverty. This study argues to understand the impact on livelihood of Santal women relating to livestock farming in West Bengal. To pursue the study four (04) districts' namely- Paschim Medinipur, Jhargram, Bankura and Puruliya were selected purposively considering the thick population of Santals in the state of West Bengal. From each district one blocks and under which one village is selected randomly. From each village, 50 no's of tribal women involving livestock farming is taken randomly for data collection. The collected data were tabulated and analysed through various statistical tools, such as Co-relation, Chi square test and t-test to find out the livelihood pattern, knowledge level and adoption behaviour of the Santal women for farming livestock in the functional area of study. It may be concluded that, Santal women work hard and spend more time than the men in livestock production and management with primitive indigenous knowledge inherited from ancestors. Tribal's are inclined to traditions, religious beliefs and stress, as they live in the interior of forest having low urban contact and shy to mingle with non-tribal's. Low extension contact, lower income, unavailability of credit, lower educational status, problems in marketing etc. are the other constraints for adoption of new technology to improve their livelihood in the functional area.

## **A STUDY ON THE POPULATION INCIDENCE OF ADULT RICE LEAF FOLDERS *CNAPHALOCROCISMEDINALIS* GUENEE (CRAMBIDAE: LEPIDOPTERA) ON KHARIF RICE IN THE TERAI AGRO CLIMATIC CONDITIONS OF THE NORTHERN PARTS OF WEST BENGAL, INDIA**

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### **ABSTRACT**

Incidence of adult moths of rice leaf folder (LF), *Cnaphalocrocismedinalis* Guenee (Crambidae: Lepidoptera) was studied during two consecutive kharif seasons (July to November) during the years 2019-2020 on paddy variety MTU 7029. The adult leaf folder moths first appeared in the field during 32<sup>nd</sup> standard week and their population was found to fluctuate throughout the crop growth period. Number of adult moths captured by sweeping net was found to increase along with the advancement in





the crop growth stage and it was also noticed that higher number of adult moths were caught during the last few weeks (43<sup>rd</sup>, 44<sup>th</sup> and 45<sup>th</sup> Standard Weeks) when the crop was near to maturity. It has become evident from the study that the abiotic factors like minimum temperature, relative humidity (both maximum and minimum) and rainfall has significant negative correlation with adult population of rice leaf folder moths. Correlation study between rice leaf folder adult capture and plant phenological parameters like average tiller/hill, average leaf/tiller as well as Growing Degree Days (GDD) revealed that the adult population was strongly and positively correlated with GDD. This finding suggests that the physiological age of the rice plants might have played significant role in the population buildup of the rice leaf folder during the later stage of crop growth.

## EFFECT OF DIFFERENTIAL SUBSTITUTION ON NUTRIENT THROUGH ORGANICS ON SOIL NITROGEN BALANCE IN BASMATI RICE BASED CROPPING SYSTEM

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### ABSTRACT

The present investigation entitled 'Effect of differential substitution on nutrient on nitrogen balance in soil in basmati rice based cropping system' was carried at Research Farm, of Division of Agronomy SKUAST-J, during the year *kharij*2015-17. The experiment comprised of sixteen treatments in randomized block design with 400% cropping intensity including four crops basmati rice-knolkhol-knolkhol-green gram for two years. After two years the highest soil nitrogen build up in soil (8.79 kg/ha) was recorded with treatment 100 % N through FYM followed by (8.56 kg/ha) recorded with treatment 100 % N through Vermicompost and (7.87 kg/ha) recorded with treatment 100 % N through Vermicompost and FYM (1:1) whereas lowest build up in soil nitrogen (4.53 kg/ha) was recorded with treatment 100 % recommended dose of nitrogen.

## PROFITABILITY OF BASMATI RICE BASED CROPPING SYSTEM AS INFLUENCED BY DIFFERENTIAL SUBSTITUTION ON NUTRIENT THROUGH ORGANICS IN SUBTROPICAL CONDITIONS IN J & K

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### ABSTRACT

A field experiment was conducted for two years (*kharij*2015 to summer 2017) at research farm of division of Agronomy; SKUAST-J to study the effect of system economics in basmati rice based cropping system in subtropical conditions of union territory Jammu and Kashmir. Experiment was conducted in randomized block design with sixteen treatments. Source of organic nutrients used in the experiment were Farmyard manure and Vermicompost alone and in different combinations along with inorganic fertilizers. Different crops Cereal-Vegetable-Pulse were used in the system including rice (basmati370) - knolkhol (G40) - knolkhol (G40) - green gram (SML-668). Highest gross returns (Rs1147974.89/ha), net returns (Rs945908.73/ha), and B:C ratio (4.68) in the entire cropping system was recorded with treatment 100 % NPK (recommended dose of fertilizers) whereas lowest gross returns (Rs758105.43/ha), in the system was recorded with treatment 25 % NPK+75 % N through FYM and lowest net returns (Rs 477943.85/ha), and b:c ratio (1.69) in the system was recorded with treatment 25 % NPK+75 % N through Vermicompost.

## STUDY THE IMPACT OF COMMUNICATIONAL AND MANAGERIAL ATTRIBUTES ON KNOWLEDGE LEVEL OF BEEL USERS ON SUSTAINABLE DEVELOPMENT OF BEEL FISHERIES

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### ABSTRACT

Wetland is a broad term, which encompasses a wide range of permanent-fresh water or shallow coastal waters. Among the Indian States, West Bengal has second largest areas under wetlands mainly associated with the Ganga covering 8, 43, 221



hector area. Wetlands food chain provides fish and wildlife habitat, nutrient cycling, sediment trapping, socio-economic values, sites for research and education, heritage and even aesthetic values. Now due to implementation of various development activities, intensive urbanization, anthropogenic pressures deteriorates beels water quality resulted in prolific weed growth, declined bio-diversity and other associated problems. Keeping these facts in mind for the improvement of the productions of these potentials resources, sustainable approaches are needed for improving its production and maintain ecological balance. Sustainable Development Approach, the understanding of beel user's knowledge level is quite imperative in this direction. The study was conducted at Rasik Beel under Coochbehar district of West Bengal to observe the impact of communicational and managerial variables on knowledge level of beel users for Sustainable Development of beel fisheries. The finding of the study revealed that communicational variable i.e. utilization of information source, was a significant and positive variable associated with ( $p < 0.01$ ) with beel user's knowledge level. Further, it was found that, in case of managerial attributes i.e. training need, borrowing habit and saving habit were significantly and positively associated ( $p < 0.01$ ) with beel users knowledge level. Whereas decision making process and fishing effort were found to have no association with knowledge level. But, beel users' information seeking behaviour for sustainable development of beel fisheries was shown to be the most substantially contributing variable ( $t$ -value: 7.369886\*\*) among these four significant variables. So, concerted educational and communicational efforts are needed to educate and aware the beel users for sustainable development of beel fisheries.

## **BOTTOM-UP MECHANISM OF TOLERANCE AGAINST CONCURRENT ABIOTIC STRESSES IN KHEJRI (*PROSOPIS CINERARIA*) UNDER HOT ARID REGION**

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### **ABSTRACT**

Abiotic stress tolerance is a complex phenomenon, expression of which depends on accomplishment and interaction of various morpho-physiological and biochemical traits like antioxidant defense bio-molecules and strength of antioxidant enzyme system. Khejri (*Prosopis cineraria*) belongs to family Fabaceae, is one of very important multiple abiotic stress tolerant perennial tree of The Thar Desert. The genus *Prosopis* has attracted attention because of its ability to survive in extremely hot-arid, saline and inhospitable locations, sometimes being the only trees able to do so. To elucidate the "Bottom-up" (intrinsic) mechanism of tolerance in Khejri against concurrent Abiotic stresses occurs naturally in hot arid region, the present study was conducted to evaluate the pattern of stress responsive along with antioxidant enzymes like SOD, APOX and Catalase in leaves collected during different months from two genotypes (Tharshobha and Wild). A significant seasonal variation was observed in all evaluated parameters like chlorophyll, MDA, phenolics, flavonoids, TAA, and antioxidant enzymes activities. The highest accumulation of MDA, Phenolic, flavonoids, TAA, SOD and APOX was observed during the sever summer (May-June) and winter (Dec-Jan) months in both the genotypes. Unlike these metabolites, chlorophyll content was lowest during summer (May-June) months and maximum during March. The catalase activity increased only during winter months. The extreme summer and winter seasons creates sever oxidative stresses in plant metabolism, and require maximum amount of stress scavengers to cope with the generated oxidative stress. This study demonstrated that khejri plant has strong Bottom-up (intrinsic) antioxidant defense mechanism which responds quickly towards occurrence of concurrent abiotic stresses in different months under hot arid region and make this plant tolerant against concurrent Abiotic stresses.

## **NUTRIENT FORTIFICATION EFFECT ON SOIL BIOCHEMICAL PROPERTIES, NUTRIENT AVAILABILITY AND YIELD OF MUSTARD IN CALCAREOUS SOILS**

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### **ABSTRACT**

Availability of micro and secondary nutrient to Indian mustard in arid and semi-arid regions are often found deficient in soils. Though, the irrigation water in such areas is poor in quality but it is inescapable as there is no alternative source of irrigation in such areas. The application of micronutrient enriched FYM may improve availability and their uptake to mustard results in higher productivity and quality of crop in such soils. An experiment comprising 15 treatment combination replicated



thrice, was laid out in split plot design with three treatments of FYM level (Control, @5 t ha<sup>-1</sup> and @10 t ha<sup>-1</sup>) and five treatment of sources of nutrient (control, 2.5 kg Zn + 1 kg B+ 5 Kg Fe + 10 kg S ha<sup>-1</sup>, 5 kg Zn + 2 kg B+ 10kg Fe +20 S kg ha<sup>-1</sup>, 2.5 kg Zn + 1 kg B+ 5 Kg Fe +10 kg S Enriched FYM @ 500 kg ha<sup>-1</sup> and 5 kg Zn + 2 kg B+ 10kg Fe+20 kg S Enriched FYM @ 500 kg ha<sup>-1</sup>). Significantly highest seed (29.71 qha<sup>-1</sup>) and stover (76.49 qha<sup>-1</sup>) was observed under the treatment in which micro and secondary nutrient applied at the rate of 5.0 kg Zn + 2 kg B+ 10 Kg Fe +20g S Enriched FYM @ 500 kg ha<sup>-1</sup> (Zn<sub>2</sub>B<sub>2</sub>Fe<sub>2</sub>S<sub>2</sub>En). Nutrient enrichment with micro and secondary nutrient at the rate of 5.0 kg Zn + 2 kg B+ 10 Kg Fe +20g S Enriched FYM @ 500 kg ha<sup>-1</sup> (Zn<sub>2</sub>B<sub>2</sub>Fe<sub>2</sub>S<sub>2</sub>En) significantly increased the microbial biomass carbon (56.46 % SMB-C) and SOC (17.13%) over control. Similarly, nutrient fortification significantly enhanced the activity of dehydrogenase enzyme (56.27%), alkaline phosphatase (101.44%) and aryl sulphatase (73.7%) in soil over control. Availability of S, Zn Fe and boron has increased by 17.74, 127.68, 43.41 and 52.76 percent under the treatment in which these nutrients are applied at the rate of 5.0 kg Zn + 2 kg B+ 10 Kg Fe +20g S Enriched FYM @ 500 kg ha<sup>-1</sup> (Zn<sub>2</sub>B<sub>2</sub>Fe<sub>2</sub>S<sub>2</sub>En) over control (Zn<sub>2</sub>B<sub>2</sub>Fe<sub>2</sub>S<sub>2</sub>) respectively. Enhancement in seed and stover yield might be due direct increase in nutrient availability and indirectly overall improvement in soil biochemical properties resulted to more vegetative growth and dry matter accumulation in plants.

## VALORISATION OF WASTE PLASTICS : AN APPROACH TOWARDS ENVIRONMENT CONSERVATION AND SUSTAINABLE DEVELOPMENT

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### ABSTRACT

Plastic is one of the chemical materials that pose tremendous environmental problems. Most of the plastic materials are disposed of in the oceans and other water bodies after their use; millions of marine animals die every year either due to entangling in the waste plastics resulting in suffocation or once they eat it, resulting in health problems. Out of the total plastic produced, more than 40% of plastic is used only in the food-packaging sector. Complete eradication of plastic is highly challenging as plastic has now become an inevitable part of our daily lives because of its low cost, lightweight and versatile nature. The best that can be done to substitute the standard but poor management techniques (incineration and landfilling) is the valorisation of waste plastic to produce alternative fuel for various operations. Pyrolysis is an environment-friendly and effective method that can be adopted to convert the waste plastic into pyrolytic oil, which can be further transformed into pyrolytic fuel by upgrading. The upgraded fuel has very similar properties to that of gasoline or diesel. It will thus help to resolve the twin problems viz. poor management of waste plastics and continuously increasing fuel demand. Other than that, using waste plastic for civil engineering works is a highly efficient technology that is easy and sustainable. This study aims to explore the best-proven techniques for valorisation and sustainable management of waste plastics, which will ultimately help environmental conservation.

## COLLECTION AND CHARACTERIZATION OF INDIAN AVOCADO ACCESSIONS USING MORPHOLOGICAL DESCRIPTORS

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### ABSTRACT

Avocado is one of the important exotic fruit crops belonging to the *Lauraceae* family. It was first introduced into India during the early decades of 19<sup>th</sup> century. A wide variability has created in the Indian avocado accessions due to frequent introductions from different hotspots and the seed propagation of this crop by the farmers. An understanding of diversity in the existing germplasm is a prerequisite for crop improvement programmes. Morphological characterization is a simple, easy and cost-effective technique to study the diversity among the existing germplasm. The information on collection and characterization of genetic diversity in the Indian avocados is very limited. In the present study, a total of 83 avocado accessions were collected from different parts of major avocado growing regions of India i.e., Karnataka, Kerala and Tamil Nadu were characterized for different leaf and fruit morphological characters. The results showed the existence of wide range



of variability for leaf length (10.7 to 28 cm), leaf width (4.63 to 14.5 cm) and fruit pedicel diameter (0.56 to 1.48 cm). The highest fruit (934.12 g) and pulp weight (736.19 g) was recorded in PA-102 accession and lowest was observed in PA-056 accession. The wide variation for peel weight (9.75 to 73.47 g) and peel thickness (0.23 to 2.23 mm) was also observed in the collected accessions. The significant differences were also noticed for seed weight, seed length and seed width among the accessions. The Pearson correlation matrix showed positive correlation of fruit weight with pulp weight (0.98), peel weight (0.77), seed weight (0.64), fruit length (0.72) and fruit diameter (0.83). The characterization of germplasm accessions suggests a wider variability in the studied accessions for leaf and different fruit characters and also it offers opportunities for selection of genotypes with superior yields and quality for commercial cultivation and hybridization programmes.

## GENETIC DIVERSITY IN GRAIN MINERALS (IRON AND ZINC) AND PHYTIC ACID CONTENTS IN DIVERSE RELEASED COMMERCIAL CULTIVARS OF LENTIL

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### ABSTRACT

Lentil grains are highly nutritious, and are promising candidates in South Asia and North Africa for micronutrient malnutrition alleviation. For the biofortification of this crop, genetic variations of the micronutrient content are necessary. A useful solution to increase the intake of food minerals through the daily diets is the bio-fostering of basic food crops. Missing Iron (Fe) and Zinc (Zn) in poor economies, especially women and pre-school children, poses serious problems. The lentil seeds represent an excellent source of staple foodstuffs which can be a viable source for biological enhancement. Plant breeding requires a comprehensive understanding of the genotype and environment that underpin GE interaction. Using GGE and AMMI (additive main effects and multiplicative interaction) models, we investigated genetic stability and GE for grain Iron, Zinc, and phytic acid content in 16 lentil cultivars. For two years, genotypes were tested in the field at six locations across eastern and central India. The content of Fe and Zn in lentil genotypes showed significant genetic heterogeneity. Across six contexts, grain iron, zinc, and phytic acid levels ranged from 111.10 to 48.80 mg/kg, 73.82 to 25.40 mg/kg, and 0.77 to 2.94 g/100g (dry weight), respectively. The contents of grain iron, zinc, and phytic acid were affected by the environment and GE. Grain mineral and phytic acid content heritability estimates in lentil genotypes were found to be high. The possibility of these lentil genotypes to promote Fe and Zn genetic enhancement through hybridization and selection was demonstrated by these heritability findings. A significant positive connection between Fe and Zn content suggested that an approach for simultaneously improving Fe and Zn in lentils may be developed. For Fe content, our research discovered the stable and optimal genotype PusaShivalik, and for Zn content, PusaAgeti. The findings of this work will be relevant in the future for mapping and tagging genes/QTL controlling Fe, Zn, and low phytic acid content quality.

## INSECT-PEST STATUS ON CUMIN (*CUMINUM CYMINUM* L.) AND THEIR MANAGEMENT UNDER FIELD CONDITIONS

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### ABSTRACT

Cumin (*Cuminum cyminum* Linn.) is an important and major seed spices crop. Plants are erect, bushy annual herb (2n=14) belongs to the family Apiaceae. It is originated from Mediterranean region and now it is growing in many countries in the world including India, Pakistan, Iraq, Iran, Turkey, China, Egypt, Syria, Israel and Italy. In India, cumin is largely cultivating in the states of Gujarat, Rajasthan and Madhya Pradesh and also some part of Andhra Pradesh and Maharashtra. Cumin was cultivated in an area of 12.76 lakh hectare area, producing 9.12 lakh tonnes of seeds with an annual productivity of India 715 kg ha<sup>-1</sup> in 2019-20 (Anonymous, 2021) reflecting as largest producer, consumer and exporter over the world. Cumin seeds are primarily used for giving *Tadka* in most of cooking vegetables to create special flavour. It is also used for flavouring, seasoning and imparting aroma in variety of food items and beverages. Besides importance in food industry, it has several medicinal properties used as stimulant, carminative, stomachic, astringent and constructive in diarrhea and dyspepsia (Malhotra and Vashishtha, 2008). The dried cumin seeds contain 2.5 to 4.5% volatile oil. Due to oleoresin and cuminaldehyde content, it has good demand in the international market. Cumin crop is severely infested by insect-pests and diseases which are one of the





limiting factors affecting its growth and quality yield. Among insect-pests, aphids, *Myzus persicae*, *Hyadaphis coriandri*, and *Aphis gossypii*; thrips, *Thrips tabaci* and *Frankliniella schultzei* Tryb., jassid, *Empoasca* sp., whitefly, *Bemisia tabaci* Genn., and seed bug, *Nysius* sp. are the major sucking insects and causes serious economic losses. Apart from these pests of major status, crop is also getting infested with seed borer, *Hellula undalis* F. (Lepidoptera: Crambidae); tobacco caterpillar, *Spodoptera litura* Fab. (Lepidoptera: Noctuidae); painted bug, *Bagrada hilaris* (Burm.) (Hemiptera: Pentatomidae); red cotton bug, *Dysdercus koenigii* Fab. (Hemiptera: Pyrrhocoridae); stink bug *Nezara viridula* L. (Hemiptera: Pentatomidae); grasshopper, *Acrida* spp. (Hemiptera: Acrididae) and termite, *Odontotermes obesus* (Ramb.) Isoptera: Termitidae during different vegetative growth stage. Cumin aphid causes serious damage at flowering stage of the crop by yellowing and curling of leaves in the initial stage and later the plants show stunted growth and the inflorescences set a few seeds which are shriveled. The reported insect pests appear at different crop growth stages cause 15-25% yield loss. In the absence of regular monitoring and suitable control measure on time, pest population exceeded above injury level, resulting significant loss in yield and quality and yield loss can reach to 60-70 per cent. For the management of pest, an effective management tactic i.e. seed treatment with imidacloprid 600 FS @ 3ml/kg seed (ST) followed by foliar application of ker plant extract 10ml/lit., *Verticillium lecani* (1x10<sup>8</sup>cfu/g) @ 6g/lit. and fipronil 5%SC @ 0.035% 3ml/lit., give high-quality control of pests.

## POTENTIALITY OF BIOLOGICALS AGAINST RHIZOCTONIA SOLANICAUSING SHEATH BLIGHT IN RICE

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### ABSTRACT

Inhibitory effect of few cruciferous plant extracts was tested by poisoned food technique. At 1:1 dilution the highest inhibition of 51.1% was observed in cabbage and the least inhibition of 21.93% over control was observed in case of radish. At 1:100 and 1:1000 dilutions none of the plant's extracts were effective against *Rhizoctonia solani*. At 1:1 dilution only cabbage was found effective. The inhibitory effect of bio fumigant plants was tested against *R. solani* by following sealed Petri plate technique. Mustard completely inhibited the growth of the pathogen whereas cauliflower showed least inhibition with 44.8 mm radial growth of the pathogen. A total of six bioagents were tested for the antagonistic effect against *R. solani* by dual culture technique. The highest inhibition was observed in native *Trichoderma viride* (38.88%) and the least inhibition was noticed in case of commercial *Pseudomonas fluorescens* and *Bacillus subtilis* which recorded 18.88% inhibition over control.

## STUDIES OF HETEROSIS AND COMBINING ABILITY FOR YIELD AND QUALITY TRAITS IN YARDLONG BEAN (*VIGNA UNGUICULATA* (L.) WALP. SSP. *SESQUIPEDALIS* VERDC)

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### ABSTRACT

The present investigation entitled "Genetic analysis for yield and quality traits in yardlong bean (*Vigna unguiculata* (L.) Walp. ssp. *Sesquipedalis* Verdc.)" was undertaken at College of Horticulture, Venkataramannagudem, Andhra Pradesh to estimate the heterosis and combining ability by employing half diallel design. For half diallel analysis, the planting material consisted of seven parents (Geethika, Babli, Vizianagam Local, Bobbili Local, Lola, Trivendrum Local and Bhuvaneshwar Local), the resultant 21 F<sub>1</sub> hybrids and commercial check i.e. Arka Mangala which were grown in RCBD design. The heterosis of the F<sub>1</sub> hybrids resulted from half diallel analysis revealed that six crosses viz., Babli x Bobbili Local, Babli x Lola, Babli x Trivendrum Local, Bobbili Local x Lola, Bobbili Local x Trivendrum Local and Lola x Trivendrum Local were the most promising crosses over the commercial check Arka Mangala for yield and quality traits in yardlong bean. Fifteen characters exhibited higher *sca* variances than *gca* variances and the ratio of *gca* to *sca* variance was less than unity indicating the predominance of non-additive gene action and improvement of these traits can be made through heterosis breeding. The lines Babli, Bobbili Local, Lola and Trivendrum Local recording significant positive *gca* effects were found to be promising



general combiners for yield and quality traits. In respect of *sca* effects, six crosses were identified as promising specific combiners for yield and quality traits in yardlong bean. Based on the studies of half diallel analysis, it was concluded that three hybrids viz., Babli x Bobbli Local, Babli x Lola and Babli x Trivendrum Local were most promising hybrids with desirable *sca* effects, heterosis and *per se* performance for fruit yield and other desirable traits. These hybrids may be further tested over locations and seasons and recommended for commercial release and the material generated in the present investigation could be utilized for future breeding programmes.

## EVALUATION OF PLANT OIL AGAINST RICE MOTH *CORCYRA CEPHALONICA* (STANTON) INFESTING STORED GROUNDNUT

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### ABSTRACT

Laboratory experiment was conducted to study the efficacy of different nine plant oils @ 1.0 ml/100 g groundnut kernels against *Corcyra cephalonica* (Stainton). Among different plant oils, neem oil proved to be the most effective as it recorded highest oviposition deterrence of 96.17 %, percent reduction of adult emergence of 97.86 %, lowest longevity of male (2.53 days) and female (2.53 days) moths, lowest female fecundity (26.54 eggs) and lowest egg viability (47.96 %). The next best effective treatments were karanj oil and castor oil. There was no adverse effect on the germination of groundnut seeds treated with different plant oils during storage period of up to 120 days.

## DIRECT ORGANOGENESIS IN *PUNICAGRANATUM* L. CV. KANDHARI KABULI FROM HYPOCOTYL EXPLANTS

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### ABSTRACT

A high efficiency plant regeneration protocol has been developed for *Punicagranatum* L. cv. Kandhari Kabuli using hypocotyl explants. Hypocotyl explants (about 0.5–1.0 cm in size) were procured from 15 to 20-day-old in vitro germinated seedlings. The highest frequency of shoot regeneration (68.21 %) along with 3.18 average number of shoots per explant was obtained via direct organogenesis from hypocotyl explants cultured on Murashige and Skoog's medium supplemented with 2.0 mg/l 6-benzyl amino purine and 1.5 mg/l  $\alpha$ -naphthalene acetic acid. High percentage root regeneration (85.62 %) in in vitro developed shoots was obtained on half strength Murashige and Skoog's medium supplemented with 0.10 mg/l  $\alpha$ -naphthalene acetic acid and 0.02 % activated charcoal. Pomegranate plantlets were able to regenerate within 6 weeks and well rooted plantlets were successfully acclimatized in plastic cups containing autoclaved peat moss. They were weaned in a growth room and finally moved to a greenhouse. This is the first report on direct organogenesis in *P. granatum* L. cv. Kandhari Kabuli using hypocotyl explants. This regeneration protocol will be very useful for undertaking genetic manipulation providing a value addition to pomegranate propagation in future.

## GROWTH AND FLOWERING OF CHRYSANTHEMUM AS INFLUENCED BY VARIETIES AND PLANT GROWTH RETARDANTS

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### ABSTRACT

An experiment was conducted during Kharif season 2018-19 and 2019-20 at Department of Horticulture, Vasant Rao Naik Marathwada Krishi Vidhyapeeth, Parbhani (Maharashtra), India to study growth and flowering of chrysanthemum as influenced by



varieties and plant growth retardants. The results of the experiment revealed that significantly, minimum plant height was recorded in Brown (34.49 cm). Whereas, among various concentrations growth retardant MH 1000 ppm reported minimum plant height (37.78 cm). Significantly, maximum leaf area was observed in cv. Raja Pandharpuri (35.08 cm<sup>2</sup>) when spread with MH 1000 ppm (34.13 cm<sup>2</sup>). Significantly, maximum number of branches plant<sup>-1</sup> (40.20), stem diameter (0.89 cm) and Number of leaves plant<sup>-1</sup> (108.11) was noticed in Shinaton. However, Significantly, maximum number of branches plant<sup>-1</sup> (35.24), stem diameter (0.81 cm) and Number of leaves plant<sup>-1</sup> (207.13) was found in MH 1000 ppm. In respect of flowering parameters, significantly early days to first flower bud initiation (65.17 days), days to full opened flower from bud emergence (23.59 days), days to 50 % flowering (96.23 days) were recorded in cv. Raja Pandharpuri. Significantly, early days to first flower bud initiation (68.48 days), days to full opened flower from bud emergence (22.40 days), days to 50 % flowering (104.48 days) were recorded in treatment Control (Water spray). However, maximum blooming period (46.00 days) were recorded in cv. Shinaton when spread with MH 1000 ppm (49.23).

## **USE OF SOIL HEALTH CARD IN MAPPING SOIL FERTILITY STATUS**

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### **ABSTRACT**

Soil fertility map for a particular area can prove highly beneficial in guiding the farmers, manufacturers and planners (associated with fertilizer marketing and distribution) in ascertaining the requirement of various fertilizers in a season/year and making projections for increased requirement based on cropping pattern and intensity. Huge point data on soil nutrients are available under the Soil Health Card Schemewhich can be utilized to produce a detailed map on soil nutrients. Several interpolation techniques have been used and are in use for mapping soil nutrients with point data. However, the traditional interpolation methods like ordinary kriging have been found inefficient in many cases particularly in the variable terrains and climatic regions as the soil forming factors of climate, land cover, and terrain affect greatly the soil nutrient properties. In the era of machine learning, random forest and regression kriging are some of the suggested advanced tools for mapping the soil nutrients which utilizes the environmental covariates as inputs. This study utilized the soil health card data to prepare a detailed gridded (30 m) map of soil nutrients for Kanker district of Chhattisgarh state using different techniques of interpolation including ordinary kriging, random forest and regression kriging. The study found that the random forest method produced best results with highest accuracies and spatial distribution as compared to the other methods. Thus the random forest approach is suggested for mapping nutrients in a region with large variability in terrain, landforms, vegetation, and climate.

## **CONSTRAINTS FACED BY THE MEMBERS OF THE FARMER PRODUCER ORGANIZATION**

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### **ABSTRACT**

The FPO is a farmers' organization, made and run by farmers with the support of promoting NGO called as POPI (Producer Organization Promoting Institutions). In the initial few years of formation of FPO, POPI provides hand holding support to the farmers and when it is seeing that farmers must take it forward on their own and acquire technical and managerial capability to run the business successfully, POPI withdraws its support. Most of the FPOs are passing with multiple constraints like personal, technical, financial, infrastructural and competitive market. As a result of all this, the farmers suffer distress sale and ultimately, they do not get remunerative prices for their produce. Most of the FPOs are passing with multiple constraints like personal, technical, financial, infrastructural and competitive market. Hence, the present study was conducted to explore the constraints faced by the members of Farmers Producer Organization. The data were collected through interview schedule from 320 members of four selected FPOs of Udaipur district viz. Wakal Agro Food producer Company Ltd., Ogna (Jhadol),



Bhomat Agro Food producer Company Ltd., Ogra (Jhadol), Jhadol Producer Company, Jhadol, Mewar Green Agro producer Company Ltd., Kolyari and It was found that operational (67.60 MPS) and economic constraints (65.50) were the major obstacles faced by the FPO members which were creating problems in carrying out FPO's activity efficiently. There is need to manage these constraints so that they do not affect the organizations significantly. It needs to take the form of a one-stop-shop that offers both hardware and software solutions to raise the income of farmers, especially small and marginal farmers (Economic survey, 2015-16).

## **SPECIES COMPOSITION AND CARBON STOCK OF TRADITIONAL AGROFORESTRY SYSTEMS OF WESTERN HIMALAYA**

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### **ABSTRACT**

Agroforestry is a new name given to an age-old integrated farming practices where woody perennials are grown along with agriculture crops, pastures and/or livestock. In this era of changing climate, land degradation, population explosion, etc. agroforestry practices are one of the most promising strategies efficient in mitigating and adapting to the above said changes. Several agroforestry systems exist in the Himalayas, where the livelihood of major rural populations depends upon the different outputs of the systems. Keeping this in view, the present investigation was carried out to study species composition, carbon stock pattern of traditional agroforestry systems along an altitudinal gradient in Solan district of Himachal Pradesh, Western Himalaya. The floral spectrum of the traditional agroforestry system was broad. A total of 55 species belonging to 41 genera under 22 families were recorded. Out of total plant species, 32 species (57.14%) were trees (22 silviculture trees species and 10 fruit tree species) and 23 species (42.86%) were comprised of agriculture crops. Almost similar kinds of agriculture crops were grown throughout the altitudinal gradient, however, the woody perennials species composition changes marginally along the elevation. The tree and crop combinations varied with place and 12-18 agroforestry system units were identified. The total carbon stock (vegetation+soil) of traditional agroforestry was 88.27 tC/ha, of which soil and vegetation contributed 66.16% and 33.84% of carbon stock, respectively. The total carbon stock increased gradually along the elevation up to a certain elevation and then decreased. Thus, the traditional agroforestry system of the Western Himalayas harbours a wide range of plant species and stores a considerable amount of carbon stock in vegetation and soil.

## **BIODIVERSITY AND IPRS ISSUES AND CHALLENGES**

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### **ABSTRACT**

India being a country rich in biodiversity has been victim of bio-piracy in case of turmeric, neem and basmati incidents. It is important for countries to conserve their biodiversity and associated indigenous knowledge through the tools of intellectual property rights. In India, the Biodiversity Act, 2002 provides legal framework to ensure benefit sharing in various forms as in case of intellectual property with bio-resource for the relevant traditional knowledge. Effective implementation of the above is a challenge. Biodiversity is the basic of our sustainability. The current Intellectual Property Rights (IPR) regime is encouraging commercialization of seed development, monoculture, protection of new plant varieties, microorganisms, genetically modified organisms and restrains the exploitation of traditional knowledge. Adequate penal provisions and compensation amounts must be prescribed in the enacted laws for curbing the exploitation of resources. The relationship between IPRs and the provisions of the TRIPS Agreement and the CBD gives rise to a range of issues like access and benefit sharing, protection of traditional knowledge, technology transfer, and the conservation and sustainable use of biological diversity. Policy-makers have an important role to play in ensuring that policies and practices relating to IPRs, and the need for the conservation of biodiversity, are mutually supportive. Governments must adopt an integrated approach a cross national and international forum, if they are to create space for implementing the challenges like to develop and implement access and benefit sharing





regimes with minimum binding standards in national legislation. Insisting on permanent observer status in the Council for TRIPS, developing strong guidelines for access and benefit sharing, requesting the CBD Secretariat to compile further case studies and empirical evidence, effective *suigeneris* systems should be consistent with the provisions of the CBD and the I U, protect farmers' rights, including the right to save and share seeds, and respect national priorities regarding protection of traditional knowledge, and access and benefit sharing.

## INTRASPECIFIC VARIATIONS AMONG THREE POPULATIONS OF *HOLOTRICHIA CONSANGUINEA* BLANCHARD, (COLEOPTERA : SCARABAEIDAE) OF INDIA

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### ABSTRACT

White grubs are the major pests of several economically important crops that belong to family Scarabaeidae under order Coleoptera. Among white grub species *Holotrichia consanguinea* is considered as a major pest. Studies on intraspecific variations of *Holotrichia consanguinea* were carried out from three geographical populations of India collected from endemic areas of Uttar Pradesh, Rajasthan and Andhra Pradesh. Morphometric studies were carried out for 30 specimens of both sexes of each population on 23 and 19 characters of male and female respectively, to study for variation among the populations. Morphometric data were subjected to different statistical analyses viz., univariate, multivariate, principal component analysis and discriminant function analysis. The various analyses revealed that maximum selected character states showed significant differences among all three populations. The principal component analysis revealed that PC1 and PC2 could explain 42.64% variation in males and 63.57% in females, which had loadings of five characters that can be useful in differentiating the three populations. The discriminant function analysis confirmed the worthiness of selected characters in differentiating the three populations of both male and female *H. consanguinea*. The territorial map drawn from two canonical discriminant functions showed the plots of three distinct populations indicating that significant differences exist among the three populations of *H. consanguinea*, which need to be explored further.

## REGIONAL DISPARITY IN FOOD CONSUMPTION PATTERN AMONG THE PEOPLE OF NORTH EAST INDIA

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### ABSTRACT

Studying dietary pattern of people of any region has extensive implications for the quality of life of its population. It also acts as a direct measure to know the agriculturally important crops or vegetables of the region. This paper examined the dietary pattern, and its related issues persist in North-eastern India; present study has considered all states of this region except Assam. The food consumption pattern reported that people mainly depend on cereals (117 kg/person/year in Sikkim to 165 kg/person/year in Manipur, NSSO, 2014) and rice has occupied major share. It also been found that Manipur (1.32%) is less dependent on public distribution system (PDS) for rice whereas with large population Tripura (37.19%) depends more on the same. As the people of this region fond of animal protein, they consume less pulse (4.90 kg/person/year in Manipur to 6.65 kg/person/year in Arunachal Pradesh) as source of protein. But as compared to Recommended Dietary Allowance (RDA) dietary intake of edible oil, egg, milk and vegetables are very less. This study also reported that consumption of milk and other dairy products are very less in all the states except Sikkim (71.30 gm/person/year). Even the region is witnessed to temporal variations in yield of food grains over the years, ranges between 284.6 (Mizoram in 2008) to 2782.91 (Tripura in 2015) (Uttam et al. 2020). Distribution of cold storage capacity is also highly variable i.e. 2100 mt. in Sikkim to 46,354 mt. in Tripura; which is having direct relation to food availability. This study recommends that from health and nutrition perspective, the people of N-E region need to be more aware about the dietary diversity and recommended dietary allowance to be followed; and the production, productivity, storage etc. are also areas of concern as these are vital influencing factors at the household level.



## DIAGNOSIS AND TREATMENT OF BABESIOSIS IN DIARA BUFFALOES OF PERI-URBAN BLOCKS OF PATNA, BIHAR

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### ABSTRACT

Study was carried out in different villages of peri-urban villages of Patna during the period December 2018 to October 2020. Collected blood samples from buffaloes suffering from high fever or has recent history of high fever, red urine and tick infestations or sharing common shelter infected cattle with tick transmitted pathogens. All the samples were initially screened by Giemsa's stained blood smear examination for presence of parasites. Samples found positive for babesia spp. were confirmed by PCR using specific primers coding for 18S ribosomal RNA gene. The positive amplification was observed at 689bp. The positive amplification product was purified and outsourced for sequencing and submitted to NCBI (GenBank: MH936010.1) and observed to be similar to *Babesiabigemia*. Blood samples were further investigated for changes in haematological parameters using standard techniques. Infected buffaloes (n=6) were randomly divided into two equal groups. Group 1 were given single dose of dimenazineacetate @ recommended dose along with supportive therapy. Group 2 were given single dose of imidocarb dipropionate @ recommended dose along with supportive therapy. Treatment response in both the groups was observed based on improvement in clinical examination and observation of GSBS negative result post 15 days of treatment. Based on the GSBS diagnosis, low prevalence of 5.61%, was observed in buffaloes infected with *Babesiabigemia* in peri-urban cattle of Patna. Both recommended drugs for treatment of Babesia were found effective in improving treatment in infected buffaloes and capable of eliminating the pathogen in 15 days post treatment.

## COMPARATIVE EVALUATION OF THE PROPERTIES OF COLLAGEN PEPTIDE EXTRACTED FROM DOLPHIN FISH BONE BY CONVENTIONAL AND MICROWAVE PROTOCOLS

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### ABSTRACT

Dolphinfish, also called mahi-mahi is a highly prized and demanded seafood species. Its flesh is sold fresh as well as frozen in the seafood market. The by-products such as skin, scales, bones etc generated by its processing are dumped into the environment causing serious pollution issues or end up as low commercial value products. An important waste reduction strategy for the industry is the recovery of profitable by-products from fish wastes. Fish bone, which is separated after removal of muscle proteins on the frame is a valuable source in identifying health promoting components. The organic component of fish bone, which accounts for 30% of the material, is made up of collagen. Processing of these bones for collagen peptide extraction helps in reducing the fish waste which is a major concern of the fish processing industries. In the present work, collagen peptide was extracted through conventional and microwave protocols. The extracted collagen peptide was spray dried and its properties were analysed. Microwave extracted collagen peptide was superior to conventionally extracted collagen peptide with a comparatively higher yield. Samples in this study showed higher ferric reducing antioxidant power than BHA and BHT, recommending as a ferric reducing antioxidant. Both samples were observed as good anti-inflammatory agents as well as antioxidants.

## NEW PLANT BREEDING TECHNIQUES FOR IMPROVEMENTS OF FRUIT CROPS

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### ABSTRACT

Since the turn of the century several new tools and techniques have been invented and used to facilitate breeding of new improved crop varieties. Breeding fruit trees through conventional methods is a major challenge due to problems like



incompatibility, long juvenility, sterility, heterozygosity and polyembryony. Recently, new techniques have been developed and classified as new plant breeding techniques (NPBTs) such as cisgenesis, oligonucleotide mutagenesis, reverse breeding, sequence-specific nuclease technology (genome editing tools like CRISPER/Cas9 and Zinc Finger Nuclease), intragenesis and RNA-dependent DNA Methylation. Among these, cisgenesis and genome editing constitutes two of the most promising strategies to develop genetically improved tree crops. Cisgenesis involves the transfer of gene with all native components like introns, promoter and terminator from one genotype to another of the same or of a sexually compatible species. Since only introns are transferred to the host plants, thereby ensuring the transfer of only gene of interest. Moreover, cisgenesis is perceived as a technique to overcome the main problem of traditional breeding, termed "linkage drag" – which is explained as transfer of unwanted gene along with gene of interest. Cisgenesis unlike transgenics does not alter the gene pool of host plant and serve as a promising tool for further improvement of elite cultivars, particularly in crops that are vegetatively propagated such as apple and grapes. Till date, cisgenesis work have been reported mainly in apple and grapes with the aim to induce resistance to scab and fire blight in apple and downy mildew in grapes. Likewise, genome editing technologies like CRISPER/Cas9 that was originally discovered for defense against viral infection have revolutionized the breeding program. Main advantages of CRISPER/Cas9 technology is its specificity, efficiency, ease of engineering and complementarity with target DNA. Popularity of CRISPER/Cas9 can also be attributed to the fact that, among other genome editing tools like ZFNs (Zinc Finger Nuclease) and TALENs (TALE nucleases), CRISPER/Cas9 is least expensive and most user-friendly. This genome editing technique have been used to induce disease resistance in fruit tree species like in apple to confer resistance against *Erwinia amylovora* by editing DPM-1, 2 and 4 genes and in citrus against citrus canker by modifying susceptibility gene *LATERAL ORGAN BOUNDARIES 1 (CsLOB1)*. With the advent of new technologies, there is also rising concern regarding bio-safety issues that product arising from such techniques might cause off target mutation in host plant. However, the techniques such as cisgenesis and gene editing tools like CRISPER/Cas9 does not alter the genome of host and in most cases produce cultivar similar to those that would have been produced through traditional breeding methods. Thus, these techniques hold huge potential for fruit crop improvement.

## ECOFRIENDLY AND ECONOMIC CROP HEALTH PACKAGE EMPHASIZING MINERAL NUTRITION WITH SPECIAL REFERENCE TO SILICON FOR YIELD ENHANCEMENT IN BITTERGOURD (*MOMORDICA CHARANTIA* LINN.)

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### ABSTRACT

Bitter gourd (*Momordica charantia* Linn.) locally known as 'Pavaykka' is the most popular cucurbitaceous vegetable in Kerala especially in the Kollam district with high market demand both domestic and export. However, its productivity is declining nowadays due to soil-related problems like indiscriminate and continuous use of heavy doses of fertilizers and high incidence of pests and diseases which ultimately leads to poor yield. Balanced application of nutrients increases crop yield. It was also found that silicon application had beneficial effects in cucumber cultivation which enhanced the growth, yield and improved the resistance to diseases and tolerance to abiotic stresses (Miyake and Takashi 1983, Lee *et al.*, 2000). Keeping all these facts in view, a field investigation was carried out to develop an eco-friendly and economic crop health package emphasizing mineral nutrition including silicon for higher growth and yield with reduced incidence of pests and disease in the bitter gourd in the agro-ecological unit AEU 9 (South Central laterite) of Kollam district of Kerala. The field experiment was conducted at the farmers' plots during 2019-20 with 13 treatments and 3 replications. The experiment was laid out in randomised block design with the following treatments: T1-Farmers practices (use of complex fertilizers and cocktail of pesticides), T2-Recommended dose of fertilizers (RDF), T3-Soil test-based nutrient management (STBNM), T4-RDF + soil application of rice husk ash @500kg/ha, T5-Soil test-based nutrient management + soil application of rice husk ash @500kg/ha, T6-T2+foliar application of calcium silicate at vegetative and flowering stage @ 0.5%, T7-T3+ foliar application of calcium silicate at vegetative and flowering stage @0.5%, T8-T4+ foliar application of calcium silicate at vegetative and flowering stage @0.5%, T9-T5+foliar application of calcium silicate at vegetative and flowering stage @ 0.5%, T10-T2+ foliar application of potassium silicate at vegetative and flowering stage @0.5%, T11-T3+foliar application of potassium silicate at vegetative and flowering stage @0.5%, T12-T4+foliar application of potassium silicate at vegetative and flowering stage @0.5%, T13-T5+foliar application of potassium silicate at vegetative and flowering stage @ 0.5%. All the crop management practices except liming, manuring, and fertilizers application were done according to the package of practices



recommendations of Kerala Agricultural University. The variety used was Preethi, the most popular one in the Kollam district. Various observations viz plant height, days to first female flower appearance, duration of the crop, days to first picking, harvest duration, fruit weight, fruit yield, disease incidence were taken and subjected to statistical analysis using the web-based agricultural statistical software package WASP of ICAR Central Coastal Agricultural Research Station, Goa. The economics of each treatment was calculated. The study revealed that the application of different silicon sources both soil (rice husk ash @500 kg/ha) and foliar (potassium silicate @0.5 % at vegetative and flowering) along with Soil test-based nutrient management significantly increased the fruit yield (20601.67 kg/ha) compared to farmers practice (14433.33 kg/ha). The highest benefit-cost ratio (2.38) was recorded by the application of potassium silicate at vegetative and flowering stage @0.5% along with soil test-based nutrient management and rice husk ash @500kg/ha (T13) and was higher than all other treatments. The lowest BCR of 1.54 was recorded by the treatment T1 ie the farmer's practice. The same treatment was effective in reducing the disease incidence (10.53%) compared to the farmer's practice (79.43%) at the fruiting stage of the crop. Hence the treatment T13 (soil test based nutrient management + rice husk ash @500kg/ha + foliar application of potassium silicate at vegetative and flowering stage @0.5%) can be considered as an eco-friendly and economic crop health package for yield enhancement in Bitter gourd in the AEU 9 (agro-ecological unit 9-south central laterite) of Kollam district.

## **OPTIMIZATION OF STARCH ISOLATION PROCESS FOR MANGO SEED KERNEL AND ITS CHARACTERIZATION**

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### **ABSTRACT**

The disposal of fruit processing residues and consequent waste of valuable substances are a problem in many countries. The mango processing industries generate approximately 40-60% by-products which consist of 12-15% of peels and 15-20% of mango seed kernels. The higher generation volume of mango seed kernel makes it cheaper and readily available material for extraction of starch. The mango stone was collected from the fruit processing industries, Abohar, Punjab. A method combining a Plackett-Burman design (PBD) and a Box-Behnken design (BBD) was used to evaluate the effects of major treatment process variables, including the particle size, soaking solid-liquid ratio, NaOH concentration, soaking temperature, soaking time, stirring rate, ultrasonic power, mixing solid-liquid ratio, mixing time and mixing speed, on the starch isolation. The response value was starch yield. Soaking temperature, particle size, soaking time, and mixing solid-liquid ratio were significant factors. The conditions of adjusting the particle size to 0.6 mm, the temperature of soaking to 31°C, soaking time to 42 min, and mixing solid-liquid ratio to 1:6 would favor maximum response value obtainment. The starch yield, purity, and amylose were 49.85%, 94.95%, and 23.55%, respectively. The prepared starch was characterized for color value, swelling power, water solubility index, pasting property, granule size, and morphology. The study suggested that the prepared starch was suitable for food applications.

## **ATTITUDE OF URBAN HOUSEWIVES TOWARDS TERRACE GARDENING**

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### **ABSTRACT**

As the greener cover of urban areas are eaten away by the skyscrapers and concrete paths, the idea of urban greening and terrace cultivation should take a foothold. If it is taken up by the women, we can encompass gender empowerment along with natural conservation and good agricultural practices. Here, we are trying to analyse the attitude of urban housewives towards terrace gardening. The findings of the present study, which is conducted at Pune city, clearly depicts that there is a moderate level of positive attitude towards terrace gardening (53.55 per cent). While analysing the factors affecting the attitude, it is evident that the variables such as age, area of cultivation, experience, information sources utilisation, and innovativeness is correlated with attitude towards terrace gardening at one per cent level of significance, while, time spent on gardening





activities and frequency of harvest were correlated with attitude towards terrace gardening at five per cent level of significance. The variables such that education, family size, annual income, health consciousness, and vegetable consumption pattern doesn't show any effect on the attitude towards terrace gardening as they were non-significant.

## IMPORTANCE OF NATURAL/PLANT-DERIVED PESTICIDES FOR AGRICULTURE

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### ABSTRACT

Pest is a very important factor for agriculture which determines the economy of the agriculture sectors. The pests have specific nature and presence along with crops, season, and natural locality. It can be controlled by the use of various organic and inorganic pesticides but harm the plants, animals, and soil. However, many of the modern pesticides are used today which persist in soil and environment for years and compound the store of toxins in the air, soil, and water. The toxic build-up of these chemicals has been shown to cause damage to animals, plants, human health and is not easily degradable in the environment. The bio-pesticides are a natural product that extracted from plants. It is natural, biologically occurring compounds that are used to control various agricultural pests which infesting plants in gardens, farmlands, forests, etc. Plant biodiversity has a lot of specific plants which have specific natural components and specific lethal characters against various pests. It can be used for the control of pests. Plant-derived pesticides are cheaper, easily available, biodegradable, and eco-friendly. According to some researches, the plant-derived products have pesticide properties as well as nutritional values in the soil profile. Therefore, it can be used for the control of harmful pests and as a bio-fertilizer.

## BIOLOGY OF FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (J.E. SMITH) (LEPIDOPTERA: NOCTUIDAE) ON SORGHUM

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### ABSTRACT

The present study was undertaken at Department of Entomology, College of Agriculture, Rajendranagar, Hyderabad during Kharif, 2019 to know the biology of fall armyworm, *Spodoptera frugiperda* on sorghum. The results revealed that mean incubation period were  $2.47 \pm 0.051$  days. The larva passed through six different instars. The first, second, third, fourth, fifth and sixth instar larva lived for  $2.40 \pm 0.063$  days,  $2.37 \pm 0.051$  days,  $2.23 \pm 0.051$  days,  $2.25 \pm 0.054$  days,  $3.23 \pm 0.051$  days and  $2.80 \pm 0.075$  days, respectively with a total mean larval period of  $15.30 \pm 0.167$  days. The mean pre pupal and pupal period were  $2.45 \pm 0.054$  days and  $7.88 \pm 0.075$  days, respectively. In the present study, mean longevity of female and male moth were  $39.00 \pm 0.591$  days and  $34.35 \pm 0.543$  days, respectively. The preoviposition, oviposition and postoviposition period ranged between 3 to 4, 3 to 4 and 4 to 5 days with a mean of  $3.34 \pm 0.116$ ,  $3.42 \pm 0.147$ ,  $4.43 \pm 0.136$  days, respectively. Total number of eggs laid by a single female ranged between 606 to 764 eggs with a mean of  $686.68 \pm 9.252$  eggs and sex ratio of male to female as 1: 1.14 when their larvae fed on sorghum. These results help in understanding the biology of *S. frugiperda* fed on sorghum.

## MICROBIAL AMELIORATION : APPROACH TO MITIGATE ABIOTIC STRESSES IN FRUIT CROPS

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### ABSTRACT

Global climatic records have shown a tremendous increase in world temperature since 1970, as well as changes in precipitation regimes, leading to severe consequences for fruit crops, such as strawberries. In the current scenario of climate change, abiotic stresses (such as salinity, drought, cold, heat, and heavy metal) have become major threats to global horticultural production. Fruit plants are more frequently subjected to abiotic stresses due to their permanent establishment. In addition to direct stress



on plants, climate change has expanded the range of pathogens and pests and increased the frequency and severity of disease outbreaks. To ensure food security with a limited increase in horticultural land, a sustainable strategy is to increase plant resistance and resilience to counteract climate change-induced stresses. Fortunately, some helpful microbes, notably bacteria and fungi, can restrain the negative impacts and improve plant performance in stressful environment. Some soil microorganisms like arbuscular mycorrhizal fungi (AMF) and plant growth-promoting rhizobacteria (PGPR) inhabit the soil rhizosphere and develop a symbiotic relationship with the roots of most of the plant species. Compared to agrochemicals, microbial bio-stimulants do not accumulate for the long term, have low toxicity, and are less prone to resistant strains of pests and pathogens, and, therefore, can be considered environment- and human-friendly. Microbes help in the amelioration of different types of plant stresses such as metal, salt, drought, and other biotic stress. All these stresses produce reactive oxygen species (ROS) that cause oxidative stress in plants. ROS negatively affect the cellular activities that cause oxidation of proteins, peroxidation of lipids, and inhibit the activity of the enzyme that results in total cellular damage. Beneficial microbes potentially represent a sustainable and effective strategy in combating the various abiotic stresses. Moreover, the use of microbial bio-stimulants could effectively maintain agro-ecosystem ecological balance by minimizing the use of pesticides and/or heavy metals in fruit crops.

## PROFILING OF BIOACTIVE CONSTITUENTS OF *GARCINIA INDICA* (KOKUM) ACCESSIONS

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### ABSTRACT

*Garcinia indica* (kokum) is a functional fruit, rich in highly beneficial metabolites. Present study aimed to characterize this fruit for its potential uses and as a source of hydroxycitric acid, anthocyanin (natural colorant), and phenolic compounds. Here we used liquid chromatography-mass spectrometry (LC-MS) to analyze the composition of metabolites in ripened fruit. It has a significantly high quantum of anti-obesity agent, hydroxycitric acid (15.60%–22.92%) which makes it as a suitable candidate for weight loss supplements. The total anthocyanin content (4.47 mg/g – 7.08 mg/g) is higher than majority of the reported fruits and vegetables, which suggests its potential as a natural colorant. A total of thirty eight anthocyanin compounds were identified and quantified, and majority of these were reported for the first time. Cyanidin-3-sambubioside, peonidin-3-arabioside and pelargonidin-3-glucoside were the major anthocyanins found. This is also rich in phenolics, since thirty individual phenolic compounds were identified. With respect to phenolic compounds, this was found rich in ortho/para coumaric acid, naringenin and apigenin which have myriad industrial applications. Overall, this work highlights the *Garcinia indica* as a rich, new, and sustainable source of bioactive substances for food and pharmaceutical applications.

## COMPARISON OF AMENDMENTS ON CHROMIUM BIOAVAILABILITY AND UPTAKE IN SOIL – PLANT SYSTEM

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### ABSTRACT

The containment of this contaminant (heavy metal) in the soil is necessary to reduce the transfer of metals to the agricultural produce. The chromium bioavailability and uptake is affected by the application of amendments. A crop growth experiment was conducted to study the effect of amendments in soils under different dilutions of treated tannery effluent (TTE) containing chromium (Cr). The effluent of chrome tanning industry treated through water hyacinth biochar was utilized in the study. The treatments included three dilutions of TTE (25 (W<sub>1</sub>), 50 (W<sub>2</sub>) & 75% (W<sub>3</sub>)) with no amendments (A<sub>1</sub>), four doses of water hyacinth biochar (@2.5 (A<sub>2</sub>), 5.0 (A<sub>3</sub>), 7.5 (A<sub>4</sub>) & 10.0 t ha<sup>-1</sup> (A<sub>5</sub>)), Farm Yard Manure (@12.5 t ha<sup>-1</sup>) (A<sub>6</sub>), Composted Coir pith (@12.5 t ha<sup>-1</sup>) (A<sub>7</sub>) with Marigold (*Tagetes erecta*) plants. Application of amendments reduced the bio-available (water-soluble



and exchangeable) Cr fractions whereas the organic, organic plus Fe/ Al oxide bound and residual Cr fraction increased on the application of amendments. Among different dilutions of TTE, 25 per cent TTE recorded lower quantities of various Cr fractions whereas it was higher towards an increase in the concentration of TTE (75%). Cr uptake by plants was also higher in unamended soils than the amended. Irrespective of the TTE dilutions utilized in the experiment, inclusion of farm yard manure @12.5 t ha<sup>-1</sup> is preferred for reducing the Cr toxicity in soil and its uptake by plants.

## DEVELOPMENT OF PRE-HARVEST SPROUTING RESISTANT LINES IN MUNG BEAN (*VIGNA RADIATA* L. WILCZEK) BY DISTANT HYBRIDIZATION

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### ABSTRACT

Mung bean is a main legume crop. It is having 25 percent protein content. But the crop is very much susceptible to *in-situ* germination. The pre-harvest sprouting of the mung bean causes significant losses due to sprouting of seeds in pods when the crop is on field. Because of late onset of monsoon subsequently long dry spell, sowing is not done in speculated period, hence the yield is significantly reduced. Due to late sowing, the maturity is also coinciding with heavy rains in September month which results into pre harvest sprouting. Thus, it is very necessary to develop the genotypes which are having dormancy for *in-situ* germination. In present study, an attempt was made to cross wild *Vigna radiata* var. *sublobata* (Accession No. BWM-29) with the cultivated mung bean i.e. *Vigna radiata* (BM-4). But F<sub>1</sub> showed dormancy to this and it had some undesirable characters like short pod length and small seed size. The single plant selections having seed dormancy with long pods were made. The material for present study included 70 mung bean breeding lines. Among the 70 breeding lines, 12 were derivatives of three-way crosses, 12 were derivatives of four way crosses, 41 were derivatives of single crosses derived from inter-specific cross and five were checks which are popular cultivated varieties by farmers. Observations on *in-situ* germination were recorded at the interval of 5 days, 10 days, 15 days, 25 days and 35 days both in field and laboratory conditions. Based on data, total number of 14 derivatives found most dormant. The resistant breeding lines for pre-harvest sprouting found in the study are SPS-10, SPS-42-1-10, SPS-40-1-13, SPS-42-1-8, SPS-42-11-1, SPS-42-1-11-2, SPS-6-1-11, SPS-6-1-25, SPS-6-11-7, SPS-6-23-6, SPS-6-39-19, SPS-6-52-6, SPS-6-52-15 and SPS-6-53-13.

## EVALUATION OF SUPERABSORBENT POLYMER FOR DROUGHT MITIGATION IN INDIAN MUSTARD (*BRASSICA JUNCEA* L.): IMPACT ON GROWTH, PRODUCTIVITY AND PROFITABILITY

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### ABSTRACT

Oilseed brassica is the important group of the oilseed crops in India, playing a crucial role in meeting the edible oil requirements of the country by contributing more than 33% of vegetable oil production. Indian mustard (*Brassica juncea* L.) mostly being cultivated under rainfed ecologies frequently faces drought like situations. This ultimately resulted into poor seed and oil yields due to moisture stress environment coincided with critical growth stages. Accordingly, to enhance the productivity and profitability of the mustard under moisture stress conditions, a field experiment was conducted in a factorial-RBD with superabsorbent polymer (SAP: Pusa hydrogel) and its application rates i.e. 0, 1.5, 2.5 and 5.0 kg ha<sup>-1</sup> under moisture stress and normal moisture regimes. The SCMR, dry matter accumulation and 1000-seed weight were recorded higher under normal moisture regime than the moisture stress regime. Among the SAP levels, the maximum values of these parameters were recorded with 5.0 kg ha<sup>-1</sup> which was found on par with 2.5 kg ha<sup>-1</sup>. Normal moisture regime resulted the maximum oil yield (21% higher), net returns (29% higher) and economic efficiency over the moisture stress regime. Among the SAP levels, the maximum oil yield was recorded with 5.0 kg ha<sup>-1</sup> (1.12 t ha<sup>-1</sup>), being on par with 2.5 kg ha<sup>-1</sup> but significantly higher by 15-30% over the rest of the treatments. Similarly, the maximum net returns (? 74.79 × 10<sup>3</sup> ha<sup>-1</sup>) and economic efficiency (? 519 ha<sup>-1</sup> day<sup>-1</sup>) were also recorded with SAP @ 5.0 kg ha<sup>-1</sup>, though it was found on par with SAP @ 2.5 kg ha<sup>-1</sup>,



but significantly higher by 17-30% over the rest of the treatments. Thus, it can be suggested that use of superabsorbent polymer could be an alternative technology for mitigating the moisture stress and enhancing the mustard productivity and farmer's income in drought prone rainfed area.

## EFFECT OF NUTRIENT MANAGEMENT PRACTICES ON SOIL BIOLOGICAL AND CHEMICAL PROPERTIES IN GROUNDNUT

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### ABSTRACT

For long term sustainability of groundnut production system, optimization of the mineral nutrition through integrated use of all available nutrient sources must be done according to need in the most appropriate way. Nutrient management involves the conjunctive use of chemical fertilizers, organic manures, biofertilizers etc. and assumes great importance recently due to the paucity of fertilizers and need to sustain productivity. Groundnut is an exhaustive crop and removes large amount of macro and micro-nutrients from the soil which cannot be met by single nutrient source. The supply of nutrients through organic and inorganic sources and biofertilizers have been found to be the best option, hence there is ample scope of increasing productivity through combined use of various nutrient sources. Adequate manuring does not only improve the yield but also maintains the soil health and sustains the productivity. This study was carried out to evaluate the effect of nutrient management practices on soil biological and chemical properties of light black soil in groundnut. An experiment was conducted during kharif 2020 in randomized complete block design having seven treatments; T1-control, T2-100% RDF, T3-75% RDF + 5 t FYM ha<sup>-1</sup> + BF, T4-100% RDF + BF, T5-100% RDF + 5 t FYM ha<sup>-1</sup> + BF, T6-125% RDF and T7-150% RDF, and replicated thrice. Recommended dose of fertilizer as 25 kg nitrogen, 50 kg P<sub>2</sub>O<sub>5</sub>, and 30 kg K<sub>2</sub>O ha<sup>-1</sup> was applied in crop. In biofertilizer treatments, seed treatment with DGRC1 culture was done. Soil parameters were analyzed for 0-15 cm soil depth. Significantly higher soil microbial biomass carbon and activities of soil enzymes viz., acid and alkaline phosphatase,  $\beta$ -glucosidase, dehydrogenase and fluorescein diacetate enzymes were observed under application of 100% RDF + 5 t FYM ha<sup>-1</sup> + BF compared to other nutrient management practices. Similarly available nitrogen, phosphorus, potassium in soil, and soil organic carbon was higher under 100% RDF + 5 t FYM ha<sup>-1</sup> + BF.

## KETAMINE-XYLAZINE ANAESTHESIA FOR ORCHIECTOMY IN RABBITS (*ORYCTOLAGUS CUNICULUS*)

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### ABSTRACT

In this study ten (10) healthy male rabbits weighing 1.8 to 2.0 kg body weight were used as a part of recycling and reusing the animal after approval by the Institutional Animal Ethics Committee (IAEC), (vide approval no. - IAEC/C.V.A.Sc/VSR/430 dt. 12. 12. 2020). Their health status was accessed by physical examination, faecal sample testing, complete blood count and were accordingly taken care. These animals were fed on seasonal tender green grasses, overnight-soaked gram (@ 80-100g per animal), dalia, and fresh water *ad libitum*. All these ten rabbits were acclimatized for one week period prior to experimentation. The pre-operative fasting time in all these rabbits was kept for 4-5 hours. Premedication was done with inj glycopyrrolate, @ 0.01 mg/kg SC, five minutes later anaesthesia was induced with injection xylazine @ 4 mg/kg and inj. ketamine @ 40mg/kg IM. The anaesthetic efficacy was accessed by induction time, recovery time, clinical parameters and blood glucose monitoring in each animal of this study. Induction of anaesthesia with ketamine and xylazine was found smooth in all these animals. The mean induction time was 6.19±0.46 minutes in this study. During recovery period slight struggle was observed in three animals, though smooth recovery was observed in rest of the seven animals. Mean duration time of surgery and Mean recovery time were 9.65±0.63 minutes and 22.56±0.96 minutes respectively. The anaesthetic period was found sufficient enough for performing bilateral orchietomy in rabbits in this study. Among clinical parameters rectal temperature (RT) showed a non-significant (P<0.05) reduction at 30 minute and one hour post operatively and thereafter it showed increment in its value and it reached near to its base line value by 24 hours post-induction. Respiration Rate (RR) increased significantly (P<0.05) at one minute of glycopyrrolate and ketamine-xylazine administration. However, its value returns near





to its base line value at five-minute post induction and remain near to its baseline value afterwards. A significant ( $P < 0.05$ ) decrease in heart rate (HR) was observed after five minute of ketamine injection and it remains significant up to 60-minute observation of this study. All haematological parameters in both groups were found within normal physiological reference range except for Hb and PCV parameters. The values of both these parameters were found decreased significantly ( $P < 0.05$ ) at 24-hour interval as compared to baseline value of these parameters. Blood glucose value showed a significant increase ( $P < 0.05$ ) in its value from 60 minutes to 48 hours interval and thereafter it showed a decline and returns to near its base line value by fourth day (96 hours) of observation of this study. It was concluded that ketamine-xylazine produces satisfactory anaesthesia in rabbits underwent orchietomy.

## **SURGICAL MANAGEMENT OF OBSTRUCTION OF RETICULO-OMASAL ORIFICE IN CATTLE**

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### **ABSTRACT**

A clinical case cow of acute tympany reported at Department of Veterinary Surgery and Radiology. History revealed animal has chronic tympany from two month and progressive decrease in appetite. Owner previous day offer grain, after that acute tympany developed. Initially gas removed with 16-gauge needle and animal treated with anti-bloat agent intra-rumenally and orally. After some time tympany again developed, so decided rumenotomy to save the life of animal. By rumenotomy impacted material was removed from the rumen and phytobezoars from the reticulo-omasal orifice. Reticulum was carefully examined for presence of any foreign particle. Animal post operatively prescribed with broad spectrum antibiotic amoxicillin sodium and Sulbactam sodium at the dose rate of 10 mg/ kg body weight intramuscularly for 7 days. Analgesic agent Inj. Meloxicam and paracetamol combination was given at the dose rate of .2 mg/ kg body weight I/M for first day and .1 mg/kg for next three days. Animal was also treated with fluid therapy, neuro-vitamin 10 ml I/M and pre and probiotic agent for three days. Blood sample was found positive for anaplasma species. So animal was also treated with inj. Oxytetracycline 10 mg /kg body weight intravenously with 5 days along with other supportive therapy. Animal start feeding from next day and fully recovered after 15 day. Suture was removed on 12<sup>th</sup> days.

## **YIELD OF AROMATIC RICE UNDER DIFFERENT ESTABLISHMENT TECHNIQUES AND ORGANIC SOURCE OF NUTRIENT**

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### **ABSTRACT**

Aromatic rice holds a key position in India because of their nutty flavour, grain dimension, delicious taste, delightful fragrance, non-sticky and softness. Modern agricultural production system fully relies on the use of synthetic agro-chemicals for boosting crop productivity. At this juncture, an ardent consciousness has been sprung for adoption of organic farming to restrict the entry of toxic chemicals in the food chain. Keeping the above facts in mind a field experiment was conducted during kharif season of 2018 and 2019 at the experimental field of Uttar Banga Krishi Viswavidyalaya, Cooch Behar, West Bengal which was laid out in split plot design having three main plot treatment (ET<sub>1</sub>: Mechanical transplanting, ET<sub>2</sub>: Drum seeder and ET<sub>3</sub>: Farmer practice) and four levels of nutrient management was fitted in the sub plot (NM<sub>1</sub>: 100% nitrogen through vermicompost, NM<sub>2</sub>: 100 % nitrogen through FYM, NM<sub>3</sub>: 50% nitrogen through vermicompost + 50 % nitrogen through FYM and NM<sub>4</sub>: 100% nitrogen through urea @ 50 kg ha<sup>-1</sup>). All the treatments were replicated thrice. Results of the experiment revealed that among the establishment techniques, mechanical methods recorded higher values of yield attribute which resulted into 45% and 29% higher grain yield over drum seeding and manual methods respectively. Among the nutrient management levels, NM<sub>4</sub> recorded higher grain yield of 2.23 t ha<sup>-1</sup> during 2018 which was closely followed by NM<sub>1</sub>, however in the second year all organically amended plots showed superiority in terms of yield attributes and yield over 100% nitrogen through urea (NM<sub>4</sub>). It is concluded that to sustain the aromatic rice production, under the emerging problem of labour shortage, mechanical methods under organic culture would be a possible option.



## DELPHACID PLANTHOPPER COMPLEX IN BAMBOO: AN IDENTIFICATION GUIDE

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### ABSTRACT

Delphacidae is the second largest family of Fulgoroidea superfamily and most economically important group feeds on graminaceous plants. These are group of phloem feeding insects commonly called as planthoppers. The delphacids are easily distinguished by the presence of a large, movable spur on the apex of the hind tibiae. The Bamboo plants have notable economic and cultural significance. It is infested by many insect pests which also include planthoppers. The delphacids infesting bamboo are called bamboo delphacids. The important species infesting bamboo are *Arcofacies securisus*, *Arcofaciella sinuata*, *Bambusiphaga unispina*, *Purohita taiwanensis*, *Purohita taiwanensis*, *Tripidocephala festiva*, *Tripidocephala tuberipennis* etc. These species are known for their complexity like cryptic species, sexual dimorphism, wing polymorphism which leads to miss identification of these planthoppers many times. Although these are different species causing different state of damage there is lack correct identification and identification key guide. To confront this, we attempted exploration and identification of these planthoppers from different parts of India. Through present work we developed identification guide for all these species with detailed description comprising the ratios and photographic illustration of characters for each species male, female, and brachypterous forms. This will serve the purpose of identification and easy information retrieval on bamboo delphacids.

## WEED DYNAMICS AND TRANSPLANTED RICE PERFORMANCE UNDER SOIL MANIPULATION, WATER REGIMES MANAGEMENT AND HERBICIDES APPLICATION FOR SOIL HEALTH

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### ABSTRACT

Field investigations were conducted during 2016 Kharif and Rabi seasons to study the combined influence of tillage, water regimes and herbicides on weed dynamics and crop performance in transplanted rice. The design was split plot with combinations of soil manipulation through tillage operation and water regimes as main plot treatments and weed management practices as subplot treatments. The results revealed that when compared to the conventional farmers' practice of land preparation, the weed dry weight was significantly reduced and the crop performance was superior under intensive tillage (three ploughings followed by puddling). Among the water regimes, continuous deep-water ponding (> 7.5 cm water) either till panicle initiation or grain filling stage suppressed weed growth better than that under the recommended practice of maintaining about 5 cm water level with intermittent drainage. Weed control efficiency (WCE) was maximum under azimsulfuron 35 g/ha applied at 15 DAT, followed by pre-plant application of oxyflourfen + one hand weeding. When compared to weedy check, (bispiribac Na + metamifop) 70 g/ha as well as fenoxaprop-p-ethyl 60 g/ha were also effective but they were inferior to the manual weeding practice.

## NUTRI-SMART VILLAGES IN MOUNTAIN REGION : A NOVEL STEP TOWARDS NUTRITIONAL SECURITY

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### ABSTRACT

Malnutrition is a serious challenge in mountain region of India. Micronutrient deficiencies remain a major problem in these regions. The challenges and issues of nutrition security in mountain areas are different to those in the plains, and need special attention of policy makers and other stakeholders. Due to cultural and geographical variance across states, combating malnutrition requires a granular approach with consideration of multivariate factors pertaining to nutritional aspects. In



Uttarakhand, only 14 % area is under cultivation and about 65 % of population depends on agriculture for their livelihood. Availability of arable land is severely limited and productivity is considerably poor. This low level of productivity in hills is mainly due to non-availability of seed of improved varieties, lack of irrigation facilities, small and fragmented land holdings, shallow soil depth, severe soil erosion, difficult terrain and frequent occurrence of pest and disease infestation in crops. Due to agriculture policies adopted during green revolution, the traditional agriculture with diverse crops and cropping patterns is under great threat all over the country including Uttarakhand. These policies have favored mainly cereal crops over nutritionally rich traditional crops. Studies shows that earlier 30% people were dependent on cereals while 40% were dependent on millets grown locally. Fruits and vegetables used to contribute 20% of which 10% of the food in the form of wild edible fruits and vegetables used to come from forests. These were full of essential nutrients to meet the needs of local village communities. In the post green revolution era, the shift from millets to cereals, poor and incomplete knowledge of traditional farming system, socio-economic issues, urbanization hampered the village's food and nutritional security. Contribution of vegetables, pulses and fruits in daily diet of village people has drastically gone down. A sharp fall in the health and nutritional status of rural mountain people is visible after invasion of other crops. Nutrition-sensitive interventions are those whose primary objective is not only nutrition, but that have the potential to improve the food and nutrition security of beneficiaries. "Nutri- Smart Village" is a scientific approach to provide nutrition using available local resources of farmers in the village through interventions like demonstration, training, awareness and input support. An effort was done by ICAR-VPKAS to conceptualize the model of 'location specific nutri-smart village for high hills of Uttarakhand with nutrition sensitive approaches viz. nutrition sensitive awareness programmes, nutrition sensitive farming to enhance food production, reviving traditional farming, making food basket diverse through nutri-gardens, making food itself more nutritious through inculcation of sprouts and micro greens in diet, nutrition sensitive livelihood options like mushroom production and bee keeping, capacity development programmes and group mobilization for strengthening nutrition. The outcome of the project viz. formation of nutri-sensitive women groups and mobilization for group oriented activities, enhanced production and farm income through improved technical knowledge and skill, promoting crop diversification and consumption of nutritionally enriched food crops, drudgery reduction with the use of technological sound farm implements and reducing in musculoskeletal and postural disorders by reducing occupational related health hazards, entrepreneurship development with location specific technologies with vocal for local may be replicated in other parts of IHR with convergence of Public- Private Partnership development as functional mechanism for Government agencies-Voluntary Organisations- Farmer linkages.

## **DRYING BEADS—A NOVEL APPROACH IN DRY CHAIN TECHNOLOGY**

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### **ABSTRACT**

Even as increasing populations put pressure on food supplies, about one-third of the total food produced for human consumption is wasted, with the majority of loss in developing countries occurring between harvest and the consumer. Controlling product dryness is the most critical factor for maintaining quality in stored non-perishable foods and seeds. The high relative humidity prevalent in humid climates elevates the moisture content of dried commodities stored in porous woven bags, enabling fungal and insect infestations. Mycotoxins (e.g., aflatoxin) produced by fungi in insufficiently dried food commodities affect 4.5 billion people worldwide. The concept of drying products and maintaining their dryness with hermetic storage is called the "Dry chain". Similar to the cold chain. Once dried and appropriately packaged, dried commodities don't require additional cost to maintain their quality and safety. Drying beads are modified ceramic materials (aluminium silicates or "zeolites") that specifically absorb and hold water molecules very tightly in their microscopic pores. The beads will continue to absorb water until all of their pores are filled, up to 20 to 25% of their initial weight. Seeds (or other materials such as fruits or herbs) placed into a container with the beads will lose water due to the low air humidity and will continue to do so until they come to equilibrium. Hence, desiccant-based drying simply transfers the water in the seed to the drying beads through the air without the need for heating. Drying and dehydration is one of the most energy-intensive processes employed within the food processing industry. In fact, these processes account for 15% of the entire energy expenditures within the fruit and vegetable industry. In one way, the drying beads lower energy expenditures by intensifying drying kinetics and removing more water from the air than otherwise possible.



## **ASSESSMENT OF KISAN CREDIT CARD SCHEME ON FARMING ACTIVITIES IN MANIPUR**

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### **ABSTRACT**

KCC is one of the most popular institution short term loan for the resource poor small and marginal farmers. The scheme has also benefited a number of farmers in Manipur also. In order to examine the impact of KCC on farming activities the present study was taken up. The study is based on primary data collected from 3 districts of Manipur covering 5 villages. Primary data were collected from 125 KCC beneficiaries, to compare the result another 100 non-beneficiaries were also selected and interviewed. The average age were 48 years with farming as the main occupation and majority are having education level of middle and high school. 62% beneficiaries were women and have farming as the main occupation with average land holding ranging from 0.55 to 0.74 hectare. The average loan taken by the farmers are Rs. 18179, Rs. 36939 and Rs. 71667 for small, medium and large category respectively. Expenses on travel and visit, stationery, no due certificate and membership fee were the major cost involved in getting KCC loan. Rice is the principal crop grown by both the farmers group. KCC beneficiaries were far ahead in adoption of improved rice variety which account for 66 percent as compared to only 29 per cent for the non KCC beneficiaries. 98% beneficiaries adopted timely sowing, 98 per cent adopted balance use of fertilizer and 41 per cent adopted winter and summer cropping. Beneficiaries account for higher expenses in rice cultivation revealing that more emphasis is given on rice cultivation as they have to repay the loan. The average productivity was higher for beneficiary ie 4.1 tonnes/ ha compared to only 3.01 tonnes for non-beneficiaries. Net return and B:C ratio were Rs. 37,247 and 1.71 for beneficiaries as compared to Rs. 25,604 and 1.60 for non-beneficiaries. 51 beneficiaries have adopted winter and summer crop cultivation with an average earing of Rs. 39,532 as compared to non-beneficiaries with only 6 households with winter and summer cultivation and average earning of Rs. 21300 respectively. Livestock rearing were also done by both the farmers group by rearing pig, poultry and duck as an additional source of income. The repayment of loan was different for both the group among the categories. The outstanding amount were 71 % for beneficiaries as compared to 89% for non- beneficiaries. Repayment level is very low and need to be improved. Garrett ranking technique was used to rank the factors affecting poor repayment of KCC loan. The major reasons in order of priority were low yield, no earning in off season, increase household expenses, crop failure due to natural calamities and high cost of production.

## **GENETIC PARAMETERS ASSESSMENT OF YIELD ATTRIBUTING TRAITS IN FINGER MILLET GERMPLASM COLLECTED FROM HIGHLANDS OF UTTARAKHAND**

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### **ABSTRACT**

Genetic parameters could assist plant breeders in determining breeding methods and selection criteria. The aim of this study was to estimate the components of variance, heritability, and genetic advance for grain yield and related traits in diverse germplasm lines of finger millet collected from highlands of Uttarakhand. The research was conducted at Pantnagarcentre for Plant Genetic Resources, G.B. Pant University of Agriculture and Technology, Pantnagar in Kharif season 2019. Experimental material consisted of fifty-two germplasm lines along with seven standard checks. All germplasm accessions were laid out in a randomized complete block design with three replicates. The results showed significant genetic variability for all fourteen quantitative traits. Phenotypic coefficient of variation varied from 7.17 to 31.40. Genotypic coefficient of variation ranged from 4.21 to 29.35. It was highest for grain yield per plot (29.35) followed by biological yield per plot (24.22). Moderate GCV was recorded for 1000 grain weight (15.62) and finger length (12.63). Broad sense heritability varied from 21.00 % to 98.15%. High heritability values were obtained for 1000 grain weight (98.15), Grain Yield per Plot (87.36), Biological Yield per Plot (78.78), Days to Maturity (70.71), Finger Length (69.53) and Flag leaf blade length (61.17). Whereas, moderate broad sense heritability was recorded for Days to 50% flowering (57.88), Plant Height (46.49), Ear Head length (43.06), Finger Number on Main Ear (43.02), Peduncle length (34.46), Flag leaf blade width (33.78) and Finger width (31.58). High genetic advance was predicted upon selection for the Grain yield per plot (56.51), Biological yield per plot (44.29), 1000 grain weight (32.02) and Finger Length (22.02). High heritability was accompanied by high genetic advance for 1000 grain weight, Grain Yield





per Plot, Biological Yield per Plot and Finger Length indicating effectiveness of selection for these traits from this experiment population.

## A PHYTOPHARMACOLOGICAL VIEW OF GILOE *TINOSPORACORDIFOLIA*

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### ABSTRACT

*Tinospora cordifolia* (Thunb.) Miers, (Guduchi) is one of the important dioecious plants. In Hindi, the plant is commonly known as Giloe, which is a Hindu mythological term that refers to the heavenly elixir that has saved celestial beings from old age and kept them eternally young. Herbal medicines represent one of the most important fields of traditional medicine all over the world. To promote the use of herbal medicine & to determine their potential as a source for new drugs, it is essential to study medicinal plants which have folklore reputation in a more intensified way. This deciduous and dioecious plant belongs to the family Menispermaceae. It is a plant of significant medicinal importance in the Indian system and designated as Rasayana. Its efficacy has been also recognized by the modern system of medicine. The whole plant is used medicinally however; the stem is approved for use in medicine. This is due to higher alkaloid content in the stems than in the leaves. This plant has been known to possess immunomodulatory, hypoglycaemic, antioxidant, anti-hyperglycaemic, antiallergic, anti-inflammatory, diabetes mellitus, hypoglycemia and several other properties also. The plant mainly contains alkaloids, glycosides, steroids, diterpenoid lactones, sesquiterpenoid, aliphatic compound and other miscellaneous compound. Plants have been one of the important sources of medicines since the beginning of human civilization. There is a growing demand for plant-based medicines, health products, pharmaceuticals, food supplements, cosmetics etc.

## NUTRITIONAL BENEFITS OF SESAME SEED

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### ABSTRACT

Oilseeds are sources of energy and nutrition. The main product of oilseeds is oil which finds uses as food fat and also as industrial raw material for development of various oleochemicals. The utility of any oil depends on its quality especially the fatty acid composition. Oil cakes left after extraction of oil are richer in proteins, minerals and vitamins. Some of them are edible while others find use as animal feeds. Sesame seed is an oilseed with a chemical composition of about 50-52% oil, 17-19% protein and 16-18% carbohydrate. Its seed contains about 42-54 % quality oil, 22-25 % protein, 20-25 % carbohydrates and 4-6% ash. The seeds are typically used for oil extraction and the rest are fit for human consumption. The hull contains large quantities of oxalic acid, crude fiber, calcium and other minerals. When the seed is properly dehulled, the oxalic acid content is reduced from about 3 % to less than 0.25 % of the seed weight. Sesame seed contains antioxidants which inhibit the development of rancidity in the oil. In the food industry, where synthetic antioxidants are used extensively, there is an increasing demand for more of these natural products. The nutritional benefits derived from sesame seeds are based on the variety being utilized. These seeds have antioxidant effects, as well as useful in lowering the cholesterol level and prevention of hypertension. Dehulled seeds are directly used in different types of foods like *halva*, *laddu* and *chikki*. They are also eaten whole after roasting. Ready to eat instant foods have been prepared using sesame flour as an ingredient of other cereal, pulse and oilseed flours. Sesame seeds are directly used to garnish bakery products. Sesame flour is used as a methionine supplement. A nutritious beverage can be prepared using 70% soy protein and 30% sesame protein. Many of its distinctive chemical and physiological effects such as antioxidant activities are due to the compounds present in sesame oil that are sesame lignans. Lignans reduce the incidence rates of breast and prostate cancer and reduce serum cholesterol level. Phenolic compounds are extensively distributed in the plants. Sesame seed is the world's most important and ancient oilseed crops with a high level of antioxidants. Sesame oil is a superior vegetable oil and has a pleasant flavor. It ranks second after olive oil with regard to nutritional value. Worldwide, fatty acids composition in sesame oil is variable among the different cultivars of sesame seeds such as black, brown and white. Oil composition of sesame seeds depends on different factors such as climatic situation, soil condition and ripeness of plant. Fatty acids that are present in abundance are oleic (44 %), linoleic (34 %), palmitic (10 %) and stearic (7 %) acids which mutually comprise about 95 % of the total fatty acids. Oleic acid helps to lower



LDL or “bad cholesterol” and increase HDL or “good cholesterol” in the blood. In addition to being an imperative source of oil, sesame seeds also contain significant amount of protein (18-25 %), carbohydrate (13.5 %) and ash (5 %). Protein in sesame seeds has immobilized amino acid profile with good nutritional value similar to soybean. The seeds are also very good source of dietary proteins with fine quality amino acids that are essential for growth, especially in children. Sesame seeds are not only used for culinary purposes due to their nutritive, preventive and curative properties but also used in traditional medicines. The mineral composition of white and black sesame seeds and their hull fractions shows that calcium was the predominant mineral followed by phosphorus, potassium and magnesium. All other elements were present in comparatively low concentrations. With the exception of zinc, iron and magnesium, the minerals were found in higher quantity in black seeds than in white seeds. However, the highest amount of these minerals was observed in the hulls of white and black. Many of these minerals have vital role in bone mineralization, red blood cell production, enzyme synthesis, hormone production as well as regulation of cardiac and skeletal muscle. As a result of the benefits of sesame, seed exportation offers highest potential for farmers due to the demand for the seed.

## NEW RECORDS OF POLLINATOR BEES IN TRIPURA

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### ABSTRACT

Entomophily is indeed the most common type of pollination in angiosperms. The most common insect pollinators are represented by the orders Coleoptera, Diptera, Hymenoptera and Lepidoptera. Honey bees are designated as the major pollinators, pollinating about 66% of the world's 1500 crop species, accounting for 15-30% of food production. Halictid bees are another common group existing on both cultivated and wild flowers. An intensive survey was conducted in Tripura, in North-Eastern region of India during April 2019 for observing the diversity of bee pollinators. Collections were made with malaise traps, yellow pan traps and sweep nets. The collected specimens were brought to the laboratory, processed suitably and identified. Bees could be segregated into 6 different families, viz., Melittidae, Apidae, Megachilidae, Andrenidae, Halictidae and Colletidae. Studies on Halictid bees recorded from India indicated that all 4 sub families of Halictidae viz., Rhophitinae, Nominae, Nomiodinae and Halictinae are represented in Tripura. Perusal of literature revealed that only 25 species under 7 genera have been recorded from North Eastern states with most of the records from Khasi hills (Meghalaya) and a few from Assam. Identification of the collected material during survey resulted in establishment of 7 new records from Tripura, viz., 4 species under genus *Halictus* and 3 under *Lasioglossum*. Apart from Halictidae, sub family Apinae was represented by *Apis cerana indica*, *A. dorsata*, *A. florea* and *A. mellifera* while sub family Xylocopinae was represented by *Ceratinabinghami*, *C. bryani* and *C. smaragdula*.

## CARBON SEQUESTRATION: A WAY TO KEEP THE SOIL ALIVE

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### ABSTRACT

Global warming is a red-hot environmental issue that has arrested the world's attention at present, and it has been affecting life on the planet earth. Carbon dioxide is a major player in greenhouse gases causing global warming. The continuous increase in its concentration in the atmosphere is supposed to be augmented by human deeds such as the burning of fossil fuels and deforestation. For reduction in carbon dioxide concentration in the atmosphere, Carbon sequestration is an approach that places carbon dioxide into a depository in such a way that it remains safely stored and not released back to the atmosphere. Carbon can be sequestered in three ways as geological, ocean, and terrestrial sequestration. In terrestrial sequestration, atmospheric carbon dioxide is captured and stored in plants and soil. Soil is a major source and sinks of atmospheric carbon dioxide. Soil carbon sequestration refers to the storing of carbon in the soil. The awareness of greenhouse gas emissions and concerns about global warming have led to increased attention in sequestering carbon in soils. Improved agricultural practices have great opportunities to increase soil carbon sequestration. The various agri-management practices to sequester carbon in



soils are crop, tillage, residue, nutrient, and agro-forestry management. In the agricultural system, maintenance of soil organic carbon (SOC) has long been recognized as a strategy to reduce soil degradation while at the same time improving soil fertility, water availability, soil productivity, and overall soil health.

## **IMPACT OF SOIL HEALTH CARD SCHEME IN COMMUNITY DEVELOPMENT BLOCK BRIDJMANJANJ DISTRICT MAHARAJGANJ EASTERN UP**

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### **ABSTRACT**

Healthy soil constitute the foundation of thriving ecosystem and societies are directly tied to food and nutritional security, water quality, human health, climate change adoption and biodiversity. Soil is one of the important elements required for farming as it provide nutrient to the plant. Earth needs to be nurtured with mother's care because earth gives us everything for sustainable life so any kind of torture on it is sin. to protect soil for sustainable agriculture. The present study was conducted in community development block bridjmanjanj of maharajganj district, eastern UP. A well-structured and pretested interview schedule was used for data collection. The study conducted out of 93 inhabitant villages. Only 60 villages are benefited with the soil health card scheme. Study with regard to the Impact of the S.H.C. Scheme on knowledge and adoption of recommended doses of soil nutrients and fertilizer of farmer's. Study revealed that 46.16%, 11.54% and only 1.92% card holder improved their wheat, paddy and sugarcane production from poor yield to average and high yield besides in respect to onion and potato 5.76% S.H.C. holder gained an improved from their average and low production to high and average production respectively.

## **ROLE OF KVK IN PROMOTION OF VALUE ADDITION OF PINEAPPLE IN NE INDIA**

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### **ABSTRACT**

Pineapple from North east contributes 50 percent of total pineapple production in India. NE states, Assam (17.44%), Meghalaya (8.51%), Manipur (7.89%), Nagaland (7.81%) and Tripura (7.47%) reserved their position in top ten pineapple producing state in India. Varieties grown in NE India are Kew, Queen, Mauritius. They have good taste and unique aroma, mostly consumed for table purpose. Due to lack of postharvest management huge loss is encountered in glut season, value addition will significantly improve shelf life of product. Simple value-added products like jam, squash, RTS, preserve and candy can increase the economic value and minimize post-harvest loss. Krishi Vigyan Kendra in their village outreach programme can provide capacity building programme to self-help groups of villages to promote value addition of pineapple. Expertise of KVK can be useful for maintaining quality of product, packaging, FASSI registration and marketing in local and e-platforms of the finished products.

## **IMPACT OF INTERVENTION ON HEALTH AND LEISURE ACTIVITIES AMONG ELDERLY**

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### **ABSTRACT**

Five hundred and forty Rural and Urban male and female elderly under the age group of 60-74, 75-84 and 85 & above were randomly selected from Dharwad Taluka. Data was collected through exploratory and personal interview methods. Personal information schedule was used to elicit auxiliary information of the subjects regarding demographic variables. To explore the



health status of elderly, Ageing schedule developed by was used. Socio Economic Status Scale by was employed to assess the SES of the family. On the basis of the results that indicated a large number of elderlies with physical health problems, an intervention programme was conducted on a non-experimental group with a designed educational training program. The impact was assessed through a single pre and post test design. Results showed that 58.50 percent of rural elderly belonged to lower middle SES and 47.40 percent of the urban elderly belonged to upper middle SES. With respect to physical health problems few of the health diseases and health disorders such as Arthritis, Hypertension, Diabetes, Numbness, Asthma, Tremors and Cardiovascular diseases, Joint pain, Knee pain, Poor hearing and Poor vision were present to a greater extent in some of the elderly. Majority of the elderly reported of Going out for walk, involving in religious activities, Visiting friends, Sleeping, Watching TV, Gardening, Listening to music, Caring for grandchildren, Reading, Participating in sports/games, Working part/full time and Participating in community organization regularly. Intervention programme had significant positive impact on the health status and Leisure time activities of the rural male and female elderly who fell in lowest level of physical health and utilizing leisure time in appropriate way, which lead to the better health and better adjustment in different areas.

## **EVALUATION OF INDIAN VARIETIES OF GLADIOLUS FOR FLOWER AND CORM PRODUCTION**

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### **ABSTRACT**

Gladiolus is one of the important flowers among the important cut flowers which are being used as cut flower, bouquet and adornments at different places. Identification of suitable variety for successful cultivation under a particular state or region is most essential. Considering these points, present investigation was planned in Randomized block design. In view of qualitative and quantitative characteristics, spike length (90 cm), number and diameter of floret (17.7 cm), colour (snow white) and placement of floret on spike (formal), as well as vase life (8.59 days). The variety Sancerre followed by Hunting Song, Bindiya was seems to be better for commercial cultivation gladiolus in arid and dry regions like Dhule districts of Maharashtra.

## **EFFECT OF IMIDACLOPRID AND ITS METABOLITES ON SOIL ENZYMATIC ACTIVITIES IN COTTON FIELD AFTER APPLICATION AS SEED TREATMENT**

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### **ABSTRACT**

The insecticide may reduce soil enzymatic activities that act as a “biological index” of soil fertility and biological processes in the soil environment. An experiment was conducted to observe the effect of imidacloprid and its metabolites on dehydrogenase, phosphatase and urease activity in soil under cotton field condition. The total imidacloprid residues were mainly constituted by parent compound imidacloprid and olefin and nitrosimine metabolites. Following the application of imidacloprid @ 3.5 and 14 g a.i. kg<sup>-1</sup> of seed, total residues of imidacloprid and its metabolites were found to be 1.77 and 3.60 mg kg<sup>-1</sup>, respectively on dry weight soil in samples collected after 7 days. Imidacloprid and its metabolites had significant inhibitory effect on overall dehydrogenase activity as compared to the control cotton field with no insecticide application history particularly after 7 days of seed treatment for both the dosages. Application of imidacloprid @ 3.5 g a.i. kg<sup>-1</sup> of seed under cotton field, has stimulatory effect on phosphatase activity as compared to control cotton field. But a significant reduction of 33 and 96 per cent in enzyme activity was observed as compared to control when imidacloprid was applied @ 14 g a.i. kg<sup>-1</sup> of seed after 7 and 15 days of sowing, respectively. Imidacloprid and its metabolites had no significant effect on overall urease activity as compared to the control field. The effect of imidacloprid and its metabolites on different enzyme activity were short-lived and the activities in most cases were recovered within 45 days. But the short-term changes in the enzyme activities may affect soil mineralization.





## COMPARATIVE EVALUATION OF BIOLOGICAL CONTROL AGENTS AND CHEMICALS FOR MANAGEMENT OF SOIL-BORNE DISEASES IN UPLAND AND DESI COTTON

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### ABSTRACT

Root rot and wilt caused by *Rhizoctoniasolani* (Taub) Butler and *Fusariumoxysporum* f.sp. *vasinfectum*, respectively are the major soil-borne diseases in *Gossypium hirsutum* L. and *G. arboreum* L. cotton and cause considerable loss in plant stand and yield. The management of these diseases with chemical fungicides is not long-lasting during favourable conditions with high pathogen inoculum and have chances to create environmental pollution too. We compared biological control agents, their combinations and chemicals for root rot and wilt disease management in *Gossypium hirsutum* and *G. arboreum* cultivars CSH 3129 and CICR-3, respectively, during 2017-18 and 2018-19. Among six *Trichoderma harzianum* isolates Th-11 was found superior in mycelia growth inhibition of *R. solani* and *F. o. f.sp.vasinfectum* (64.4 -100%). The highest plant vigour index in CSH 3129 (*G. hirsutum*) and CICR-3 (*G. arboreum*) cultivars at 15 DAT were recorded with the combined seed treatment of *Trichoderma* + *Pseudomonas* + *Mycorrhiza* (890.9) and *Trichoderma* + *Pseudomonas* (393.5), respectively. The lowest area under disease progress curve (AUDPC) in CICR-3 and CSH 3129 after 90 DAS was recorded with the combined seed treatment of *Trichoderma* + *Pseudomonas* + *Mycorrhiza* and *Trichoderma* + *Pseudomonas*, respectively. Pooled data of two-year field experiments showed that the combined seed treatment with *Trichoderma* + *Pseudomonas* + *Mycorrhiza* reduced 51 and 57.5% root rot diseases in *G. arboreum* CICR-3 and *G. hirsutum* CSH-3129 cultivars, respectively. This was followed by seed treatment with *T. harzianum* Th-11 alone and the combined seed treatment with *Trichoderma* + *Pseudomonas* and were superior to chemical treatment and untreated control.

## INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT USING NANO PHOSPHATIC FERTILIZER ON NUTRIENT USE EFFICIENCY AND YIELD OF WHEAT (*TRITICUM AESTIVUM* L.) IN VERTISOLS

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### ABSTRACT

The field trial study showed that, the highest grain yield (3546 kg ha<sup>-1</sup>) was obtained by application of green manuring of sun hemp + 50% RD of NP through inorganic fertilizers + spraying of 0.5% of 1000 ppm nano P suspension at tillering and flowering stage of Wheat, which is an increase by 6% over green manuring of sun hemp + 100% RDF. Test weight (g), grain yield and straw yield (kg ha<sup>-1</sup>) of wheat recorded highest under GM\* + 50% RD of NP through fertilizer + Foliar spray of 0.5% 1000 ppm nano P suspension at tillering and flowering stage of wheat treatment 42.62 g, 3545.76 kg ha<sup>-1</sup> and 4481.43 kg ha<sup>-1</sup> respectively. Phosphorus uptake by grain and straw of wheat is higher under GM\* + 50% RD of NP through fertilizer + Foliar spray of 0.5% 1000 ppm nano P suspension at tillering and flowering stage of wheat treatment 15.35 and 9.01 kg ha<sup>-1</sup> respectively. Nitrogen, phosphorus and potassium use efficiency recorded highest in treatment T<sub>5</sub> (GM\* + 50% RD of NP through fertilizers + Foliar spray of 0.5% of 1000 ppm nano P suspension at tillering and flowering stage of wheat) 36.76%, 35.82% and 61.24% respectively. Phosphorus use efficiency is recorded in between 13.43 to 35.83 % under the application of RDF alone or in combination of nano P suspension.

## SUSTAINABLE AND ECO-FRIENDLY MANAGEMENT OF CHICKPEA WILT DISEASE

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### ABSTRACT

Chickpea (*Cicer arietinum* L.) is one of the important legume crops grown in world wide. India is a major chickpea producing country, highest production has been received from Madhya Pradesh (39%) followed by Maharashtra (14%), Rajasthan



(14%), Andhra Pradesh (10%), Uttar Pradesh (7%), Karnataka (6%) and remaining state contribute about 10 per cent. Several factors contributed towards chickpea low yield but the pathological constraints are the most devastating. Chickpea wilt caused by *Fusarium oxysporum*, a soil-borne disease. *Fusarium* wilt of chickpea is prevalent in almost all chickpea-growing areas of the world and its incidence varied from 14 to 32 % in different states of India. This disease causes yield losses up to 100% under favorable conditions. Management of this pathogen is not possible by adopting a single approach like cultural practices, fungicides, host plant resistance or bioagents and thus shows the necessity to integrate management packages for controlling this devastating disease. Although fungicides have shown promising results in controlling the pathogen, phytotoxicity and fungicidal residues along with environmental contamination and human health hazards prevent their large-scale use. The use of bioagents having PGPR activities along with vermicompost and foliar spray with Salicylic acid (SA) has shown high level of protection against this devastating disease. The synergistic effects of PGPR, vermicompost, and SA could be used to build eco-friendly and long-term management strategies for controlling chickpea wilt disease.

## BIOCHEMICAL DIVERSITY IN BRASSICA LEAFY GREENS AND SENSORY EVALUATION OF ITS SAAG QUALITY

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### ABSTRACT

The present work deals with comparing nutritional status of edible leaves from twelve Brassica accessions of Indian and exotic origin and its exploration as a diet for humans. A wide variation was recorded for crude protein (6.41 to 18.08%), glucosinolates (9.34 to 28.44  $\mu$ moles/g), phytic acid (7.23 to 12.05%), chlorophyll (11.54 to 22.15 mg/g), carotenoids (1.18 to 2.59 mg/g), ascorbic acid (50.64 to 115.58 mg/100 g), total antioxidants (1.74 to 4.82 mg/g), total phenols (3.38 to 8.15 mg/g) and carotene (16.23 to 63.53  $\mu$ g/g) content. Out of twelve, 3 of the promising accessions, namely, PAU Chinese Cabbage, KPT 9 and Saagsarson were identified to have rich antioxidative profile with low quantity of antinutritional compounds. A significant difference in the compositional pattern of key minerals was observed in the accessions. The brassica leaves accumulated significantly higher contents of Ca and Fe among all macro- and micro-nutrients. In addition, leaves of GSC 7 was considered a good source of Ca (859.25 mg/L), K (187.05 mg/L), Mg (81.59 mg/L), Fe (4.95 mg/L), and Zn (0.65 mg/L). The presence of less concentration of antinutritional factors such as glucosinolates (10.04  $\mu$ moles/g) and phytic acid (8.32%) in leaves of GSC 7 might be effective in enhancing the mineral absorption from the soil. Organoleptic evaluation of saag prepared from the leaves of these Brassica plants was conducted by a panel of ten judges using 9-point Hedonic rating scale test. The results revealed that the maximum overall acceptability was shown by Saagsarson, China sarson 1 and PAU Chinese Cabbage No. 2. Our findings, conclusively suggest that our local Brassica leafy greens viz., PAU Chinese Cabbage No. 2 and Saagsarson are good source of nutrients with high overall acceptability as diet and thus their consumption could be encouraged.

## ECO-FRIENDLY AND PROFITABLE INTERCROPPING SYSTEM FOR MANAGEMENT OF SAP FEEDERS IN SESAME

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### ABSTRACT

Sesame (*Sesamum indicum* L.) is perhaps the oldest oilseed known and used by human beings. Sesame is described as the "Queen of oilseeds" because it contains high oil (38- 54 per cent), protein (18-25 per cent), calcium, phosphorous, oxalic acid and excellent qualities of seed oil and meal. India is a world leader in area, production and export of sesame. However, the productivity is low in India as compared to world's average. Among various factors responsible for the low productivity levels of sesame, the insect pests, usually inflict very severe damage to the crop directly by feeding and indirectly by transmission of virus and mycoplasma diseases. In view of deleterious effects of sole dependence on chemicals, eco-friendly avenues like intercropping needs to be explored, which bring about desirable changes in micro climate of crop canopy favouring



suppression of pests. Field experiments were executed to investigate the impact of intercropping on sap feeders for three consecutive years. Lowest mean thrips population recorded was 3.87 per plant in sesame intercropped with green gram and 4.14 per plant with finger millet. Minimum population of leaf hoppers was registered in sesame with intercrops, green gram and finger millet (2.77 per plant) and similarly lowest population of aphids were also recorded in sesame intercropped with finger millet and green gram (5.16 and 5.23 per plant). The highest population of thrips (6.74 per plant), leaf hoppers (4.54 per plant) and aphids (8.47 per plant) were recorded in sole sesame crop. Results pertaining to yields revealed that, sesame intercropped with finger millet has achieved highest average System Equivalent Yield of 285.7 kg/ha during followed by sesame+greengram (241.9 kg per ha), whereas, average yield of sole sesame was 186.5 kg/ha. Upon comparison of the benefit cost ratio (BC ratio), the sesame+finger millet proved to be the most profitable with BC ratio of 2.48 followed by sesame+greengram (2.18) in comparison to sole sesame (1.39).

## STRATEGIES FOR PROMOTING BIOFORTIFIED CROPS/FOODS FOR NUTRITION AND HEALTH: EXTENSIONISTS PERSPECTIVE

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### ABSTRACT

Agriculture have always been searching for new ways to target the most prevalent conditions like malnutrition, anemia and undernourishment in India. Because of its agrarian domain, the reach of agricultural varieties targeting important nutritional factors are more as compared to other domains such as to incorporate diverse dietary habits and fortified processed foods. Though they have been found very well complimenting to each other but the reachability lags at many levels. Introduction of new biofortified varieties with several vitamins and minerals is now proved to be a very effective means of delivering essential nutrients to all parts of a country. As a forward step towards the same, this research study has been carried out in which several strategies were highlighted for promoting biofortified crops/ foods for better nutrition and health. These strategies were called out from the focus group discussions with experts and review of literature and other related subject experts. They were then ranked on a scale of 5 to 1 (Most relevant to non-relevant) according to the importance of their effectiveness in the present Indian scenario from the perspective of extensionists (N=200) and farmers (N=3200). Further to filter the irrelevant strategies, these shortlisted strategies were further studied by a senior multidisciplinary panel of judges to determine their relevancy for subsequent screening for inclusion in the final list and to obtain relevancy percentage, relevancy weightage and relevancy scores for all the statements was calculated using standard formulae. The lists were then analyzed using Modified Fuzzy Analytical Hierarchy Process to prioritize and rank the most important strategies.

## INVASION OF RUGOSE SPIRALING WHITEFLY, *ALEURODICUS RUGIOPERCULATUS* MARTIN (HEMIPTERA : ALEYRODIDAE) IN EASTERN INDIA

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### ABSTRACT

Biological invasions by non-native species are considered to be a major threat to agricultural production, biodiversity, and livelihood security. Currently, exotic whitefly, *Aleurodicus rugioeperculatus* Martin (Hemiptera: Aleyrodidae), commonly known as the rugose spiraling whitefly (RSW), is wreaking serious havoc in agriculture and forestry ecosystems in the Eastern part of India particularly in Odisha. Frequent roving surveys in Bhubaneswar and surrounding area revealed that this serious pest has established its population in more than two dozen crops including fruit, vegetable, plantation, ornamental, and avenue crops. Both immature and adult stages were found to colonize on the abaxial surface of leaflets and sucking the phloem sap abruptly. Subsequently, the secretion of the copious amount of honeydew facilitates the growth of sooty mold (*Capnodium* sp.), which affects the photosynthetic process. Incidence pattern could easily be recognized due to its spiral pattern and white flocculent matter. Its infestation was noticed on diverse host plants (*Mangifera indica* L., *Anacardium occidentale* L., *Annona squamosa* L., *Syzygium aqueum* Alston, *Syzygium jambos* L. Alston, *Syzygium cumini* L. Skeels, *Averrhoa carambola* L., *Cocos nucifera* L., *Areca catechu* L., *Roystonea regia*, *Acacia auriculiformis*, *Amaranthus tricolor*, *Solanum torvum* Swartz, *Zea mays* L., *Trichosanthes dioica* Roxb., *Musa* sp., *Aegle marmelos* L. Correa, *Hylocereus undatus*, *Ficus*



*benghalensis*, *Caricapapaya* L., *Zizyphus mauritiana* Lam., *Artocarpus heterophyllus* Lam., *Codiaeum variegatum* L., *Psidium guajava* L., *Ficus religiosa*, *Manilkara hexandra* (Roxb) Dubard, and *Polyalthia longifolia*) with low to high levels of infestation. Installation of yellow sticky traps and spraying of neem oil (1% concentration) with 2% starch solution were found effective for its management. Besides, regular monitoring and timely management are suggested to check its further spread. The present study would be very helpful in creating awareness about RSW among various stakeholders and developing its sustainable management strategy.

## CASHEW FRUIT DEVELOPMENT AND THE BIOCHEMICAL CHARACTERIZATION OF CNSL FREE MUTANT

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### ABSTRACT

Cashew (*Anacardium occidentale* L.) is an important tree nut crop. It is grown in over 30 countries; it ranks third in the international market among edible tree nuts. Cashew fruit (nut) is a drupe, which is attached to the expanded pedicel called as cashew apple. Cashew kernels are a rich source of nutrients important for human health. The understanding of fruit development and its physical modulations and compositions is limited in cashew. In the current study, we attempt to describe the developmental stages of cashew fruit (nut and apple) and the physical modulations occurring during fruit development. Besides, biochemical characterization of CNSL free mutant (NRC-116) for phenolics, carbohydrates, kernel oils and antioxidants are carried out in comparison with popular cultivar Bhaskara. Dissection analysis of the developing cashew nut and apple suggested that in the initial phase (i.e., BBCH 701-709), the nut develops at a faster rate and attains the full size while cashew apple grows slowly and in the later phase (i.e., BBCH 811-819), the cashew apple grows at faster phase to attain its full size in about two week's time. Analysis of physical modulations (length, breadth and weight) of developing cashew nut and apple showed that both follow different growth and maturity curves. The size and weight of cashew apple increased continuously during the development and showed an upward curve whereas the size and weight of nuts in different developmental stages showed a sigmoid curve. Evaluation of CNSL contents in the developing nuts (i.e., BBCH 701-819) of six genotypes showed that the CNSL biosynthesis is in the log phase during BBCH 705-709 stages. In CNSL free types (NRC116 and NRC188), no CNSL was found at all the stages of fruit development confirming defect in the CNSL pathway. Further, the biochemical analysis of cashew nut kernel, shell and leaves of Bhaskara and NRC116 suggest that synthesis of phenolics (secondary metabolites) in different parts of the plant are significantly affected in CNSL free genotype whereas the other components such as carbohydrates and fatty acids (primary metabolites) are not affected compared to the CNSL containing types.

## RURAL DEVELOPMENT APPROACHES AND STRATEGIES IN INDIA

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### ABSTRACT

Rural Development is a multi-dimensional phenomenon. Close examination of rural development administration in India reveals that, there are many agencies such as the Government, Corporate Sector, Cooperatives, Self-Help Groups, Voluntary Agencies and NGOs are involved in this process. The term 'rural development' is a subset of the broader term development. The term rural development connotes overall development of rural areas with a view to improve the quality of life of the rural poor. In this sense, it is a comprehensive and multi-dimensional concept, encompassing the development of agriculture and allied activities, village and cottage industries including crafts, socio-economic infrastructures, community services and facilities, and above all, the human resource development in rural areas. India has a very long history of experimenting with various approaches to rural development. Even in the pre-independence era, a number of rural reconstruction experiments were initiated by the nationalist thinkers and social reformers. Well known among them were the 'Gurgaon' Experiment of





F.L.Brayne (1920), the Marthandam Experiment of Spencer Hatch (1921), the Srinikethan Experiment of Poet Rabindranath Tagore (in the 1920s), the Sevagram Experiment of Mahatma Gandhi (1933), the Firka Development Scheme (1946), and the Etawah Pilot Project of Albert Mayer (1948)<sup>11</sup>. Besides these experiments by social reformers and missionaries, various departments of the Government-agriculture, cooperative, irrigation, health, education- also tried in their own way to resolve rural problems falling within their respective jurisdiction.

The policies that are formulated to bring about rural development are required to incorporate the components, which have been stated as Environmental Conditions, Technology, Infrastructure, Self-Reliance, Law and Order, Education, Training Programs etc.

## EFFECT OF PHOSPHORUS AND BORON ON YIELD AND YIELD ATTRIBUTING COMPONENTS OF MUNGBEAN

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### ABSTRACT

The experiment was laid out in a Randomized Complete Block Design (RCBD) with sixteen treatment combinations having three replications. The results indicated that the crop responded significantly to phosphorus and boron in respect of growth and yield such as plant height, number of branches plant<sup>-1</sup>, pods plant<sup>-1</sup>, pod length, number of seeds pod<sup>-1</sup>, 1000 seed weight, seed yield, stover yield, biological yield and harvest index. In the combination of phosphorus and boron, all the parameters were significant by influence. The highest seed yield (4.98 q ha<sup>-1</sup>) was obtained from 60 kg P ha<sup>-1</sup> followed by 40 kg P ha<sup>-1</sup> (4.70 q ha<sup>-1</sup>) and 20 kg P ha<sup>-1</sup> (4.47 q ha<sup>-1</sup>) while the lowest seed yield (3.98 q ha<sup>-1</sup>) was obtained from the control plot. In case of boron application, the highest seed yield (4.45 q ha<sup>-1</sup>) was obtained from both treatment i.e 1.5 kg B ha<sup>-1</sup> and 2kg B ha<sup>-1</sup> followed by 1.0 kg B ha<sup>-1</sup> (4.17 ha<sup>-1</sup>) whereas the lowest seed yield (3.98 q ha<sup>-1</sup>) was obtained from the control plot. The highest seed yield (5.12 q ha<sup>-1</sup>) was obtained from the combination of 40 kg P ha<sup>-1</sup> × 1.5 kg B ha<sup>-1</sup> while the lowest seed yield (3.98 q ha<sup>-1</sup>) was obtained from the control plot. The results suggest that mungbean crop may preferably be fertilized with a combination of 40 kg P ha<sup>-1</sup> × 1.5 kg B ha<sup>-1</sup> to obtain maximum seed yield in the agroclimatic condition of the study area.

## NUT AND KERNEL CHARACTERISTICS OF ALMOND (*PRUNUS AMYDALUS* BATSCH.) CULTIVARS UNDER TEMPERATE CONDITIONS OF KASHMIR

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### ABSTRACT

Investigations were carried out on ten almond varieties to study their nut and kernel characteristics planted at Dryland Agriculture Research Station (DARS), SKUAST-Kashmir. Maximum nut weight (2.40 g) and nut length (43.16 mm) was recorded in IXLand Merced respectively, however nut breadth was maximum in Primorskij (18.66 mm). Kernel weight was recorded highest in merced (1.10 g) along with kernel length (26.80 mm), whereas minimum kernel breadth was registered in Drake and Shalimar (9.00 mm). Minimum values for nut weight (1.75 g) and nut length (29.66 mm) was recorded in Non pariel and Mukhdoom respectively. Maximum shelling percentage (58.28%) was recorded in Non pariel. Primorskij had papery shell with light kernel and shell color.



## EFFECTS OF CLIMATE CHANGE ON PLANT DISEASE SCENARIO

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### ABSTRACT

Climate change is the realist and biggest threat of the present century. It is affecting natural and agriculture ecosystems throughout the world (Stern 2007). It's already contributing to the death of nearly 400,000 people a year and costing the world more than US\$ 1.2 trillion, thus wiping 1.6% annually from the global GDP (McKinnon, 2012). Climate change is the result of the acceleration in the increase in temperature and concentration over the last 100 years. During the period, the global mean temperature has increased by 0.74°C and atmospheric concentration has increased from 280 ppm in 1750 to 400 ppm in 2013. Such changes will have a drastic effect on the growth and cultivation of the different crops on the earth. Simultaneously, these changes will also affect the reproduction, spread and severity of many plant pathogens, thus posing a threat to our food security. Climate change is also putting stem rust resistance due to Sr31 under threat of Ug99 race of stem rust caused by *Puccinia graminis* sp. *tritici*. Elevated temperature and concentration is also posing higher threat perception of late blight (*Phytophthora infestans*) disease of potato and important diseases of rice, namely blast (*Piricularia oryzae*) and sheath blight (*Rhizoctonia solani*). Climate change has also led to some of the severe epidemics in all over the world. It has not only increased the biotic stresses of plant but also increased the cost of their management. Climate change has both positive and negative effect of crop diseases. However, little work has been done to model the effects of climate change on plant disease epidemics (Garrett et al., 2006). Changing weather can induce severe plant disease epidemics, which threaten food security, if they affect staple crops and can damage landscapes, if they affect amenity species.

## INNOVATIVE AND RECENT APPROACHES FOR NUTRIENT MANAGEMENT IN CASHEW

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### ABSTRACT

Cashew (*Anacardium occidentale* L.) is a tropical nut crop introduced to India and being extensively cultivated along the east coast and west coast regions apart from some plains and north eastern regions. The low productivity of cashew in India is mainly due to low care and attention given to the crop apart from the fact that most of the cashew plantations are raised on highly eroded landscapes. Most of the cashew growing soils are low in soil fertility in terms of nitrogen, base status, cation exchange capacity and micronutrients such as zinc and boron. The studies indicate that adequate nutrient management practices can improve yield of cashew. Proper nutrition is essential for the growth and development of crops. The nutrient management for the crop should be need based addressing the growing needs of the crop. The information and communication technologies (ICTs) can be used for accurate information delivery. For empowering the growers for arriving at the location specific nutrient requirement based on the actual field conditions, a software and mobile app on nutrient management was developed. Moreover, for in-season correction of nutrient deficiency, leaf analysis based nutrient management protocol utilizing the diagnosis and recommendation integrated system was developed. The use of recent technologies shall be beneficial to address the nutrient management issues in cashew.

## CROSS SPECIES TRANSFERABILITY OF CORIANDER FUNCTIONAL DOMAIN-SSR MARKERS IN FENNEL

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### ABSTRACT

Fennel is one of the valuable seed spice crops having a good export potential to boost national economy. It has prime importance in medicinal and nationwide market but crop is still underutilized and lack of novel breeding strategies. Based on the functional annotation terms and domains associated with disease resistance, five FDM-SSR markers validated in coriander



varieties and cross species transferability was confirmed in five fennel germplasm lines. The successfully amplified SSR products were scored manually as '1' (presence) and '0' (absence) as per SSR amplified. Genetic similarity matrix was obtained and cluster analysis was performed using NTSYSpc-2.02i software by selecting Jaccard's coefficient and UPGMA with bootstrap value 1000. Among them, five primers showed polymorphism and produced total 49 alleles in fennel. Dendrogram was generated using UPGMA clustering method. Primer-pairs, ACorSGD-1, ACorSGD-2, ACorSGD-3, ACorSGD-4 and ACorSGD-5 showed alleles and confirmed transferability in fennel. Our results indicates that the primers designed for coriander is showing good transferability in fennel crop and can be used in disease resistance confirmation during germplasm line molecular characterization and can be a good set of primers as asset to molecular biologists, breeders and seed spices scientists. These FDM-SSRs might be used for classifying different species in fennel and even different seed spices from the same family.

## **KNOWLEDGE LEVEL AND ADOPTION BEHAVIOUR OF BACKYARD POULTRY FARMERS IN NORTH AND MIDDLE ANDAMAN DISTRICT**

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### **ABSTRACT**

The present study examined the skill level of twenty-four backyard poultry farmers in Dukenagar village of North and Middle Andaman. In this study, questionnaire consisting of a total of twelve different questions on best practices in backyard poultry farming were used to assess the skill level of the participants. Primary data collected through personal interviews and observations at the farmer's field were analysed using descriptive statistics. It was revealed that few respondents in Dukenagar village (8%) had improved Vanaraja breed. None of the respondents in Dukenagar were using artificial incubation technique for hatching of eggs. Results also revealed that insufficient technology input (96%), infectious diseases (86 %), predation problem (84 %) and non-availability of training programmes (80 %) were the severe constraints in affecting adoption of scientific practices in backyard chicken in the village. Based on the survey results, the training and demonstration activities were undertaken for respondents in Dukenagar village (n=24). Evaluation of knowledge level of participants for the best practices in backyard poultry farming revealed increase in knowledge level after the training programme. The results on demonstration on backyard farming of Vanaraja birds indicated higher growth performance of birds compared to local chick population. The benefit cost ratio after the demonstration for backyard farming of Vanaraja was 2.18 compared to local backyard chickens which was only 1.30. It was noted that percent change in adoption of best practices in backyard poultry farming was highest for separation of sick birds (56%) followed by deworming (42%), storage of eggs in refrigerator (38%), rearing of Vanaraja birds (29%), vaccination (25%), artificial incubation (25%), use of litter material (21%), artificial brooding (13%) and night shelter (8%). In conclusion, the programme contributed to increase in knowledge and skill level of participants on scientific practices in backyard poultry.

## **SOIL MANAGEMENT OPTIONS FOR RESOURCE CONSERVATION IN LOWER SHIVALIK REGION**

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### **ABSTRACT**

A field experiment was conducted from 2009-10 to 2016-17, to assess the effect of tillage, residue and brown manuring practices on resource conservation, soil quality and crop yield, in maize (*Zea mays* L.) - wheat (*Triticum aestivum* L.) sequence. Six treatments were implemented which comprised of (T1) Conventional tillage; (T2) Deep tillage once in three



years; (T3) Conventional tillage with integrated nutrient management; (T4) Conventional tillage with brown manuring in maize + cowpea (1:2) and wheat+ pea (4:1) ratio; (T5) Conservation tillage; and (T6) Conservation tillage with brown manuring. The tillage management practices were compared for their effect on resource conservation and selected soil quality indicators. As compared to control (T1), 80% reduction in soil loss, 22% increase in soil organic carbon, 85% increase in microbial biomass carbon and 28% increase in soil available nitrogen was recorded with the treatment T6. In surface soil, the soil organic carbon (%) was 0.62, 0.71, 0.69 and 0.73 under CT, CT-BM, CST, CST-BM treatments respectively. In surface soil, the microbial biomass carbon ( $\mu\text{g/g}$  soil) was 182, 328, 385 and 461 under CT, CT-BM, CST, CST-BM treatments respectively. The highest percentage of macroaggregate was recorded under CST-BM system, followed by CT, CT-BM and lowest in DT. Mean soil available nitrogen varied from 180 to 333 Kg/ha, and the brown manuring systems significantly increased soil available nitrogen due to incorporation of leguminous plant residues. The treatment T6 (Conservation tillage with brown manuring) have been found to be the best in terms of resource conservation and sustainable crop production.

## **BREEDING COLE CROPS FOR NUTRACEUTICALS AND BIOACTIVE COMPOUNDS**

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### **ABSTRACT**

Vegetables play a vital role in food and nutritional security. Cole group vegetables such as cabbages, broccoli, cauliflower, Knolkhol and Kale are known for their glorious supply of vitamins, minerals, nutraceuticals and bioactive compounds. Brassicaceae family vegetables provide a decent supply of the many health-promoting and probably protecting phytochemicals as well as vitamins, minerals, phenolics, carotenoids, and glucosinolates. Incorporating these potent plant-based compounds in our daily diet guards against several of today's commonest and fatal cancers of that nearly 30-40 % directly joined to improper diet and connected factors. Nowadays, customers find it hard to please nutrient-rich merchandise for health optimum advantages. The scientific proof confirms various medical properties for the treatment of chronic diseases like fatness, type-2 diabetes, vessel diseases (hypertension, cardiac stroke and high blood pressure) and cancer. Thus, enhancing these nutraceuticals and bioactive compounds through conventional and modern breeding approaches have extended prospects regarding their use for helpful effects on human nutrition and health worldwide. This paper reviews the available literature on nutraceuticals and bioactive compounds from edible crucifers, their health-promoting helpful effects and their doable role in impartation defense against diseases particularly, cancer.

## **A STUDY ON ECONOMIC IMPORTANT TRAITS OF INDIGENOUS SAHIWAL CATTLE**

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### **ABSTRACT**

Livestock is an important and integral part of agriculture sector and plays an important role in the national economy and in the socio-economic development of the country. Cattle are the most important livestock in India and play vital role in agriculture related economy. Among them Sahiwal is considered as the best milch dairy breed of the country and is well adapted to the tropical and sub-tropical conditions of Indian sub-continent. Their special characteristics like disease resistance, adaptability to harsh climatic conditions and ability to sustain on poor quality roughages. The present study was conducted on 105 Sahiwal cattle in 2020, which were maintained under All India Coordinated Research Project (AICRP) on cattle Sahiwal (DRU) at instructional dairy farm, G.B.P.U.A. & T., Pantnagar. The semen of proven bulls from Progeny tested sires of superior genetic merit provided by CIRC (ICAR), Meerut/ NDRI, Karnal is being used to inseminate females of university farm. The performance record of Sahiwal cattle maintained at Instructional Dairy Farm at Pantnagar University were utilized to estimate means of economically important traits. It was found that the overall average age of first calving, lactation milk yield, lactation length, peak yield, dry period, service period, calving interval, wet average and herd average were  $1176.33 \pm 24.86$  days,  $1878.37 \pm 67.39$  kg,  $269.44 \pm 7.36$  days,  $12.15 \pm 0.23$  kg,  $140.18 \pm 7.89$  days,  $153.88 \pm 6.65$  days,  $422.75 \pm 7.89$  days,  $7.14 \pm 0.27$  kg and  $4.55 \pm 0.17$  respectively.





## COCONUT BASED CROPPING SYSTEMS FOR HIGHER PRODUCTIVITY AND SUSTAINABILITY

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### ABSTRACT

Coconut (*Cocosnucifera*L.) belonging to family Arecaceae is the only known leading species of the genus *Cocos*. It is one of the most beautiful and profitable palms in the world. Under suitable conditions, fruit yield should be at a monthly duration throughout its life span. Due to its versatility in producing different commodities, the coconut is aptly named “Kalpavriksha or Tree of Heaven”. Coconut mono-cropping goes against the practice of efficient utilization of natural resources. It provides very low income to the farmers even with an optimum planting density, as a large area under the plant canopy remains unutilized. Weeds growing in this unused area compete with the palms for moisture and nutrients and as a result of which plant could not produce satisfactory yield. Therefore, coconut-based intercropping systems could be practiced for the efficient utilization of natural resources and getting additional income on a sustainable basis. The intercrops aim at increasing the production and productivity from the given piece of land. During the initial years of coconut cultivation, the sunlight intensity is high and is not utilized completely by the plantation, however, the sunlight and other resources are used efficiently when intercrops are grown. About 4000 to 7000 roots are found in middle-aged palms. Hence, the active root zone is confined to approx. 25% of the available land area and the remaining area can be profitably exploited for raising of intercrops or multi-tier crops. Hence, we should follow CBFS. Coconut based cropping/farming systems, involving cultivation of compatible crops in the interspaces of coconut and integration with other enterprises like dairy, poultry and aquaculture offer considerable scope for increasing production and enhancing productivity per unit area, time and inputs by more efficient utilization of resources like sunlight, soil, water and labour. Intercropping is considered profitable as it enhances the regular employment opportunity to family labours thereby meeting their increasing daily requirements. The main objective of employing intercrops was greater utilization of soil resources available in the interspaces of the fruit trees and for additional income by raising additional crops. The farming system is diversified by intercropping cash crops, such as cacao, coffee, banana, pineapple, guava, etc. and changing to multi-storied cropping systems, can generate much higher returns. CBFS also helps in Carbon sequestration, as Coconut acts as a sink for the CO<sub>2</sub>, thereby helping in mitigating climate change. So, Coconut based cropping systems are indeed essential for a sustainable approach towards the ecosystem, as it ensures increase in production and quality of the produce, as well as enhances the soil quality. CBFS is quite essential for Climate mitigation purpose, as it plays a major role in preventing global warming. The biomass generated due to this cropping system can be recycled back to the soil by converting it into readily available forms, which in turn enriches the soil.

## UTILIZING POTENTIAL OF MILLETS AS NUTRI-CEREAL UNDER CLIMATE CHANGE SCENARIO IN INDIA

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### ABSTRACT

India has been bestowed with huge diversity and wide choice of crops. Green revolution one hand made the country self-sufficient for food grains on other hand it reduced the area and diversity of many minor crops to a great extent. In this current scenario with changing climatic conditions, escalating population and unrestricted use of natural resources, there are lacking of resources to provide nutritious food to all. Besides the staple rice and wheat; Neglected and under-utilized plant species are those crops that could be the key to sustainable agriculture in most developing countries facing a resource crunch as well as rapid depletion of natural resources. Millets are one of the major underutilized crops with a Nutri-cereal potential. The major group of crops includes small millets (finger millet, foxtail millet, barnyard millet, little millet and *kodo* millet) pseudo-cereals (grain amaranth, buck wheat and chenopodium). Millets are highly nutritive, non-acid-forming, gluten-free and having dietary properties. Millets are Nutri-cereals and rich in carbohydrates, dietary fibres, energy, essential fatty acids, proteins, vitamin-B and minerals such as calcium, iron, magnesium, potassium and zinc, which helps to prevent from post-translational diseases like, diabetes, cancer, cardiovascular and celiac diseases, etc. Millets help in controlling blood pressure, blood sugar level and thyroid but in spite of these functional properties, millets consumption is still declining. Small millets besides being an excellent food crops they provide nutritious fodder for animals. Small millets leaves are broad and the



plant picks up good growth in short time and thus produces voluminous fodder. Small Millets fodder is highly palatable and can be used for making hay or silage. Its fodder is considered superior to rice and oat straw because of high protein and calcium content. Barnyard millet straw contains up to 61% total digestible nutrients and good amount of protein and digestible fibre. Pseudo-cereal is very important in view to provide unique nutritional attributes and developing contingent plan for erratic weather conditions. These crops have been successfully deployed in different parts of the country including remote and tribal areas for securing nutritional and food security. In hilly state Uttarakhand, improved varieties of finger millet, barnyard millet and grain amaranth along with improved packages of practices were found most effective and enhancing yield more than 42 % compared to traditional practices. Similarly, in Koli hills of Odisha, tribal areas in TamilNadu and different parts of Karnataka different small millets have successfully deployed as a viable alternative against erratic weather situations. Thus, these crops can be well deployed in planning of contingent planning for erratic weather situations, crop diversification, dual purpose crops for ensuring food and fodder supply and fighting against hidden hunger due to its unique features. This paper presents the current status, nutritional significance and impact of successful utilization these underutilized crops under changing climate conditions to ensure nutritional and food security.

## **DEVELOPMENT OF PAMPHLET ON BALANCED DIET AND ITS EVALUATION BY EXPERTS**

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### **ABSTRACT**

Health and nutrition are the most important contributory factors for human resource development in the country. A proper diet is essential from the very early stages of life for proper growth, development and to remain active. Use of print media is of greater advantage in all the sectors because of its reliable and scientific information in simple language, well defined subject and pictorial illustrations that reach a larger number of people quickly. Communication with rural people is difficult and challenging task. Hence, a mode of communication required which impacts the mind of target audience through textual as well as visual means. Therefore, pamphlets are considered the effective tools to spread the information and awareness. The study was planned to develop a pamphlet on balanced diet and conduct assessment by experts. In line with this purpose, collected subject matter information and pamphlet was developed by researcher. The pamphlet was evaluated by a panel of ten experts from Food Science and Nutrition and Extension Education and Communication Management Department on a five-point continuum from 'excellent' to 'poor' with scores 5 to 1, respectively. Results reveal that overall mean weighted score of pamphlet was 4.32 out of maximum score 5, which indicate that pamphlet was measured to be very good for all the criteria.

## **DETERMINANTS OF INTENSITY OF ADOPTION OF NUTRI-RICH VARIETIES BY MALE-AND FEMALE-HEADED HOUSEHOLDS**

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### **ABSTRACT**

The intensity of adoption is measured as the ratio of the area under cultivation for the new varieties to the total farm land cultivated. These analyses will help increase the understanding of the factors or variables that influence a household decision to increase the area under production of the varieties promoted by the project. The study was conducted in the Bagpat district of the Uttar Pradesh. Through purposive sampling 100 beneficiary and 100 non-beneficiaries' data were Collected. The results of the Tobit analysis showed that the factors that influenced male-headed households' intensity of adoption were household size, income, farm size, and access to credit. For female-headed households, household size, income, farm size, extension contact, and participation in associations significantly influenced the probability of intensity of adoption of nutri rich varieties promoted by the project. The estimated coefficient of household size was positive and significant at the 5% level for both male-and female-headed households. These results show that, on average, male-and female-headed households who had larger households will increase the probability of intensifying their adoption of nutri rich varieties. The implication of this result is that larger households have the labour that will enable them to increase their level of production. Income also has an estimated coefficient that is positive and significant at the 1% probability level for male-headed households and at the 10%



probability level for female-headed households. The implication of this is that the probability of a household increasing the adoption of nutri rich varieties increases as the level of income increases. The estimated coefficient of access to credit was positive and significant at the 1% level for male headed households. Access to credit is a very important variable because it not only influenced adoption but the intensity of adoption as well.

## INFLUENCE OF DIETARY INCLUSION OF DIFFERENT SPICES ON PERFORMANCE, MEAT QUALITY AND LIPID PROFILE IN BROILER CHICKEN

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### ABSTRACT

The present study was done on one hundred fifty (150) day old broiler chicks of mixed sexes. Spices like *Trigonella foenum-graecum*, *Cinnamomum cassia*, *Zingiber officinale*, *Curcuma longa* and *Coriandrum sativum* were collected and grounded. Feed for broiler birds was formulated after inclusion of the dried processed spices at 1% level and were fed to birds of five different treatment group and control group was given without any spices. The birds were divided into six (6) treatments as T1 (Control), T2 (with 1% *Trigonella foenum-graecum*), T3 (with 1% *Cinnamomum cassia*), T4 (with 1% *Zingiber officinale*), T5 (with 1% *Curcuma longa*) and T6 (with 1% *Coriandrum sativum*) with twenty (25) birds in each group. The experiment was conducted for six weeks. The results revealed that body weight was significantly ( $P < 0.05$ ) different with highest overall (0-6 week) average body weight gain of 1608 gram was observed in T6 (1% *Coriandrum sativum*) group, significantly ( $P < 0.001$ ) highest overall (0-6 week) feed intake of 2307 g was obtained in T5 (1% *Curcuma longa*) group and Significantly ( $P < 0.001$ ) lowest overall FCR of 1.82 in T3 (1% *Cinnamomum cassia*). Highly significant ( $P < 0.001$ ) difference was also observed in the carcass characteristics where Defeathered weight, Eviscerated weight, Dress yield, Breast, Back, Wings and Neck was found to be highest in T6 group, Drum Stick and Thigh was found to be highest in T5 group and highest Giblet was found in T3 as compared to control. Dietary addition of 1% spices had significantly ( $P < 0.001$ ) lowered serum cholesterol, serum triglyceride, serum LDL and VLDL cholesterol, breast and thigh meat cholesterol level while serum HDL cholesterol was significantly higher. Thus, better performance, meat quality and lipid profile of birds were observed and also cholesterol level of meat was reduced with feeding of different spices in broiler birds.

## EFFECT OF FEEDING BLACK CUMIN AND FENUGREEK, EITHER SINGLY OR IN COMBINATION ON EGG YOLK CHOLESTEROL, SERUM LIPID PROFILE, IMMUNE RESPONSE AND CAECAL MICROBIAL COUNTS IN LAYING QUAILS

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### ABSTRACT

The present work was carried out in one hundred eighty white feathered laying quails (*Coturnix coturnix japonica*) of 8 weeks of age to study the effect of feeding black cumin and fenugreek on performance, egg quality traits and egg sensory attributes. The experiment was conducted following 2 x 3 factorial CRD wherein two spices (black cumin seed and fenugreek seed) were fed at three dietary levels (0, 1.5 and 3.0% of each spice) in combination. All the laying quails were distributed randomly into nine dietary treatment groups (T1 to T9) and each treatment has five replications containing four birds/ replication. The feeding trial was conducted for six weeks. The result revealed that dietary addition of black cumin at 1.5 and 3% level on egg yolk cholesterol represent a highly significant ( $P < 0.01$ ) reduction effect of cholesterol in laying Japanese quails at VI week as compared to control birds. Fenugreek addition in diet had a highly significant ( $P < 0.01$ ) effect in lowering egg yolk cholesterol (mg/g yolk) content in Japanese quail eggs in II, IV and VI weeks. Diet added 3% fenugreek at 6 weeks feeding had highest egg yolk cholesterol reduction of 14.77 mg/g yolk. Black cumin showed a significant ( $P < 0.05$ ) effect in lowering liver cholesterol and total serum cholesterol and highly significant ( $P < 0.001$ ) variation were observed in serum HDL of Japanese quails. Dietary addition of fenugreek had highly significant influenced on liver cholesterol, serum total cholesterol, triglycerides, HDL, LDL and VLDL in laying Japanese quails. HA titre in dietary black cumin at 3% level and fenugreek at 1.5



and 3% level were significantly ( $P<0.001$ ) higher as compared control group. Interaction between black cumin and fenugreek showed a non-significant difference for CMI and a highly significant ( $P<0.001$ ) variation in HA titre with highest value in T9 group receiving 3% black cumin and 3% fenugreek. Feeding of black cumin at 1.5 and 3% level had shown significantly ( $P<0.001$ ) lowest TVC, Coliform and *E. coli* growth. No significant change in lactobacillus growth by feeding of black cumin. Other than Coliform, *E. coli* and Lactobacillus, fenugreek had highly significant ( $P<0.01$ ) influenced on total viable count of laying Japanese quails. The interaction of black cumin and fenugreek had no significant difference on cecal microbial growth of laying Japanese quails.

## THE ROLE OF SPECIFIC POTATO VOLATILES IN POTATO-WHITEFLY INTERACTION

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### ABSTRACT

Whitefly, *Bemisia tabaci* (Gennadius), is gradually emerging as one of the major threats in the potato seed production complex in India. Whitefly infestations and the subsequent transfer of viruses are the cause of severe losses in potato production. The most important whitefly-transmitted viruses are the Gemini viruses which include the wide-spread Potato apical leaf curl virus (PALCV). Successful potato production needs seed tubers in which virus infection levels are held below critical thresholds. Because of the critical role of whitefly in transmission of Gemini virus, whitefly needs special attention in potato seed production. Whiteflies are controlled mainly by synthetic insecticides but resistance to these is evolving rapidly. A semiochemical-based management strategy could provide an alternative to the use of insecticides, by exploiting natural volatile signalling processes to manipulate insect behavior. Therefore, in this study we made an attempt to understand the role of specific potato volatiles which elicits electrophysiological response in the whitefly. We collected headspace volatile samples from both healthy, whitefly infested potato plants (variety Kufri Jyothi) and olfactometer assays were carried out to screen for attractiveness to *B. tabaci*. Dual-choice olfactometer assays with headspace volatiles collected from healthy and infested potato plants proved whitefly infested potato volatiles to be highly attractive to *B. tabaci*. Coupled GC-EAG with *B. tabaci* and infested or healthy plant volatile revealed specific compounds that elicited an EAG response. Further, headspace profiles were determined by means of gas chromatography-mass spectrometry. The specific volatile compounds which elicited EAG response from healthy potato plants were identified as  $\alpha$ -Thujene, 2,4,6-Trimethyldecane, Ethyl-benzaldehyde, 2-Butyloctanol and infested potato plants were identified as 2,4-Dimethylheptane, 2-Butyloctanol, Farnesane respectively. *B. tabaci* apparently uses, besides visual cues, specific plant volatile cues for the initial selection of a host. This study opens up huge arenas to evaluate the identified chemical cues for its potential to trap whiteflies.

## LIVELIHOOD SECURITY, DIVERSIFICATION AND ITS DETERMINANTS IN NATIONAL CALAMITY AFFECTED AREA OF INDIA : SUSTAINABLE LESSONS LEARNT FROM PAST TO COMBAT COVID-19

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### ABSTRACT

Kosi River is known as the sorrow of Bihar, India but the devastation of 18<sup>th</sup> August, 2008 was never seen or heard before. 2008 flood is the only calamity in the annals of India to be officially stated as a “National Calamity”. So, the study was purposively conducted in the flood affected region following the exploratory research design, comprising 160 respondents. Livelihood security (LS) Index was used under an exhaustive list of 7 sub-indicators and it depicted that only one sub-indicator i.e. educational security had crossed the barrier of halfway mark, which explicitly suggested improvement possibilities in almost every sub-indicator of LS. Finally, the factors which influenced the LS of the respondents were identified through standardized multivariate regression (SMRA) model. Out of 18 predictive variables only 13 variables were fitted in SMRA model, whose communalities after extraction from exploratory factor analysis were greater than 0.7 in the





preliminary study. SMRA model revealed that dependency ratio, health index, migration, women employment in a household, livelihood diversification, cropping intensity, innovativeness and lean season employment should be given utmost priority in order to boost LS. So, the unemployment crisis arose due to reverse migration during COVID-19 can be tackled if one can explore the livelihood opportunities as did by farmers affected by 2008 calamity. Thus, if administration wants to combat COVID-19 crisis dependency ratio should be reduced moreover high livelihood diversification, women employment in a household, innovativeness and lean season employment should be promoted. Manuscript concluded by proposing recommendations to ensure LS by exploring employment opportunities in alternative livelihoods options.

## **ADOPTION LEVEL OF GOOD DAIRY FARMING PRACTICES IN SELECTED AGRO-CLIMATIC ZONES OF PUNJAB**

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### **ABSTRACT**

The present study was carried out with the objective to measure adoption level of GDFPs among dairy farmers of Punjab. Two agro-climatic zones viz; Central plain zone (CPZ) and Western plain zone (WPZ) of Punjab were selected having maximum number of dairy animals. From CPZ, Ludhiana and Sangrur districts and from WPZ, Tarn Taran and Ferozepur districts were selected purposively based on maximum number of dairy animals, milk production, well-developed infrastructure for dairy development and availability of potential dairy farmers in the respective zones. Majority of the respondents of both CPZ and WPZ were found in the medium category of adoption level of GDFPs and having positive relation with age, education, FES, land holding, livestock holding, milk production, milk consumption, milk sale, total annual income, extension contact and mass media exposure. However, in case of overall adoption level, majority (42.00 %) of dairy farmers in CPZ had high adoption level while in WPZ, most (54.00%) of the dairy farmers had medium adoption level about GDFPs. The Adoption Index (AI) of feeding practices were ranked first in central plain zone respondents with adoption index (50.00) which was followed by health care, management and breeding which were ranked as 2nd, 3rd and 4th rank, respectively. However, in case of western plain zone respondents breeding practices with adoption index (89.33) were ranked first followed by feeding (2nd), management (3rd) and health care (4th). The finding of study concluded that by sensitizing and training of the field functionaries/A.H officials about the GDFPs and strengthening the livestock extension and input services to the doorstep of dairy farmers can further improve the production and reproduction performance of dairy animals.

## **REVIEW OF NANO TECHNOLOGY IN CROP IMPROVEMENT**

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### **ABSTRACT**

In memory of the father of *Nano Technology* Physicist Dr. Richard Feynman. *Nanotechnology* is engineering of Nano scale objects at molecular level, it is study and application of extremely small things that of about 100 nano meters or less than 100 nano meters. Nano means 1 billionth, Nanometer = 1/80,000 diameter of human hair. India ranks 3<sup>rd</sup> number for Research in *Nano Technology* only after China and USA. Indian Agriculture practice is associated with traditional system, Green Revolution, Alternative Farming like "Conservation Agriculture" and "Organic farming" for obtaining smart and sustainable crop production. However, these practices could neither retain Carbon for longer period nor check pollution N<sub>2</sub>, Hence the soil media throughout the world, especially those brought under green revolution or contaminated with harmful trace metals and pesticides residues, since it is not possible practically to eradicate entire soil mass through bioremediation. Hence, at this juncture applying of reengineering top plants for which *Nano Technology* could be a promising one. *Nano Technology* has a potential to revolutionize agriculture system. It has potential role in monitoring crop growth, protecting crops, detection of crop pathogens, increases global production and enhances food security and reduces waste for sustainable intensifications and production of bio-fuels. As per Toxicology studies Nano Tech do not have much more negative impact on Agro environments. Hence Nano Technology is eco-friendly and challenging to accept for the improved crop production. Nano technology in agriculture solves the purpose of Doubling the farmers income by 2022. "My village My Proudh" "Mera Gaon Mera Gaurav" Hence implementation of *Nano technology* is proud for all innovative farmers and progressive farmers.



## AN INNOVATIVE CONTROL STRATEGY OF PEAFOWL IN GROUNDNUT CROP AT TELANGANA, INDIA

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### ABSTRACT

The Indian peafowl *Pavocristatus* Linn, national bird of India is also known as common peafowl or blue fowl or peacock, belongs to the family Phasianidae of class aves and is protected under schedule-1 of Indian wildlife protection act. Indian peafowl is a omnivorous bird act as a bio control by feeding on harmful insects and on the other hand it feeds on crops and causing damage during sowing, seedling and ripening stages of the crops. The extent of damage during sowing and seedling stages ranges between 42-70%, while in ripening stage, the per cent damage ranges between 15-35% in different crops. Due to intensive damage caused by the Peafowl, the farmer's attitude changed drastically and poisoning the seeds with insecticides and fungicides resulting high mortality of Peafowl. To prevent this trend, conducted a study in groundnut crop at farmers field, Rajendranagar, Hyderabad during 2015-18 and developed ecofriendly cost-effective technology. In Ground nut crop, during seed sowing stage, fixing of jute rope around the crop with the help of pegs in 1 m intervals and 1 foot above ground lying the rope in the entire crop in checkered pattern forming squares of 1 m x 1 m to prevented entry of Peafowl into the crop fields to the extent of 93% during germination compared to control 67%. This method is ecofriendly, cost effective and accepted by the farmers to reduce the menace of peafowl.

## CONSUMER PREFERENCES IN PURCHASING FRUITS AND VEGETABLES FROM ORGANIZED AND UNORGANIZED RETAILERS IN NAVSARI CITY

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### ABSTRACT

In India the supply chain of fruits and vegetables is fairly one dimensional and there is very little value-added activity since distribution remains fragmented and unorganized. So, for reducing the wastage in fruits and vegetable sector and providing high share to farmers in consumer rupees there is urgent need for establishing an efficient supply chain that links farmers, retailers and consumers. In this regard this study aims to find the Consumer Preferences in Purchasing Fruits and Vegetables from Organized and Unorganized Retailers in Navsari City. The primary data were collected by survey method with a pre-designed structured questionnaire. The sample size of this study was 100 consumers selected purposively from Navsari city of South Gujarat. The analytical tools employed include tabular analysis and relevancy rating used to rank the factors and retail formats. Also the association between profile of consumers and their preferences of unorganized and organized retail stores was analysed by using Pearson Chi-square test. The data analysis shows that there is a difference between the consumers' perception towards both organized and unorganized retailers regarding purchase of fruits and vegetables. Also it was found that income, gender and education plays a significant role in selecting the different retail formats while purchasing fruits and vegetables. So, it could be concluded that both the organized and unorganized retail stores need to upgrade their facilities according to the requirements of the customers. Also there is need for the development of a robust supply chain which in turn will integrate farmers into the modern retail practices to ensure farmers receive higher prices for their produce.

## EFFECT OF ORGANIC SOURCES OF NUTRIENT ON GROWTH, YIELD AND SOIL FERTILITY OF *ALOCASIA INDIICA*

Ch. Tania, S.S. Roy, Ch. Premabati Devi and T. Basanta

### ABSTRACT

The field experiment on organic nutrient management was carried out at ICAR Horticultural farm Lamphelpat Langol to study the effect of organic nutrient on growth, yield and soil nutrient status of *Alocasiaindica*. The design of the experiment is RBD with three replication and 11 treatments. The result of the investigation reveal the maximum plant height (97.33 cm), number of leaves/plant (5.16), number of petiole/plant (5.36), length of petiole (82.67 cm), length of girth (25.44 cm), leaf length (38.78 cm), leaf breadth (35.61 cm), weight of corm (140.67g), yield/plot (2.87 kg) and projected yield/ha (12.79 t/ha) was



recorded with control (RDF) followed by 100% vermicompost + Azospirillum +PSB + AM which recorded plant height of 93.44 cm, number of leaves/plant (5.22), number of petiole/plant (5.22), length of petiole (81.45 cm), weight of corm (130.00 g), yield/plot (2.76kg) and projected yield/ha (12.28 t/ha) while the minimum plant height (78.02cm), number of leaves/plant (4.33) length of petiole (62.44 cm), length of girth (25.44 cm), leaf length (25.44 cm), weight of corm (97.37 g), yield/plot (1.98 kg) and projected yield/ha (18.81 t/ha). The soil fertility after harvest recorded the highest soil pH (6.18), organic carbon (1.60%), available nitrogen (432.12 kg/ha), available phosphorous (22.80 kg/ha) and available potassium (460.00 kg/ha) was found with the treatment 100% vermicompost + Azospirillum +PSB + AM while the lowest soil fertility status after harvest was recorded with control plot.

## INFLUENCE OF POTASSIUM AND NITROGEN ON TURMERIC (*CURCUMA LONGA* L.) CV. SURANJANA FOR PLANT NUTRIENT CONTENT AND SOIL FERTILITY STATUS IN THE ALLUVIAL PLAINS OF WEST BENGAL

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### ABSTRACT

The field trial was carried out to find out at Horticultural Research Station, Bidhan Chandra Krishi Viswavidyalaya, Mondouri, Nadia, West Bengal during 2012-13 and 2013-14 to evaluate the response of different levels of soil application of potassium and recommended dose of nitrogen and phosphorous along with nitrogen 2% foliar spray once and twice and their interactions on plant nutrient content and soil fertility status after harvest. The design of the experiment was two factorial R.B.D with 8 treatments and three replications. The treatments consisted of four levels of potassium ( $K_2O$  @ 80, 120, 160 and 200 kg/ha) and two spray schedule of N @ 2% as foliar spray of urea to know the role of potassium and nitrogen on plant nutrient content and soil fertility status after harvest. The plant analysis of the leaves of turmeric showed improvement in leaf N, P and K concentration with the application of potassium and nitrogen. The N, P and K content was comparatively highest in  $K_2O$  @ 200kg/ha + N @ 2% double spray, followed by the sole application of potassium ( $K_2O$  @ 200kg/ha). The soil analysis after harvest of turmeric indicated better building of soil nutrient status i.e., N, P and K with the application of potassium and nitrogen. The soil pH (7.07%), organic carbon (0.83%), nitrogen (269.69 kg/ha), potassium (315.11 kg/ha) and water holding capacity (56.10%) was recorded maximum with application of  $K_2O$  @ 200kg/ha + N @ 2% double spray. The phosphorous content of the soil was however recorded maximum with  $K_2O$  @ 160kg/ha + N @ 2% double spray (56.44%), however application of  $K_2O$  @ 80kg/ha + N @ 2% single spray and the showed minimum soil nitrogen, phosphorous and potassium concentration. It appears from the results that application of  $K_2O$  @ 200kg/ha + N @ 2% double spray proved most effective.

## SOUS VIDE : A CULINARY TECHNIQUE TO COOK A HEALTHY FOOD

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### ABSTRACT

Fish and meat is good source of easily digestible protein with proportionate amount of essential amino acids, fatty acids, vitamins and minerals. Fish and meat products are generally cooked before consumption. Cooking i.e. heat treatment makes the food more digestible, palatable and acceptable by enhancing the sensory and nutritional quality. Cooking is also necessary to destroy spoilage as well as foodborne microorganisms for achieving food safety. Generally, the consumers demand for high quality food in terms of tenderness, appearance, flavour and nutrition. Cooking methods are having important effects on all these properties. There are various cooking methods (heat treatments) like frying, roasting, grilling, boiling, steaming are being followed to prepared foods. However, some heat treatments can cause undesirable nutritional loss in food as well as loss of appearance like overcook, uneven heating, moisture loss, shrinkage and hard texture etc. The processor as well as consumers are always in search of a proper cooking methods where food will be in its maximum nutritional value and perfect doneness. Sous vide can be the option for this. 'Sous vide' is a French term which means "under vacuum". Sous vide is a



processing technology in which food is vacuum sealed in a heat-stable, food-grade plastic pouch and then cooked at a gentle temperature in a precisely controlled water bath. Compared to other cooking methods, this method is an interesting cooking alternative as food holds its perfect level of doneness with natural sensory qualities and nutritional value. Sous vide is relatively new form of cooking and getting popularized among new generation. But, modern era of sous vide began in the early 1970s to reduce the product loss of foie gras. In this process, food is mixed with proper ingredients and then tightly wrapped in plastic packets prior to cook in water bath at predetermined temperature. The sous vide food can be consumed directly or can be lightly grilled, or broiled the food to add a crispy, golden exterior layer according to consumer taste. Here, cooking can be done determining the perfect 'core' temperature to achieve the desired taste and texture and preserving maximum of its integrity, flavour and colour. This technique produces results that are impossible to achieve through any other cooking method. So sous vide can be considered as a perfect cooking method and the truth is that meat, fish, vegetables or any other food taste like never before.

## **MECHANISM OF SILICON UPTAKE AND ITS ROLE IN STRESS TOLERANCE IN RICE**

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### **ABSTRACT**

Silicon (Si) is gaining attention as it has been observed to improve plant tolerance against biotic as well as abiotic stresses. However, under favorable conditions, most of the plant can grow without it. Therefore, Si has yet not been fully accepted as essential element rather it is being considered as quasi-essential for plants' growth. Si is also known to enhance resilience in plants by reducing the plant's stress. Besides its second most abundance on the earth crust, most of the soils lack plant available form of Si i.e. silicic acid. Si takes up by plant roots as monosilicic acid  $[\text{Si}(\text{OH})_4]$ , an uncharged molecule and passed through the plasma membrane via two Si transporters, Lsi 1 and Lsi 2, which function as influx transporters and efflux transporters, respectively. Silicon protects rice plants from stalk rot, blast and leaf spot diseases. Silicon solubilizer treatment can reduce stem borer infestation in rice crop. Several key agricultural advantages are associated with Si application such as an increase in plant yield, growth, and production as well as improvement in soil structure. Si fertilization is beneficial for sustainable rice production and also for getting higher income. So, understanding the role of silicon in plant is of great concern. The mechanism of silicon uptake and its involvement in stress tolerance in rice were briefly discussed in this article.

## **ANTHROPOGENIC IMPACT ON THE ENVIRONMENT: ROLE OF BIOTECHNOLOGY IN CLIMATE CHANGE MITIGATION STRATEGIES**

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### **ABSTRACT**

Anthropogenic Impact on the Environment has resulted in global warming resulting in famine, floods and communicable diseases at a rapid pace. According to Smith et al. (2014) climate change affects human health through three pathways (i) changing frequency and severity of extreme weather events, such as heat, drought, and heavy rain (ii) Secondly, climate change's effects can be mediated through natural systems, for instance, by altering the burden and pattern of distribution of vector-, water-, and food-borne diseases. (iii) Finally, climate change may impact health indirectly, via social institutions, resulting in undernutrition, mental ill-health, and even violence and conflict. Climate change and Covid 19 are dual problems of the 21<sup>st</sup> Century. Covid-19 pandemic has delimited the social gathering of people globally. It is important that both the United Nations Environment Programme (UNEP) and the multilateral environment agreements (MEAs) continue to function during COVID-19 to sustain momentum on environmental priorities. A thorough understanding on the environmental consequences of mitigation strategies in communities would assist in preventing and controlling an emerging public health emergency in the future. Carbon dioxide ( $\text{CO}_2$ ) emissions a major Greenhouse gas (GHG) are expected to increase to 35.6 billion metric tonnes by 2020 and 43.2 billion metric tonnes by 2040. Substitution of fossil fuels which are major contributors of greenhouse gases requires that the agricultural and municipal wastes readily available in its towns and cities





are converted to bioenergy. Gene-editing techniques are advancing rapidly, bringing the promise of many biological and ecological benefits, from eradicating human diseases to preventing species extinction. CRISPR-Cas9 is the latest, quickest tool in the genetic editing tool box, allowing extraordinary precision in the manipulation of genomes. Role biotechnology in climate change mitigation shall be reviewed.

## **SUMMER PLOUGHING – AN OPTION FOR SOIL IMPROVEMENT**

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### **ABSTRACT**

Tillage improve'sedaphological conditions such as soil aeration, seed-soil contact, nutrient availability, porosity, pore size distribution, and pest activity. Ploughing a field across a slope with specialised equipment during the hot summer months with the primary goal of opening the soil crust, deep ploughing, and simultaneous overturning of the soil beneath to disinfect it with the help of piercing sun rays is known as summer ploughing. Farm studies revealed that ploughing to a depth more than 12 inches or subsoiling to a depth of about 18 inches, enhanced crop yields, like the response of potatoes to deep summer tillage was more marked on fields that were heavily manured than on those lightly manured. Similarly, Sugar beet usually yielded more if the potash and phosphate were spread on the ground before ploughing. As tillage effects soil physical parameters such as soil moisture content, aeration, temperature and penetration resistance hence it has direct effect on the process of seedling emergence and root growth. Deep summer ploughing was found to be more effective than shallow ploughing in controlling numerous perennial and annual weeds. When ploughing to 9–10 in. depth, it is proposed that much of this gain could be obtained if ploughs were employed that cut a furrow substantially wider than the standard 10½–11 in. furrow, allowing for more complete inversion of the furrow slice. . During the hot summer months, many insects and pests hibernate beneath the soil crust or stubbles. The strong rays of the sun enter the soil as a result of overturning the earth during summer ploughing, killing the eggs, larvae, and pupae of soil borne insects and pests, reducing the risks of insects and pests on succeeding crops. As a result, the farmer's expenses for insecticides and other pesticides have decreased. Although there are several advantages can be harnessed by summer ploughing but in fact, an unnecessary intensive tillage strategy will cause harm to the soil fertility. Therefore, in the operative planning, it is very important to be aware of the actual field conditions for the specific year, and thereby also the infield variations to carryout tillage operations and planning for summer ploughing.

## **BIODIVERSITY - THE LIFE SUPPORT SYSTEM**

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### **ABSTRACT**

India is one of the world's most biologically and culturally diverse countries. Biodiversity represents all life. It also contains two of the world's 25 biodiversity hotspots because of their extraordinarily high levels of species richness, endemism and threatened status. Biodiversity is the variety of plant and animal life in the world or in a particular habitat. Biodiversity is measured by two major components species richness and species evenness. This includes genetic diversity within and between species and of ecosystems. India is one of the mega biodiversity centres in the world and has two of the world's 25 biodiversity hotspots located in the Western Ghats and in the Eastern Himalayas. The forest cover in these areas is very dense and diverse and of pristine beauty and incredible biodiversity. Biodiversity has several values such as economical, ecological, ethical, medicinal, aesthetic, social and many more.

## **INFLUENCE OF FOLIAR CHEMICALS SPRAY ON GROWTH, SEED YIELD AND QUALITY IN TOMATO**

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### **ABSTRACT**

A field experiment was conducted at main agricultural research station, UAS, Dharwad during kharif to understand the effect



of foliar suppletion of GA3 (100 ppm), IAA (50 ppm), NAA (50 ppm), 2,4-D (1ppm) ethrel (200 ppm), TIBA (10ppm), DAP (2 %) along with water spray as control on tomato variety Megha on seed yield and quality in tomato. Chemicals were sprayed at 2 stages (50 % flowering and fruit setting stage). Among the stages spraying chemicals at 50% flowering recorded significantly plant height (94.42 cm), No of primary (1.6), secondary (7.3), and tertiary branches (3.8) over spray at fruit setting stage. Among the chemicals GA3 (100ppm) recorded highest height (125.3 cm) and branches. Yield parameters like fruit per plant (35.9), fruit weight per plant (1.71 kg), fruit weight per ha (24.52 t), seed yield (9.66 g/ plant), Seed yield per hectare (124.5 kg), were highest with spraying at 50 percent flowering. Among chemicals GA3 (100 ppm) NAA (50 ppm) showed significantly maximum number of fruits per plant (41.5 and 37.7), fruit yield per plant (2.0 kg) and 1.84 kg, fruit yield per hectare (27.34 t and 24.95 t) and seed yield per plant (12.34 g), and 10.69 g and seed yield per hectare (166.5 kg) and 149.3 kg) compared to other chemicals and control. The seed recovery was significantly maximum with 100ppm GA3. Seed quality traits such as 1000 seed weight (3.81 g), germination (91.22 %), root length (4.67 cm), shoot length (7.96 cm) and vigour index (1150) were significantly highest with these seeds obtained from spraying at 50 % flowering with GA3 spray as compared to NAA spray and rest of chemicals. Experiment results clearly indicated that GA3 100 ppm spray can be applied at 50 percent flowering to get higher plant growth, fruit yield and seed quality in tomato seed production.

## ASSESSMENT OF THE INTEGRATED PEST MANAGEMENT (IPM) MODULE AGAINST PADDY STEM BORER *SCIRPOPHAGAINCERTULAS* WALKER

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### ABSTRACT

Tripura is one of the seven states in the north eastern part of India is primarily an agrarian state. In Tripura, paddy is grown in both plains and hills, cover 78–90% of cultivable areas with hydromorphic clay-rich acidic soils. The major constraints of rice production in Sepahijala district of Tripura is the occurrence of insect pests at various stages of crop growth. Among the various insect pests, yellow stem borer, *Scirpophagaincertulas* (Walker) (Lepidoptera: Pyralidae), is an important pest causing significant yield loss. Therefore, in the present study, the field experiment was laid out in a randomized complete block design to find out the effective management practice for paddy stem borer. Results revealed that IPM plot recorded least dead heart and white head of 7.17% and 4.11 %, respectively, with highest grain yield (4.56t/ha), net return (Rs. 34575/ha) and B:C ratio (1:1.72) as compared to farmer's practice. Thus, cultivation of rice by IPM module is found economically prudent to suppress *S. incertulas* incidence and accordingly to boost up the production.

## IDENTIFICATION OF NUTRI-RICH DONORS IN HEXAPLOID WHEAT (*TRITICUM AESTIVUM* L.)

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### ABSTRACT

Malnutrition is one of the major global health issues, especially for those who live in low- and middle-income countries. Women and young children constitute the most vulnerable group for the protein and micronutrient deficiency. Wheat constitutes nearly one-third of the total cereals consumed in the world. However, major wheat-based diets fail to deliver the required quantity of protein and minerals. Biofortification is one of the most economical and sustainable approach to alleviate micronutrient and protein malnutrition. Bi-parental RIL population derived from a synthetic hexaploidy wheat i.e. synthetic 46 (high grain Fe, Zn, GPC and TGW) and Indian cultivar HD 2932 was used to screen grain iron, zinc and protein content. Population consisted of 188 RILs and two parents was grown in two field replications in randomized complete block design. Twenty-five spikes were harvested randomly and threshed for iron, zinc and protein content analysis. The grain Fe and Zn content was analysed using Energy Dispersive X-ray Fluorescence (ED-XRF) and protein content was measured by infra-red transmittance-based instrument infra-tec 1125. Grain protein, Fe, Zn content was ranged between 9.77-17.78gms, 32.1-55.3 ppm and 36.2-77.5 ppm, respectively. The frequency distribution of all the traits showed continuous variation and transgressive segregants were appeared for all the traits. Positive correlation between GPC and GFeC ( $r = 0.62$ ,  $P = 0.01$ ), GZnC and GPC ( $r = 0.59$ ,  $P = 0.01$ ), and GFeC and GZnC ( $r = 0.55$ ,  $P = 0.01$ ) were found. A total of 15 lines were



identified with high protein, Zn and Fe content. These nutritionally rich lines will be evaluated for the stability under diverse environments and could be utilized as a potential donor to improve the iron, zinc and protein content in the elite breeding material.

## **MARKER ASSISTED STACKING/PYRAMIDING OF DISEASE RESISTANCE GENES FOR DURABLE RESISTANCE IN WHEAT (*TRITICUM AESTIVUM* L.)**

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### **ABSTRACT**

Wheat being a staple food crop is essential for food security. Rust diseases like stem and leaf rust continues to be a serious threat to wheat production at national and international level. In recent years, powdery mildew disease is emerging as a threat to wheat production due to climate change and intensive crop cultivation practices. Development of resistant cultivar is the most economical, reliable and sustainable way to control rusts and powdery mildew diseases. Stem rust, leaf rust and powdery mildew resistance genes viz., *Sr2/Lr27/Yr30*, *Sr24/Lr24* and *Sr36/Pm6* were pyramided using marker assisted backcross breeding approach. Based on phenotypic observations, five populations were selected at BC<sub>4</sub>F<sub>6</sub> with respect to yield traits, leaf and stem rust and powdery mildew reactions. These populations were subjected to molecular marker analyses. Out of the five populations, *Sr2+* was present in all the populations, while *Sr24/Lr24* and *Sr36/Pm6* was present in the fourth and fifth population. The identified population carrying *Sr24/Lr24*, *Sr36/Pm6* and *Sr2+* genes were stabilized at BC<sub>4</sub>F<sub>7</sub> generation. The use of gene stacks/pyramids of major (*Sr24/Lr24* and *Sr36/Pm6*) and minor gene (*Sr2+*) that confer resistance to most of the pathotypes of stem rust, leaf rust and powdery mildew could impart durability and sustainability to the cultivars than single gene deployment.

## **IMPACT OF COVID-19 PANDEMIC ON NON-AGRICULTURAL MIGRANT LABOURERS**

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### **ABSTRACT**

The COVID-19 pandemic has created an unprecedented scenario in the whole world. The virus has infected about 190 million human beings and claimed more than 4 million lives across the world. In India, more than 30 million people are directly infected and number of casualties crossed four Lakh due to COVID-19. Further, the pandemic has hampered all sectors of the economy significantly. At one point of time during 2020, the GDP growth rate went down up to -24 % which is the largest GDP contraction ever. The pandemic largely affected the lives of industrial labourers and daily wage workers who lost their jobs and forced for migration back to their native places. There are estimated more than 10 million people migrated in the country during COVID-19. In our country, most migrants in the state originate from Uttar Pradesh and Bihar followed by Rajasthan and Madhya Pradesh. In fact, these are the estimates only, there is hardly any authentic data of migrants available with Government. The COVID-19 resulted in a sharp rise in unemployment across the country, hunger and starvation, exodus to hometowns and villages and dearth of skilled labourers for the industry. Keeping this scenario in mind, the RVSKVV, Gwalior has organised a webinar on Rehabilitation of Non-agriculture Migrant Labourers due to COVID-19 Pandemic: Challenges and Opportunities during June 2020. More than 1000 professionals from agriculture & allied areas and stakeholders from other relevant fields have participated from across the country. Out of total participants, 313 participants registered their feedback in the form of suggestions on such a burning issue of current importance. The webinar has six important sessions including skill improvement training activities for migrant labourers, Role of ICAR in rehabilitation, FPOs and its prospects for migrant, initiatives of NABARD & other banking organizations and role of SAUs and KVKs in reengaging them into agriculture and allied livelihood. The participants were largely satisfied with the subject of the webinar. They were keen to know the alternate entrepreneurial options for resettlement in their natives. Participants also suggested that the KVK and agricultural universities need to take lead in making functional strategy for rehabilitation of such workers. It was also highlighted by the participants that a decentralized development approach/model needs to be promoted by the Government to elude such a large human displacement.



## PERFORMANCE OF HIGH YIELDING VARIETIES OF SESAME DURING EARLY KHARIF IN NELLORE DISTRICT OF ANDHRA PRADESH

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### ABSTRACT

Rabi rice crop is being harvested in the months of March & April in Nellore district of Andhra Pradesh in India. Farmers are cultivating only rice in Early Kharif in an area of 40,000-60,000 ha. However sometimes, due to insufficient irrigation water availability during Early Kharif, this rice area is being drastically reduced. In the absence of irrigation water through canals, farmers are keeping their lands fallow. Due to unavailability of water in canals for Early Kharif, farmers are interested in cultivation of temperature tolerant and low water requirement crops like sesame. Hence an experiment was conducted during E. Kharif, 2020 at Agricultural research station, Nellore to evaluate high yielding sesame varieties at different dates of sowing. The experiment was conducted in split plot design with three dates of sowing as main plots i.e., D<sub>1</sub>: May II F.N, D<sub>2</sub>: June I F.N, D<sub>3</sub>: July II F.N, and four varieties of sesame as sub plots i.e V<sub>1</sub>: Madhavi, V<sub>2</sub>: YLM 11, V<sub>3</sub>: YLM 17 and V<sub>4</sub>: YLM 66 and replicated thrice. The results indicated that sowing of sesamum during May II F.N recorded significantly highest seed yield (961 kg/ha) followed by June I F.N (758 kg/ha). The lowest seed yield (561 kg/ha) was recorded at June II F.N sowings. Among the varieties tested, YLM 66 recorded significantly highest seed yield of 856 kg/ha which in turn on par with Madhavi (808 kg/ha) followed by YLM 17 (724 kg/ha). YLM 11 recorded the lowest seed yield. Highest B: C ratio (2.88) was recorded when sowing was taken up during May II F.N and YLM 66 (Sarada) variety recorded highest B: C ratio of 2.57.

## DEVELOPMENT OF EDIBLE COATING FOR FOOD APPLICATION

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### ABSTRACT

Edible coating extends the shelf life of fresh horticultural produce. It acts as a barrier to environmental factors (like moisture and gases), prevent undesirable changes and thus provide safe food to consumer. A perishable food with health benefits often ends up being wasted due to their susceptibility towards microbial spoilage causing organism. In the present investigation, Food coating has designed using a combination of chitosan (shrimp shell) and guar gum (Guar pods). Five different concentrations were selected to check the potential and efficacy of coating material. Fig is highly perishable fruit and to maintain its texture and nutritional value is very challenging. To observe the effect of coating material during storage, sample were kept at refrigeration (4±1°C) as well as ambient temperature (30±1°C) and evaluated for its mechanical, chemical and microbial properties. Obtained results indicated that edible coating has extended the shelf life of fig more than 8 days at refrigeration condition compared with uncoated.

## IMPACT OF DIFFERENT LEVELS OF PLANTING DENSITY AND FERTILIZERS ON GROWTH AND YIELD OF TISSUE CULTURE BANANA CV. NEY POOVAN (AB) UNDER HILL ZONE OF KARNATAKA

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### ABSTRACT

The experiment was conducted in tissue culture banana cv. Ney poovan (AB) to evaluate the influence of three planting density and levels of fertilizers was laid out Factorial Randomized Block Design with two replications on growth and yield parameters of banana. The results of growth and yield parameters discovered that, as influenced by different levels of spacing, plant density and fertilizers on plant and ratoon crop of banana significantly recorded maximum with plant distance S3-4.0 x 2.0 m with D<sub>1</sub>- single plant per pit and higher fertilizer F<sub>3</sub>-150%. The maximum pseudostem height and leaf area index of plant and





ratoon crop was recorded in  $S_1$  (310.26 and 304.47 cm) and (2.93 and 2.56) and plant density in  $D_3$  (310.44 and 309 cm). The pseudostem girth, number of leaves, functional leaves and leaf area was recorded maximum in  $S_3$  (61.91 and 59.50 cm), (18.16 and 16.97), (11.45 and 10.77) and (14.66 and 12.71  $m^2 plant^{-1}$ ) and in plant density was  $D_1$  (62.61 and 60.18 cm), (1839 and 1732), (11.92 and 11.13) and (15.45 and 13.37  $m^2 plant^{-1}$ ) of plant and ratoon crop. The maximum yield per ha was recorded in  $S_1$  (40.77 and 38.31 t/ha) and plant density in  $D_3$  (43.44 and 42.64 t/ha). The yield attributes like bunch, clump yield, hand and finger weight was recorded maximum in  $S_3$  (11.11, 21.63, 1.08 kg and 67.96 g) and (11.04, 21.51, 1.04 kg and 66.30 g) and in plant density was  $D_1$  (11.53, 25.08, 1.12 kg and 69.20 g) and (11.13, 24.60, 1.06 kg and 67.87 g) of plant and ratoon crop, respectively. Whereas in fertilizer ( $F_3$ ) was recorded significantly maximum yield in plant crop (34.26 t/ha). However, the interaction effects the highest yield per pit was recorded in  $S_3D_1$  (4.0 X 2.0 m with single plant per pit) by plant and ratoon crop (12.13 and 11.92 kg), which was on par with  $S_3D_1$  (11.83 kg and 11.65 kg),  $S_2D_2$  (11.54 and 11.01 kg),  $S_3D_2$  (11.39 kg and 11.51). In clump yield per pit and yield t/ha was recorded highest in  $S_3D_3$  (30.28 and 29.85 kg) and ratoon crop (37.31 t/ha).

## **BIO-FORTIFICATION TO MINIMIZE HUNGER AND MALNUTRITION**

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### **ABSTRACT**

In total, more than two-thirds of the world population suffer from at least one micronutrient deficiency, where women and children are disproportionately affected. Malnutrition is an alarming problem in the world. While providing enough calories, monotonous diets based on cereals and other starchy staple foods often fail to provide sufficient quantities of essential minerals and vitamins like iodine, iron, zinc and vitamin A and thus create a “hidden hunger” of micronutrient malnutrition. Hidden hunger is insidious. It strikes people who, on the outside, may appear to be consuming an adequate amount of food, mainly staple crops grown on small family farms. Yet, the calories of many staple crops disguise an invisible hunger that affects the health and wellbeing of people living on the margins. Hidden hunger describes a condition of under nutrition where the body lacks essential vitamins and minerals that keep people healthy. Over two billion people worldwide are affected by hidden hunger. Bio fortification is the process of breeding nutrients into food crops, provides a comparatively cost effective, sustainable, and long-term means of delivering more micronutrients. This approach not only will lower the number of severely malnourished people who require treatment by complementary interventions but also will help them maintain improved nutritional status.

## **EDIBLE VACCINE : THE FUTURE WAY OF VACCINATION**

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### **ABSTRACT**

Enhancing immunity through vaccines are conventional way to fight against various diseases and immunizing human being with edible plant parts is an evolving way with countless potential. The selected or desired foreign antigen of any pathogen is inserted into selected host plant by using various transforming techniques to create a transgenic plant, which can use as edible vaccine. As compared to conventional vaccines, edible vaccines are economic feasible, easy to store and use, show very less amount side effects and retain many more benefits. In order to protect our self against attack of foreign antigen, strong immunity is must and to develop antibodies, immune system is highly specific. To improve immunity T-cells, White Blood cells and plasma play most important role. Vaccine is a compound which introduces small or safe level of antigen to human body for the purpose of creation of antibodies against specific antigen for future protection against that particular foreign antigen of any pathogen. Conventional vaccination use parenteral vaccines in which Modified live-virus (MLV) and inactivated vaccines can be produced in cell culture, using either primary cells or continuous cell lines (WHO). As an alternative Edible Vaccines might be use to overcome demerits and potential hazards of Parenteral vaccines. Edible vaccines are economical, easy to use and store, bio-friendly and widely accepted in developing countries. Oral application of edible vaccines are very useful to enhance immunity of large population with comparably less affords as diseases like Hepatitis and Diarrhea.



## FTHERAPEUTIC EFFICACY OF *DALBERGIASISSOO* AND *AEGLEMARMELOS* COMBINATION ON ALTERED HAEMATOLOGICAL PARAMETERS IN DIARRHOEIC CALVES

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### ABSTRACT

Neonatal calf diarrhoea is the most common cause of morbidity and mortality in pre-weaned dairy calves, causing huge economic and productivity losses to dairy industry worldwide. The leaves of *D. sissoo* and dried fruit pulps of *A. marmelos* have astringent property and reduce irritation in the digestive tract thus have antidiarrheal activity against many microbial agents. Hence the present study was conducted to evaluate two therapeutic regimens for their efficacies on altered haematological parameters in calf diarrhoea caused by *E. coli*. Each of the drug regimens was tried separately on a group of 8 diarrhoeic calves with one group (Group II) calves being administered combination of methanolic extract of *Dalbergia sissoo* @ 1000 mg/kg b. wt. and aqueous extract of *Agelemarmelos* @ 200 mg/kg b. wt. till recovery or maximum of 5 days with parenteral fluid therapy and second group (Group III) calves being administered combination of methanolic extract of *A. marmelos* @ 200 mg/kg b. wt. and aqueous extract of *D. sissoo* @ 1000 mg/kg b. wt. till recovery or maximum of 5 days with parenteral fluid therapy. Efficacy of therapeutic trials was evaluated on the basis of improvement in the clinical profile and return of altered haematological parameters towards normalcy (i.e. at par to the values in the healthy control calves of Group I). The haematological profile study showed that the treatment groups (II and III) had Mean  $\pm$  SE values of Hb, PCV (per cent), TEC ( $10^6/l$ ), TLC ( $10^3/l$ ), neutrophils (per cent) significantly lower ( $P < 0.05$ ) after treatment (6 day) than the pre-treatment (0 day) values with the corresponding groups. The study concluded that the combination of *Dalbergiasissoo* and *Agelemarmelos* was found effective and safe remedy in inducing recovery in diarrhoeic calves with improvement in haematological parameters.

## SEED INVIGORATION : HYDROPRIMING IN LEGUMINOUS VEGETABLE CROPS

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### ABSTRACT

Legume vegetables play an important role in our agriculture production systems. They are used as fresh pod, immature seed and mature dry seed, and majority of them are canned and frozen for international markets. They are also used as green manure and cover crops. The ability of legumes to fix atmospheric  $N_2$  in the crop-soil ecosystem contributes to sustain production system through amelioration of physical, chemical and biological soil properties, as a rotation effect. Pea, cowpea, fenugreek and beans (Indian bean, French bean, cluster bean, broad bean, lima bean, etc) are the important leguminous vegetables grown, throughout the world. The quality of their seeds available in our markets remains poor. Use of such seeds for sowing purpose not only becomes the reason for immense loss to farmers as well as seed corporations, but also has a negative impact on the yield and quality parameters of crop. So, we need an economic and efficient sustainable technique to improve seed quality, which must be feasible to the poorest of the poor farmer. Seed priming technique has been found very effective in improving seed quality and performance. It is the controlled hydration of seeds to a level that allow pre-germinative metabolic activity to continue, but interrupts the emergence of radicle. Change in seed water content, cell cycle regulation, modification of seed ultra-structure, management of oxidative stress and reserve mobilization are the major physiological and biochemical changes taking place during seed priming. Different methods of priming are hydropriming, osmopriming, halopriming, nutripriming, solid matrix priming, biopriming, nanopriming, and hormonal priming. Among all the seed priming methods, hydro-priming is the simple one in which seeds are simply soaked in the water for a definite period of time and dried before sowing. It has been found as an effective tool to improve seed vigour and quality attributes of legume vegetable seeds. Hydropriming hastens and synchronizes the rate of germination in pea and cowpea seeds, improves field establishment in faba bean and French bean, help overcome dormancy and have better weed suppression effects, thereby improving yield attributes. It also modulates biochemical pathways and promotes better biotic and abiotic stress tolerance in pea and broad bean seeds. Since no chemical substances are involved in hydro priming, it is a cheap and eco-friendly method which can be easily adopted by the farmers, at the farm itself. And, being a low-risk technique, it can be utilized by all the growers, irrespective of their socio-economic status and can prove especially useful in dry farming and dry land farming areas. Thus, at present times,



wherein harsh chemicals are being used for treating seeds, to obtain profitable yields, we need to mend our ways to sustainable practices to enhance seed quality. Hydro priming of seeds has proved to be an easy and effective methodology to improve germination and vigour attributes of vegetable crop seeds, especially the legumes. So, we look forward for increased awareness about such techniques amongst vegetable growers so that they would be benefitted and hope for another agriculture revolution, which will be sustainable in our terms.

## **SMART FARMING : DRONES APPLICATION IN VEGETABLE FARMING**

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### **ABSTRACT**

To meet the huge demand of vegetables for the growing population, agriculture needs to be revolutionized by using latest Information and Communication Technologies (ICT). And for this, we need smart farming techniques which can be adopted to grow our vegetables in a sustainable, clean and profitable manner. One such innovative technology includes use of drones in vegetable farming. Drones are the equipment with remotely piloted aircraft systems (RPAS), having a propulsion system, a programmable controller with or without the satellite navigation system, automated flight planning features and capable of carrying payload such as cameras, spraying systems, etc. for accomplishing the given tasks. Using smart bluetooth sensors enabled with drones, farmers can use their smart phones to operate these devices easily. Drone technology has great potential in carrying out several vegetable farming operations very efficiently. It finds its application in soil analysis for field planning, planting seeds uniformly, crop monitoring and surveillance, spraying pesticides and fertilizers on large areas in less time, thereby reducing the contact of humans with harmful chemicals. Drones increase spraying capacity up to 5 times faster than with traditional machinery. Drones are also un-comparable when it comes to spot treatment automated with stress detection technology which uses sensors and cameras and work on them while leaving the healthy parts intact. Adoption of UAV (Unmanned Aerial Vehicles) reduces manual farming labour, allowing detailed observation of the cultivation field being unnoticed below the coverage of clouds, capturing high resolution images of the vegetable fields. These images help in achieving better insights on the growing vegetables, providing more accurate data for better and timely decision making to prevent losses from biotic stresses such as insect pests and diseases, optimizes fertilization, rationalize irrigation and reduce the impact of climate change and unpredictable weather using analyzed insights from data collected. Drones fitted with sensors capable of scanning crops using visible and near infrared light can be used to track vegetable health over period of time and also to monitor response to remedied measures. The lack of availability of agricultural labour in exceptional times of COVID-19 pandemic that has necessitated adoption of social distancing measures has opened up several opportunities for the use of drones in agriculture. However, the value of drones, operational policy, and limited availability of technically trained pilots are specific hindrance in drone market development in India. Government and cooperative societies can play an important role in providing special incentives to help provide drones especially to small and medium-scale farmers who are otherwise reluctant to buy. Custom hiring schemes, training programs for drone operation and setting up of farmer group enterprises should be encouraged. The prospects of using drones in agriculture are immense, especially in vegetable businesses. They help improve production efficiency and get higher yields by identifying problems before they happen with increased crop health awareness and frequency. We hope for a bright future of drone technology in smart vegetable farming.

## **EFFECT OF DRIP FERTIGATION ON GROWTH AND YIELD OF CUCUMBER (*CUCUMISSATIVUS* L.) UNDER POLYHOUSE CONDITION**

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### **ABSTRACT**

The field experiment was carried out during two consecutive seasons of 2020-2021 at Vegetable Research Centre (VRC) of G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar (Uttarakhand) India, to study the effect of NPK fertigation on growth and yield of cucumber under polyhouse condition. The experiment was consisted of four levels of fertigation (120:60:60, 100:50:50, 80:40:40 and 60:30:30 N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg ha<sup>-1</sup>, respectively) and two levels of scheduling (25% of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, 25% N, 15% P<sub>2</sub>O<sub>5</sub> and 20% K<sub>2</sub>O, 40% N, 15% P<sub>2</sub>O<sub>5</sub> and 25% K<sub>2</sub>O, 20% N, 50% P<sub>2</sub>O<sub>5</sub> and 40% K<sub>2</sub>O and 15% N, 20% P<sub>2</sub>O<sub>5</sub> and 15% K<sub>2</sub>O at 20 days interval) i.e. eight treatments with one extra treatment (traditional methods). It



consists total nine treatments. The experiment was laid out in two factorial Randomized Block Design (RBD) which was replicated thrice. The soil of experimental plot was low in available nitrogen and high in available phosphorus and potassium and neutral in reaction. The results from the study revealed that the application of 120% RDF (120:60:60 NPK ha<sup>-1</sup>) which scheduled on the basis of physiological growth stages (25% N, 15% P<sub>2</sub>O<sub>5</sub> and 20% K<sub>2</sub>O, 40% N, 15% P<sub>2</sub>O<sub>5</sub> and 25% K<sub>2</sub>O, 20% N, 50% P<sub>2</sub>O<sub>5</sub> and 40% K<sub>2</sub>O and 15% N, 20% P<sub>2</sub>O<sub>5</sub> and 15% K<sub>2</sub>O at 30 days interval) gave higher crop growth and yield compare to other fertigation and scheduling levels. From the study it was concluded that fertigation of 120 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 60 kg K<sub>2</sub>O ha<sup>-1</sup> scheduled at physiological stages can be recommended for higher growth and yield of cucumber under polyhouse condition.

## APPLICATION OF REMOTE SENSING AND GIS IN AGRICULTURE UDER CHANGING CLIMATIC SCENARIO

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### ABSTRACT

Agricultural production systems are highly vulnerable to variations in climate and soils of different regions and play a vital role in every nation's economy. Agriculture in India is hindered due to small landholdings, inadequate resources and lack of agro-technological information. Under the changing climatic scenarios, agricultural planning and use of agricultural technologies need precise spatio-temporal and crop information for accurate data analyses, forecasts and their effective application in agricultural planning management, sustainability of agricultural resources and ecosystems over different regions.

Remote sensing and Geographic information system (GIS) are important tools to monitor the accurate picture of the agricultural sectors with high revisit frequency and high accuracy to analyze and visualize agricultural environment for sustainable management. RS and GIS play a significant role in the assessment and management of the agricultural activities such as crop acreage estimation, crop growth monitoring, crop modeling, crop yield estimation, soil moisture estimation, soil fertility evaluation, site-specific management, crop stress detection, detection of diseases and pest infestation, water resources, drought and flood condition monitoring, weather forecasting, land use/land cover analysis and precision agriculture for maintaining the sustainability of the agricultural system under changing climatic scenarios and improving the economic growth of the country.

Remote sensing data greatly contributes to the monitoring by providing timely, synoptic, cost-efficient and repetitive information. RS and GIS offer an abundant opportunity to monitor and manage agricultural resources as well as climatic scenarios at multi-temporal, multi-spectral and multi-spatial resolution. It is an urgent need to understand the specialized capabilities of an ever-expanding array of image sources and analysis techniques for agriculture experts. It increases the emphasis on the potential utility of using remote sensing platforms to obtain real time assessment of the agriculture and climatic database. Satellite remote sensing, in conjunction with Geographic information systems (GIS), has been widely applied and recognized as a powerful and effective tool in detecting land use and land cover change. It provides cost-effective multi-spectral and multi-temporal data, and turns them into valuable information for understanding and monitoring the changing pattern of agriculture and climate. Such approaches will enhance the perspectives of using remotely sensed data for digital soil mapping in agriculture sector at regional as well as global level.

## RESPONSE OF MICRO-NUTRIENTS ON YIELD AND ECONOMICS OF LINSEED (*LINUMUSITATISSIMUM* L.) UNDER LIMITED IRRIGATION

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### ABSTRACT

A field experiment was conducted during *rabi* season of 2019-20 at Oil Seed Research Farm of C S Azad University of Agriculture and Technology, Kanpur. The experiment consisted 9 treatments *viz.* T<sub>1</sub>: Control, T<sub>2</sub>: Soil application of ZnSO<sub>4</sub> @





25 kg ha<sup>-1</sup>, T<sub>3</sub>: Foliar application of ZnSO<sub>4</sub> @0.5% at 45 DAS, T<sub>4</sub>: Soil Application of ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + Foliar application of ZnSO<sub>4</sub> @0.5% at 45 DAS, T<sub>5</sub>: Soil application Borax @ 1.5 kg ha<sup>-1</sup>, T<sub>6</sub>: Foliar application of Borax @ 0.3 % at 45 DAS, T<sub>7</sub>: Soil application of Borax @ 1.5 kg ha<sup>-1</sup> Foliar application of Borax @ 0.3 % at 45 DAS, T<sub>8</sub>: Foliar application of ZnSO<sub>4</sub> @ 0.5% + Borax @ 0.3% at 45 DAS and T<sub>9</sub>: Soil application of ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + Borax @ 1.5 kg ha<sup>-1</sup> in soil assigned in randomized block design with three replication. The Linseed cv Shekhar was used in the experiment. The results in significantly maximum seed yield, oil content, oil yield and stover yield, Root development, minimum water use and ultimately higher seed yield and WUE as compared to other corresponding tested treatments indicated that application of ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + Borax @ 1.5 kg ha<sup>-1</sup> incorporated in the soil have fetched highest net return of Rs 52050 having B:C ratio of 3.51 would be quite remunerative for higher productivity along with water use efficiency in light textured alluvial soils of Uttar Pradesh.

## ULTRASONOGRAPHIC CHANGES IN TEAT TISSUE AND SUPRAMAMMARY LYMPH NODES IN DAIRY COWS AFFECTED WITH CLINICAL MASTITIS

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### ABSTRACT

The aim of our study was to examine the ultrasonographic changes in the teat tissue and supramammary lymph node in clinically mastitic dairy cows. Thirty clinically mastitic dairy cows with 120 functional quarters presented at the Large Animal Clinics of GADVASU were examined ultra sonographically. Teat tissue measurements such as overall teat diameter (OTD), teat wall thickness (TWT), diameter at level of Furstenberg (FTD), cistern diameter (CD) and teat canal length (TCL) were recorded. The length and depth of both the supramammary lymph node were also measured. Milk samples were collected aseptically to analyse bacteriological examination and the milk inflammatory parameters (CMT, pH, EC and SCC), and to correlate them with the teat tissue measurements and supramammary lymph node dimensions. Out of 120 quarters, 62 were clinically affected, 18 sub clinically infected and 40 healthy quarters. OTD in clinical quarters was significantly larger ( $p < 0.05$ ) when compared to healthy ones. TWT, FTD, CD and TCL did not differ significantly with respect to quarter health status. OTD could be significantly correlated ( $p < 0.01$ ) with TWT and FTD. CD had a strong negative correlation ( $p < 0.01$ ) with TWT. CMT had a significant correlation ( $p < 0.01$ ) with OTD and FTD. The lymph node had varied dimensions, with a mean length of  $7.80 \pm 0.20$  cm (range 3.49 – 12.7 cm) and mean depth of  $5.35 \pm 0.19$  (range 1.79- 13.4). Significant positive correlation ( $p < 0.01$ ) was present between the length and width of the lymph node and CMT. The quarters with a higher CMT score had larger lymph nodes. A non-significant ( $p > 0.05$ ) positive correlation was obtained between the lymph node dimensions and log<sub>10</sub>SCC (Healthy and subclinical quarters). On comparing the node dimensions with the teat tissue measurements, a significant positive correlation ( $p < 0.01$ ) was obtained between the length, depth and OTD of the ipsilateral side. The study concluded increased OTD and TWT with larger lymph node dimensions in mastitic cows.

## STUDY OF POPULATION DYNAMICS OF MAJOR INSECT PESTS IN SOYBEAN [*GLYCINE MAX* (L.) MERRILL]

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### ABSTRACT

The major producer of Soybean [*Glycine max* (L.) Merrill] is USA, followed by Brazil, China and Argentina. India is occupying fifth place in the world map. The important Soybean producing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Andhra Pradesh and Gujarat. In India, cultivated area of soybean is 114.78 lakh ha with a production of 105.75 lakh metric tons and productivity of 920 kg/ha. In Madhya Pradesh, it is being cultivated in about 54.01 lakh ha area with the production of 57.17 Lakh metric tons and productivity of 1059 kg/ha. In Rewa Division, 0.54 lakh ha area is under this crop and production is 0.38 lakh metric tons and productivity is 715 kg/ha. The crop is infested by more than 275 insect pests on different plant parts throughout its growth stage and about a dozen of them have been reported causing serious damage to soybean from sowing to harvesting. In Madhya Pradesh, soybean crop is attacked by many species of insect-pests viz., white fly, *Bemisia tabaci* Gennadius; green semilooper, *Chrysodeixis acuta* Walker and tobacco caterpillar, *Spodoptera*



*litura* Fabricius; stem fly, *Melanagromyza sojae* Zehn and jassid, *Empoasca kerri* Pruthi etc. Field experiment was carried out during Kharif season at the Instructional farm of JNKVV-College of Agriculture Rewa (M.P) studies include the activity of Girdle beetle {*Oberea brevis* (Swed.); Coleoptera: Cerambycidae} in the soybean crop was recorded from July to October 2017. The maximum girdle beetle population (4.10 rings/mrl) was observed in the 3<sup>rd</sup> week of August 2017 and thereafter fall in population was recorded. The pest showed a negative correlation with the minimum temperature and minimum relative humidity & rainfall but had a positive correlation with maximum temperature and maximum relative humidity. The activity of White fly {*Bemisia tabaci* (Gennadius); Hemiptera: Aleyrodidae} in soybean crop was recorded from July to October 2017. The maximum white fly population (13.40 N&A /plant) was observed in the 3<sup>rd</sup> week of August 2017 and thereafter fall in population count was noted. The pest showed a negative correlation with the maximum and minimum relative humidity & rainfall but had a positive correlation with maximum and minimum temperature.

## EGG DROPPING SYNDROME : CONTAGIOUS WIDESPREAD DISEASE OF POULTRY

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### ABSTRACT

Egg drop syndrome '76 (EDS '76) is a duck adenovirus A induced disease, affects chickens and quail while ducks and geese are observed to be natural hosts of the virus. First reported in 1976 in laying hens, since then become one of important causes of decreased egg production across the globe. The initial outbreaks were linked to a contaminated Marek's disease vaccine, that infected breeding chicken flocks. The virus subsequently spread to other flocks through infected eggs. Droppings contain the virus which can be transmitted horizontally through oral route while vertical transmission is observed via eggs. Infected wild birds can be a contamination source for poultry. EDSV is non-enveloped, providing resistance to many commonly used disinfectants. Sodium hypochlorite (bleach), chlorine dioxide, iodophors, aldehydes and some others have demonstrated efficacy, but may require longer contact times. It has tolerance for wide pH range (pH 3–10) and is also relatively tolerant of heat. However, autoclaving does successfully inactivate the virus. Chickens infected usually observed to lay abnormal eggs, with a variable decrease in egg production. The production can even deduce up to 40%, as birds tend to eat the shell-less eggs. In naive chicken flocks, the first sign is usually a loss of colour in pigmented eggs, followed by the production of thin-shelled, soft-shelled and shell-less eggs. The shells may also be rough or chalky. Duck adenovirus A, its nucleic acids and antigens can be detected in the reproductive tract, especially in the uterus (shell gland), of affected hens. Sometimes, virus may also be occurred in cloacal swabs, and occasionally found in other internal organs. The oviduct and kidneys are frequently reported positive in PCR tests. Currently, there is no specific treatment available but supportive care, including treatment for any secondary bacterial infections, is likely to be helpful in young waterfowl. The virus can enter poultry flock in infected eggs or in apparently infected replacement birds. It is very difficult to detect this virus in infected chickens before they become sexually mature therefore, some countries eradicated duck adenovirus A from breeding chickens or have flocks certified to be virus-free. Uninfected flocks should be kept away from contact with domesticated and wild birds that can be infected, especially waterfowl and their environments. Biosecurity measures, including cleaning and disinfection of any shared equipment, can reduce the risk from mites.

## OVINE PREGNANCY TOXAEMIA : A SEVERE FORM OF KETOSIS

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### ABSTRACT

Pregnancy toxemia is a common metabolic disorder of ewes characterized by low circulating blood glucose and high ketone body levels. This disease observed in animals carrying multiple fetuses, but also seen in single fetus bearing ewes that have undergone substantial nutritional stress. The disease tends to occur in the last six weeks of pregnancy, because this is the time when nutritional intakes are limited and foetal growth, and therefore energy demands, on the ewe are maximal. An unsuit in energy supply and high demand at this time leads to net energy deficiency. At the beginning, the body uses the glycogen stored in the liver to produce glucose, but then switches to mobilising increasing amounts of body fat reserves to make up the deficit, resulting in the production of ketone bodies. Ketone bodies used as an alternative energy supply to glucose, but as ketone



levels increase and glucose levels fall in the body. Hypoglycaemia is usually followed by and due to increased fat mobilisation in the body i.e., fat released from stores to convert into energy. The resulting ketone bodies are used as a source of energy, but excess will result in hyperketonaemia, which in the toxæmic ewe is accompanied by metabolic acidosis. Some of the fatty acids escape oxidation and reconverted into fat, which gets deposited in the liver. Hence, a typical feature of pregnancy is the infiltration of fatty from liver and kidneys, signifying a major metabolic disturbance of the fat and carbohydrate or “fatty liver”. Predisposing factors for the onset of disease includes dietary change, even if that is of improved nutritional quality, may result in temporary inappetence; severe weather conditions or disease in the ewes – such as a high parasite burden or a broken mouth – that may compromise nutrition. Both thin and fat ewes can be affected as thin ewes have less body reserve turn to, on the other hand over-fat ewes tend to feel inappetence as lambing approaches and they have less abdominal capacity for food. Ewes affected by pregnancy toxæmia should be treated without any delay. Severe cases should be humanely destroyed. In the case of general farm problems, review the feeding practices and adjusted to prevent future cases. Ewes should have a good body condition score of around 2.5 to 3 six weeks prior to lambing and at least 2 to 2.5 at lambing. The farmer should group and fed them accordingly in terms of their body score, foetal burden (ultrasound scanning) and expected lambing date. The farmer should also analyse the feedstuffs for their energy and protein levels and calculate their diet based on dietary requirements of the pregnant ewes. Ewes should be fed high quality roughage towards the end of pregnancy. The farmers should also have extra emergency food rations at hand in case of extreme weather conditions. Prior health problems such as foot rot should be treated.

## **FOOD TRIBOLOGY : AN INTEGRATIVE APPROACH FOR FOOD TEXTURE PERCEPTION**

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### **ABSTRACT**

The present-day research in food sensory perception is emerging in the field called Soft-tribology for oral tribological processes. In a food oral processing. Current research indicates that tribology measurements are providing visual percepts into several texture-related sensory aspects. Selecting a physiologically relevant tribological ‘system’ is predominant to the successful application of tribology as an indicator for texture evaluation. The selection of appropriate instrument, surfaces and model food system and the role of saliva, should be cautiously well thought out. Tribology and sensory perception are affected by bigeminal physico-chemical properties. Henceforth combinatory approaches that combine tribology with other characterization techniques are much needed for mechanistic understanding on their inter-relationship. Tribology is never performed alone friction measurements are a purpose of several physico-chemical parameters, including chemical composition, rheology, particle size distribution, morphology and mechanical properties, adsorption, wetting and many more. The effect of each of these variables is contrastive in each lubrication polity, and it also affects the sensory perception. Therefore, thorough characterisation of the food or a kind of model system being used in food system will result in more perceptual interpretations of tribological data in relation to food texture perception.

## **MONASCUS-FERMENTED PRODUCT RED YEAST RICE (RYR) IS A BOON TO CURE DEGENERATIVE DISEASES**

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### **ABSTRACT**

The mold *Monascus* clutches paradoxical regard in the sphere of healthcare. It has been present as an component of oriental medication since from ages. *Monascus*-fermented product red yeast rice (RYR) is being utilized to resolve atherosclerosis,



cancer, diabetes, bone ailments, and a gamut of other inflammations complications. It expatiates mycotoxins such as citrinin, which poses nephrotoxicity, hepatotoxicity, and teratogenicity risks. Also, the threat of the adverse interaction of RYR with chemotherapeutic anti-hypertensive drugs and the immuno-suppressive effects look over. With the unprecedented increase in the instances of cardiovascular diseases, and the awareness of side effects of the conventional statins, which includes myalgia, myositis, hepatic, and renal toxicities, the interest in the *Monascus*-fermented product RYR is flourishing. The advent in analytical techniques has characterized RYR to contain polyketides, unsaturated fatty acids, sterols, pigments, and statins. Monacolin K, which shares configurational familiarity with commercial cholesterol-lowering drug lovastatin, has drawn wide attention. As the refinement of the statins from the dangerous mycotoxins of RYR, and its dosage standardization, might provide a natural source of anti-lipemic nutraceutical, this aspect holds relevance for consideration.

## **STUDY OF DIFFERENT COMPONENTS OF INTEGRATED FARMING SYSTEM AND THEIR MAINTENANCE**

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### **ABSTRACT**

Almost all Indian farmers, in pursuit of supplementing their needs of food, fodder, fuel and finance, resort to adopt integrated farming systems, majority of them revolving around the crops+livestock components. Livelihood of small and marginal farmers, comprising 84% of total farmers, depends mainly on crops or livestock, which is often affected by weather aberrations. The key criteria that influence the selection of acceptable annual crops, trees, and livestock components include soil types, rainfall and its distribution, and the length of the growing season. The selection of IFS components in any farm is also determined by the needs and resource base of the farmers. They are currently unable to reap the benefits of integration due to a lack of scientifically established, economically feasible, and socially accepted adequate integrated farming systems models. Therefore, their farming pursuits are mostly subsistence in nature rather than commercial and, in many cases, unprofitable. As a result, to close the gap between the “required” and the “attained,” and to improve both quantitatively and qualitatively in meeting national food needs, sustaining the agricultural resource base, and providing livelihood security to millions of rural people, a type of agricultural research that goes beyond cropping systems and respects ecosystem integrity while humans interfere.

## **CONSTRAINTS PERCEIVED BY THE GROWERS IN ADOPTION OF RECOMMENDED JUTE PRODUCTION TECHNOLOGY**

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### **ABSTRACT**

Jute (*Corchorus olitorius* and *C. capsularis*) is considered as the “Golden Fiber” of India. It is eco-friendly, biodegradable and is an important oldest cash crop to the farmers. Jute is one of the cheapest and the strongest of all natural fibers and considered as fiber of future. It is used for the making of rope, carpet, hessian, packaging bag or gunny cloth. Global production of jute and allied fibres is around 3.0 million tonnes, 92.5% of which comes from India and Bangladesh alone. India is the largest producer of Jute in the world. The cultivation of Jute in our country is mainly confined to the Eastern states of West Bengal, Bihar, Assam and Odisha. Jute productivity in Bihar state is low as compared to national average due to several problems faced by the jute growers in its cultivation. The present production of jute could be increased considerably if the available technology is effectively transferred to the growers. Our training programmes need to focus more on transferring of new technology from the confines of laboratories and research institute to the farmers and make them result oriented. The study was conducted in Madhepura, Saharsa and Supaul districts of Kosi region in Bihar. One block from each district were selected on the basis of major area under jute cultivation. And from each block, two villages were selected randomly. From each village fifteen respondents were selected thus the total no. of respondents was ninety. The major constraints perceived by growers in





Kosi region were lack of mechanization for post-harvest processing of jute, intensity of flood and drought and lack of well-structured market. The important suggestion given by them were provide good quality seed at cheaper rate, release of flood tolerant varieties, develop mechanization and develop market structure.

## **INDIGENOUS TECHNICAL KNOWLEDGE FOR SUSTAINABLE AGRICULTURE**

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### **ABSTRACT**

Indigenous Technical Knowledge (ITK) is the actual knowledge of a given population that reflects the experiences based on tradition and includes more recent experiences with modern technologies. Indigenous Technical Knowledge means knowledge that is used by farmers generation after generation. It is the traditional knowledge of the farmers in the production, protection and value addition of crops generated by their own and by the local people. Indigenous Technical Knowledge helps to reduce the cost of production by using on farm resources. The integration of scientific and traditional knowledge would help to develop technologies which are need oriented, problem solving, locally available easily acceptable, cost effective, convincing and credible to the farmers. It helps to maintain the ecological balance by using local and organic resources for agricultural production. It reduces the cost of production by excluding chemical fertilizers and pesticides. It plays major role in recycling of crop residues by using the by-products of crops and converting them to usable products. Thus Indigenous Technical Knowledge plays a vital role in creating sustainability and globalizing the local traditions.

## **EFFECT OF NPK THROUGH DRIP FERTIGATION ON VEGETATIVE GROWTH PARAMETERS OF CHRYSANTHEMUM**

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### **ABSTRACT**

A field experiment was conducted during the winter season of 2019-20 at G.B. Pant University of Agriculture and Technology, Pantnagar to study the effect of NPK through drip fertigation on vegetative growth parameters of Chrysanthemum. The experiment was laid out in randomized block design (RBD) with three replications in open field condition. The different dose of NPK (100:150:100 and 75:112.5:75 kg NPK/ha/year) used at three different stages (vegetative, bud and flowering stage) of crop. The maximum plant height, Plant spread, number of branches per plant, length of branches and internode length were recorded in T<sub>3</sub> (100:150:100 kg NPK/ha/year) as compared to control. Thus, it can be concluded that the vegetative growth parameters significantly affect the NPK through drip fertigation.

## **SCENARIO OF BT COTTON IN INDIA**

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### **ABSTRACT**

Cotton is called 'White Gold', is an important commercial crop in India. The major impact in cotton production is its higher susceptibility to pests especially in bollworms. In India, cotton is infested by both Lepidopteran caterpillars and Hemipteran sap-sucking bugs. In India where sucking insects caused substantial damage and it needs to be controlled through insecticides. Hence Bt cotton requires certain control measures for sucking pests in India. Globally, the maximum amount of pesticides was consumed by cotton alone. Bollworms have developed resistance to most of the potent pesticides. To combat this problem, Bt cotton has been developed to control bollworm. Bt cotton contains endotoxin protein inducing gene from soil bacterium



*Bacillus thuringiensis* so it refers to transgenic cotton. Bt cotton was found to be safer to human and animal kind. Bt cotton to minimise the bollworm infestation and reduce the pesticide usage.

## SOIL ORGANIC CARBON - STATUS AND IMPROVEMENT STRATEGIES

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### ABSTRACT

Carbon is essential for plant growth, due to its effects on other soil properties. Organic matter is important since it binds soil particles together into stable aggregates which are necessary for soil structural stability. It is also involved in adsorption of cations, such as calcium, magnesium and sodium, which are important in plant nutrition, and can significantly influence soil water holding capacity, especially in more sandy soils. Soil organic carbon varies with depth. Levels are usually highest in the topsoil and generally decrease rapidly with depth. Organic carbon concentrations in the soil commonly range between 0% and 15% as a percentage by weight but most Australian soils contain levels of less than 5% SOC and 75% of Australian soils contain less than 1% SOC. In many situations the level of organic carbon does not appear to be strongly related to soil types although some soil landscapes are defined by having high organic carbon. Typically it varies as a function of climate and land use. It is usually higher in forest and pasture areas than in cultivated areas. It generally follows continental rainfall and temperature patterns (carbon accumulation increases with increasing rainfall; carbon decomposition increases with increasing temperature - these factors are then influenced by the annual input of carbon to the soil system). The soil carbon levels are the result of the balance between inputs of carbon into the soil, and decomposition and removal of carbon from the soil.

## BIODIVERSITY EMERGING ISSUES AND CHALLENGES

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### ABSTRACT

Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain. Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain. Three different types of biodiversity: -Genetic Biodiversity, Species Biodiversity, Ecological Biodiversity. Loss of biodiversity is a growing trend in virtually all Earth ecosystems. The Millennium Ecosystem Assessment document shows that losses of biodiversity and the related changes in the environment have been more rapid in the past 50 years than ever before in human history (MEA 2005). Many animal and plant populations have declined in numbers, geographical distribution, or both. Species extinction is a natural part of Earth's history. However, the current losses are the outcomes of human actions. Human activities have increased the extinction rate by at least 100 times more than the natural rate (MEA 2005). Rangelands, like other ecosystems, are vulnerable to loss of biodiversity through five major threats: habitat destruction, overexploitation of species, introduction of exotic species, pollution and global warming. Ethical value that all the species have a right to exist. Humans should not cause their voluntary extinction. Biodiversity preserves different cultures and spiritual heritage. Therefore, it is very important to conserve biodiversity. Diversity is depleting at a drastic rate and various programmes on biodiversity conservation are being launched to conserve nature.

## A STUDY OF HUNGER SITUATION IN INDIA THROUGH FORMULATION OF INDIA STATE HUNGER INDEX USING PCA

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### ABSTRACT

World is facing, one of the many terrible problems which is threatening the existence of human being, a cruel hunger. Hunger is directly correlated with food production and supply. Calculation of weights, standardization of the component data and



formulation of four different versions of the hunger index for 35 states of India was carried out. Mean squared error criterion and effect size analysis were adopted for ascertaining the efficiency of the indices. The percentage of children who are stunted in India is the most important component of India state hunger index. On the basis of results of mean squared error, standard error and the effect size analysis of the index versions, the approach of formulating the India state hunger index (ISHI) by assigning weights using principal component analysis to the non-standardized data of the components showed feasible results. According to ISHI, Kerala has the lowest value of 13.81 and Jharkhand has the largest value of the index (30.62). 16 states are categorized as moderate, 18 states are placed in serious category and the value of index for India is 26.05 and categorized in serious category.

## EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON POTATO CULTIVAR “KURFIBADSHAH” UNDER LOW-HILLS OF UTTARAKHAND

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### ABSTRACT

The present investigation was carried out to study the effect of biofertilizers, organic and inorganic fertilizers on the growth, yield and quality attributes on potato cultivar ‘KufriBadshah’ and to find out the relative economics of all treatments under study. The treatments comprised of all possible combinations of two level of nitrogen (i.e. 50 % and 75% N), three sources of organic fertilizers (viz., FYM, Vermicompost and Bonemeal) inoculated with two sources of biofertilizers i.e. Azotobacter and Phosphorus Solubilizing Bacteria (PSB). Results indicates that the nutrient application did not influence the emergence count and leaf area index the potato plants whereas it was quite effective in influencing other growth and yield parameters. A treatment combination of Vermicompost in association with phosphorus solubilising Bacteria (PSB) along with 50% recommended dose of nitrogen resulted in highest plant height, number of tubers per plant, weight of tubers per plant, tuber grade and ultimately the total tuber yield. Potato being a nutrient exhaustive crop responds towards the applied fertilizers. The integration of inorganic and organic sources with fertilizers gives maximum B:C ratio. In terms of net returns, Vermicompost + 50 % N + inoculation with PSB gave a net profit of Rs 10,4008.00 but bonemeal being too costly and FYM application rated are too high thus, lowered down the net profits. Hence on the basis of individual effects of inorganic, organic and biofertilizers it could be concluded that Vermicompost application and tuber treatment with PSB can reduce the nitrogen dose by 50% and producing the tubers having good quality and potential yields, giving optimum returns to the growers as well.

## PREPARATION AND SCREENING OF ROSELLE WINE WITH PAPAYA AND GINGER BLENDS USING YEAST *SACCHAROMYCES CEREVISIAE*

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Vasantrao Naik College of Agril. Biotechnology, Yavatmal

### ABSTRACT

An experiment on preparation of roselle wine with different fruit blends was conducted at Vasantrao Naik College of Agricultural Biotechnology, Yavatmal. during the year 2017-18. The experiment was aimed to prepare quality roselle wine by using different fruit blends and screening thereof for overall acceptance. For the said experiment, roselle juice were used for wine preparation using four different treatments viz., roselle dry wine, roselle sweet wine, roselle papaya blended wine and roselle ginger blended wine. The procedure of wine making for all these wines were developed and standardized at the Biotechnology laboratory of the VNCAB, Yavatmal. Papaya and ginger juice were added in Roselle juice in separate jars to make Roselle: papaya (1:1) and Roselle: Ginger (1:0.5) and Roselle juice in two different sets of flasks for dry and sweet wine. All the samples were set to 25°B except dry sample, set pH and yeast inoculum of *Saccharomyces cerevisiae* to all and kept for fermentation. Periodical rakings were performed to obtain clear wine. These wines were screened for different biochemical compositions and evaluated for overall acceptance using 20 points scale suggested by Amerine, *et al.* 1972 at 30 days of fermentation. Among all the wines, papaya blended roselle sweet wine was found most suitable for wine making as scored maximum points for overall acceptability i.e. 16.4 and categorized as good quality wine. However, roselle sweet wine with 14.2 points score categorized for medium quality wine and also get accepted for winery. Based on the analysed



physio-chemical parameters of different wines, papaya blended rosellewine recorded the highest contents of TSS, reducing sugar, non-reducing sugar, total sugar and alcohol and thus found most suitable for wine production among all the four tested roselle wines.

## **RELATIONAL ANALYSIS BETWEEN PROFILE CHARACTERISTICS AND EXTENT OF ROLE PERFORMANCE AMONG VILLAGE AGRICULTURAL WORKERS OF ODISHA**

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### **ABSTRACT**

Role Performance of Village Agricultural Workers (VAWs) was defined as the extent to which activities like technical, extension & training, input supply & quality control, and managerial work are actually carried out by VAWs for farmers in the area under their jurisdiction. The present study is focused on finding relationship between the profile characteristics and extent of role performance of Village Agricultural Workers (VAWs) working in state agriculture department of Odisha. Study was conducted in nine districts of Odisha which were randomly selected from three major revenue administrative divisions Cuttack, Berhampur and Sambalpur which was conducted between first week of December 2019 to first week of February 2020. Final sample size comprised of 292 VAW respondents. The method of proportional allocation in stratified sampling procedure was adopted for the selection of respondents. The results indicated that the level of role performance of the VAWs had positive and significant correlation with preferably organizational commitment, leadership ability, communication competence, frequency of visits, self-confidence, VAW's education, organizational climate, orientation towards extension profession and service experience. The value of coefficient of multiple determination ( $R^2$ ) being 0.25 indicated that the positively correlated significant variables jointly could predict 25 per cent of the variation in level of role performance of VAWs. The analysis of these relationship of profile characteristics with role performance would be crucial in finding the attributes which preferably helps in enhancing role performance and would help in designing target specific management interventions like suitable training programs for VAWs.

## **GLOBAL CLIMATE CHANGE : SCENARIO AND FOOD SECURITY**

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### **ABSTRACT**

Global climate change is because of human-induced emissions of Greenhouse Gases (GHGs) & varying weather phenomena. The last 50 years show an increasing trend of  $0.13^{\circ}\text{C}$  per decade in global mean annual temperature & now higher since last  $\frac{1}{2}$  decade, mean sea level has risen by 10-20cm in last century & snow cover is decreasing. Intermittent or decline of precipitation in tropics & sub-tropics has led to frequent droughts. Direct and indirect effects of global climate change are seen on agricultural crops, soils, livestock & pests. Global ocean has absorbed 90% of excess heat generated by GHGs emission, this has led to anomalous ocean warming. Lands around the water bodies are fertile for agricultural crops & 51% of country's net sown area are rainfed & accounts for nearly 40 percent of the total food production. India is facing Pre-monsoon cyclones in Arabian Sea for four consecutive years. In May 2021 India faced two cyclones just a week apart, cyclone "Taukte" on Western Coast due to warming of Arabian Sea and cyclone "Yaas" on Eastern Coast arising from Indian Ocean, these cyclones have become a new normal in South Asian Regions. Tall & strong waves broke mud embankments inundated fields by water which altered the microclimate of existing crops (vegetables) & led to their shortage in market & hence their price hiked. Farmers are unable to grow next crops as the embankments needs to rebuilt, also the stagnant water carries diverse plant pathogens & insect pests harmful to agricultural crops. West Bengal has estimated damage to 221000 ha of agricultural land & 71560 ha of horticulture area due to cyclone. Hence, climate change negatively affects all four pillars of Food Security which are: Availability, Access, Utilization & Stability by reducing their nutritional value, increased pest & diseases, change in income & purchasing power of people, disruption of transport & markets.





## **POTENTIAL UTILIZATION AND ACCEPTABILITY OF SELECTED VEGETABLES DEHYDRATED USING DIFFERENT PRE-TREATMENTS AND DRYING METHODS**

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### **ABSTRACT**

Vegetables are essential for proper development of human beings. The perishable commodities are rich sources of vitamins, minerals and fibers. Processing and preservation of vegetables is utmost important to utilize them timely and to avoid losses. Scientists are trying all aspects of their technical knowledge to improve the shelf life of these vegetables. Various preservation techniques are being used to increase the availability of vegetables in all seasons. Amongst these, Drying is one of the oldest methods of food preservation. It is feasible at home scale and profitable at industrial scale. The method involves minimum input with respect to labour, machines and storage. However, this affects quality of the product and thus the acceptability. Also, rehydration technique and further utilization of the rehydrated product is sometimes challenging because of its quality attributes. The present investigation aims at potential utilization of selected vegetables dehydrated using sun-drying and microwave drying methods. Physical and chemical pre-treatments were given to vegetables before drying. Rehydration techniques were standardized for each and its further utilization was recommended after sensory evaluation. The results were promising with respect to the sensory quality and rehydration characteristics (scores) of the final product. The combination of pretreatments and rehydration techniques improved the quality parameters of the product and thus the acceptability.

## **INFLUENCE OF PROFILE CHARACTERISTICS OF FARMERS ON THEIR STUBBLE BURNING BEHAVIOUR IN PUNJAB**

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### **ABSTRACT**

The problem of stubble burning has grown to be of grave concern in past few years, especially in Northern India. The most prevalent rice-wheat cropping system in states like Punjab, Haryana, Uttar Pradesh etc. features harvesting of paddy crop with mechanical combine harvesters which leaves a huge amount of stubble, commonly burnt by the farmers for speedy sowing of the subsequent wheat crop. The stubble burning in northern states is held responsible for several environmental and health issues which immediately needs to be addressed. Despite herculean efforts including judicial and legislative measures, the problem of stubble burning seems far from ending. Maximum number of stubble burning incidents was recorded from the state of Punjab. So, a study was carried out to find out which profile characteristics influence the stubble burning behaviour of farmers in Punjab. A total of 15 variables were taken for the study after consulting the available literature and experts. Coefficient of correlation was found out for variables with ungrouped data while chi-square test was applied for grouped data variables to determine the relationships. It was found that only economic motivation of the farmers was in a positive and significant relationship with the stubble burning behaviour of the farmers.

## **ENHANCEMENT OF AROMATIC RICE THROUGH GENETIC MODIFICATION IN LATERITIC BELT OF WEST BENGAL**

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### **ABSTRACT**

Rice, being the staple food of India, has its widespread area and production all over the country. Now a days priority is given on the improvement and production of aromatic rice due to their high value in auspicious occasions and growing demand in international market. Aromatic rice constitutes a small and special group of rice that is praised for its unique quality and flavour, a nature's gift to Indian subcontinent which is usually grown in north western states. West Bengal, being the leading country in rice area is still lagging in aromatic rice production due to certain factors like limiting eco-geographic conditions, lack of farmer's knowledge on the recently developed medium or short grain aromatic varieties, wide coverage by non-



aromatic local cultivars, susceptibility to diseases and pests, uncertainty of climatic condition, low yield potential etc. A lot of non-basmati aromatic rice lines had been lost after green revolution due to major emphasis on yield rather than quality. Demand of non-basmati aromatic rice is increasing day by day due to its excellent quality in the Middle East Asia. So there is an urgent need for genetic improvement and diffusion of the technologies for non-basmati aromatic rice cultivation to boost up its production which helps to promote socio-economic status of peoples in eastern regions especially in major rice growing areas of West Bengal.

## EVALUATION OF NOVEL FUNGICIDES AGAINST *SCLEROTIUM ROLFSII* CAUSING CHICKPEA COLLAR ROT

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### ABSTRACT

Collar rot of chickpea caused by *Sclerotium rolfsii* has a major constraint and potential threat to successful chickpea cultivation in Bundelkhand region of Uttar Pradesh. Therefore, efforts were made to evaluate the different novel fungicides *in vitro* condition against *Sclerotium rolfsii*. Nine fungicides were evaluated (@50, 100, 500 and 1000 ppm) *in vitro* through poisoned food technique against *Sclerotium rolfsii* causing chickpea wilt. The results revealed that fungicides viz., captan 70% + hexaconazole 5% WP (Taquat), penflufen 13.28% w/w + trifloxystrobin (Evergold), hexaconazole 5% SC (Contaf), tebuconazole 25.9% w/w EC (Folicur), inhibited 100% percent mycelial growth of the *S. rolfsii* at all tested concentrations. The effective fungicides Propiconazole 25% EC (Arihant) and propineb 70 WP (Antracol) which inhibited 100 % mycelial growth of pathogen at at 500 and 1000 ppm concentrations respectively. However, the fungicide carbendazim 50% WP (Bavistin) was ineffective in respective of inhibition of mycelial growth of pathogen at all tested concentrations viz., 50, 100, 500 and 1000. Amongst the concentrations evaluated, higher concentrations were caused more inhibition to mycelial concentration than lower concentration.

## EFFECTS OF ORAL ADMINISTRATION OF FLORFENICOL AT DIFFERENT DOSES ON THE SAFETY, SERUM BIOMARKERS AND BLOOD CELLS MORPHOLOGY OF NILE TILAPIA *OREOCHROMIS NILOTICUS* (L.) JUVENILES

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### ABSTRACT

Tilapia is one of the most consumed farmed fish, which require the use of antibiotics in certain phases of its production. This study assessed the safety of 30 days of oral florfenicol (FFC)-dosing at 0-10 times the therapeutic dose (1X: 10 mg/kg biomass/day) in Nile tilapia *Oreochromis niloticus* juveniles. Behavioural changes, feed consumption, mortality and change in biomass were evaluated. Besides, the levels of serum glucose, calcium, chloride, creatinine, alanine amino transferase, aspartate amino transferase, alkaline phosphatase and blood cell morphological changes were determined at scheduled intervals. The 30 days of oral FFC-dosing caused 3.33% (1X) to 18.33% (10X) mortalities, reduced feed intake and biomass in a dose-dependent manner. The fish fed the therapeutic dose recorded 1.25 folds increase in biomass; while the control group recorded 1.45 folds increase in 30 days. No significant erythrocyte morphological alterations were observed in the 1X group compared to the control. However, marked morphological alterations like tear-shaped, spindle-shaped and degenerative erythrocytes in higher dosing groups indicated FFC cytotoxicity. All the serum biomarkers of *O. niloticus* increased significantly on day 10 and day 30 FFC-dosing in a dose-dependent manner, except for calcium and chloride, which reduced significantly during the dosing period. Within 2 weeks of suspension of FFC-dosing, the serum biomarker levels became normal except for alkaline phosphatase and creatinine. The recovery of biomass, feed intake, serum biomarker levels and erythrocyte morphological changes suggested that the FFC induced changes are reversible. This study has, thus, proclaimed the safety of FFC at the therapeutic dose in *O. niloticus*.



## **BIOFERTILIZERS WITH ORGANIC MANURES FOR SUSTAINABLE CROP PRODUCTIVITY**

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### **ABSTRACT**

One of the major constraints regarding crop productivity in the world is unavailability of crop nutrients in appropriate amount and form. Modern agricultural practices rely mainly on use of fertilizers which certainly increased grain yield in many countries. However, the long-term use of chemical fertilizers may lead to decline in crop yield and soil fertility in the intensive cropping system. The use of renewable resources and inputs is one of the fundamental principles of sustainable agriculture which enables maximum crop productivity and minimal environmental risk. In an effort to safe guard the environment, maintain soil as the store house and enhance sustainable crop yields, replacing chemical fertilizer is of paramount importance. In such scenario, bio-fertilizers (microbial inoculants) and organic manures could be recommended. The application of microbial inoculants (biofertilizers) is a promising technology for future sustainable farming systems in view of rapidly decreasing phosphorus stocks and the need to more efficiently use available nitrogen (N). Integrated use of biofertilizers along with natural manures will offer a low capital investment and eco-friendly route to boosting farm productivity. Bio-fertilizer and organic manure are cheap and eco-friendly source of plant nutrients for sustainable crop production in low-input agriculture. Bio fertilizer is a natural input which can be applied as a complement to, or as a substituent of chemical fertilizer in sustainable agriculture. Various microbial taxa are currently used as biofertilizers, based on their capacity to access nutrients from fertilizers and soil stocks, to fix atmospheric nitrogen, to improve water uptake or to act as bio control agents. Application of organic manures has positive effects on soil physical and biochemical properties. It lowers soil bulk density; increases water holding capacity, cation exchange capacity (CEC), increases beneficial soil microbes' population, improves soil structure and enhances stable soil aggregates. Microorganisms play crucial roles such as, producing plant growth stimulating hormones, nutrients cycling thereby enhancing plant nutrients availability and uptake, nitrogen fixation, improve plant health, drought resistance and reclaim degraded soil.

## **GENDER EQUALITY AND THE ROLE OF WOMEN IN INDIAN AGRICULTURE**

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### **ABSTRACT**

Women are the backbone of any developed society. The central role of women in any society ensures progress, stability and long-term development of a nation. India is the largest agricultural dependent country wherein; the culturally diverse population still depends on 'agriculture' and for them it is not merely a business but is the "True Culture of India". For marginal and small farmers agriculture is not just an enterprise, but a way of life in which all family members including children contribute in one or the other way. Women play multiple roles right from sowing to harvesting. Women are therefore key contributors in agricultural production. They work as paid & unpaid labourers, cultivators, managers of certain aspects of agricultural production. In majority of the developing nations including India women play a vital role in agricultural activities which varies with the different crops and regions. Even though farm-women play multiple roles, in agriculture sector primary focus is given to only one gender. Male is the dominant decision maker of this industry and benefit seeker of the policies. The type of farming men practice is highly engaged, economically active and geared towards international and domestic market. The agricultural sector as a whole has benefited and emerged greatly by empowering men through technologies. But this emergence is incapable of lifting the status of women labor as an integral part of the agricultural industry. In most of the developing nations, including in India, agriculture continues to absorb and employ female workers but denied to give recognition as farmers, and the consequent entitlements. Women are also known as unsung warriors of agriculture and 'invisible contributors' so there is a need for gender mainstreaming in agriculture. However, addressing gender inequality is further essential for achieving sustainability in agriculture.



## RURAL SHG MEMBERS EMPOWERED THROUGH BACKYARDPoultry FARMING—A SUCCESS STORY

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### ABSTRACT

This story highlights the hard work and dedication of Smt. Vimal ben w/o Rajendra singh, village Bhukhi, Taluka- Kalol district Panchmahal, who become an entrepreneur through backyard poultry farming. The area of the district is predominantly tribal in nature. Due to their non-vegetarian dietary pattern, there is a good demand for meat and egg in the region. She is a traditional farmer engaged in animal husbandry and also reared some Desi poultry birds for home consumption and could not succeed due to lack of scientific knowledge of backyard poultry farming. Based on need of the region, high production potential poultry bird has been introduced and popularized as a source of sustainable livelihood for rural resource poor farm women by KVK, Panchmahal. KVK Panchmahal formed a Self-help Group “Pratistha Self Group” with chairmanship of Smt. Vimla ben and 10 other farm women. These members are perfect example of innovative farm women and entrepreneur in poultry farming among farming community. These members have been motivated by KVK Panchmahal through trainings, FLDs, farmers scientist interaction, kisan goshthi, farmers fair, exposure visit etc. She underwent training on scientific poultry rearing at KVK, Panchmahal. They were supplied 29 chicks of *Ankleshwar breed* and started a small semi-intensive poultry unit with the technical help of KVK, Panchmahal. Locally available bamboo, thatch grass and mud were used for constructing poultry shed and paddy husk as litter material for night shelter. She followed natural incubation practice integrated with scientific techniques. Smt. Vimal ben reported that the hens’ laid 1560 eggs in 72 weeks of age. She selected 550 eggs and placed on jute and then covered with cotton cloth and woven basket and stored on a self-inside their family building. When the hen stops laying all the eggs are placed under her, according to the traditional practice and successfully hatched 443 chicks out of which 220 female and 223 male chicks were raised up to time of marketing. She reared the birds under backyard system supplemented them with some concentrate feed viz crushed maize and broken rice (25-30g per day) and also adopted deworming and vaccination practices. The female birds were marketed at the rate of Rs. 100/ at around 10 weeks of age and Rs. 550/ male bird around five to six months of age. According to Mrs. Vimla ben the total cost of production on rearing of chicken was calculated Rs. 29600 and total net income earned from sale of eggs and birds for rearing of chickens were Rs. 63,200. The benefit cost ratio was recorded 1: 3.22, which appears to be very much economical and viable for rearing under backyard farming system. Now, Smt. Vimla ben is a model poultry farmer and he is guiding other farm women and SHG members on backyard poultry production. Based on the facts revealed, it may be concluded that the scientific backyard poultry production is a profitable and economic venture for resource poor farm women in terms of livelihood and economic security.

## WOMEN EMPOWERED THROUGH CROP LIVESTOCK BASED INTEGRATED FARMING SYSTEM - A CASE STUDY

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### ABSTRACT

This story highlights the hard work and dedication of Smt. Manjula ben w/o Prakash bhai from Kharsaliya village Kalol Taluka, who become an entrepreneur through crop livestock Integrated farming System. The area of the district is predominantly tribal in nature. Due to their non-vegetarian dietary pattern, there is a good demand for meat and egg in the region. She is having 4.5-acre irrigated land. She is a traditional farmer engaged in animal husbandry and also reared some Desi poultry birds for home consumption and could not succeed due to lack of scientific knowledge of farming system. KVK Panchmahal formed a Self-help Group “Prayya Self Group” with Smt. Manjula ben and 11 other farm women. KVK Panchmahal motivated him to start scientific dairy, poultry farming with crop production. As per guidance and motivational support of KVK Panchmahal she purchased two high yielding crossbred cattle and also reared 1000 broiler chicks in low-cost poultry shed designed by KVK. She has been motivated by KVK Panchmahal through trainings, FLDs, farmers scientist interaction, kisan goshthi, farmers fair, exposure visit etc. She underwent training on scientific dairy farming, broiler production, backyard poultry rearing and crop production at KVK, Panchmahal. Smt. Manjula ben was supplied 35 chicks of *Ankleshwar breed* for backyard poultry unit, mineral mixture for dairy animals and high yielding variety seed of maize, pigeon





pea, green gram, tomato and chilly by KVK Panchmahal under FLD programme. According to Smt. Manjula ben she earned approximately 4-5 lacks per annum through dairy, poultry and crop production with scientific attitude. She is perfect example of innovative farm women and entrepreneur in crop livestock based Integrated farming System. Now, Smt. Manjulaben is a model farm woman and she is guiding other farm women and SHG members for income generation through IFS.

## EFFECT OF TRADITIONAL FERMENTED CURD SUPPLEMENTATION AS PROBIOTICS ON GROWTH PERFORMANCE AND FREQUENCY OF DIARRHEA IN CATTLE CALVES - FOR SELF RELIANT FARMER

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### ABSTRACT

A trial was conducted to evaluate the effect of supplementary feeding of curd as probiotics on growth performance and frequency of diarrhea in pre-ruminant cow calves under farmer's field in semi-arid condition of Gujarat, India, during the year 2020-21. Twenty four, pre-ruminant female Gir calves with average age of fifteen days were selected randomly and distributed equally in to four groups, six each in a completely randomized design i.e. T<sub>1</sub>- basal diet (control), T<sub>2</sub>-basal diet + *Saccharomyces cerevisiae* @ 5 g per calf/ day, T<sub>3</sub>-basal diet + *Lactobacillus acidophilus* @ 1 g ( $2 \times 10^{10}$  cfu/ g) per calf/ day and T<sub>4</sub>-basal diet + Traditional curd @ 50 ml per calf/ day, respectively for a period of 90 days. Calve diarrhea was evaluated using the faecal score. A faecal score greater or equivalent to 3 was used as an indicator of diarrhea in the study. The study revealed that, the average initial body weight of calves was 26.40±0.81, 25.90±0.96, 26.10 ±0.84 and 26.30±0.93kg, respectively in T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> groups. The maximum body weight of calves was attending in T<sub>4</sub> (63.20±1.23kg.) followed by T<sub>3</sub> (62.70±1.10kg.), T<sub>2</sub> (61.30±1.27 kg) as compared to control (53.50 ±1.16 kg) after 90 days feeding. The results of the study revealed that the average daily gains and final body weight of calves was significantly ( $P < 0.01$ ) higher in curd and probiotics groups as compared to the control group. The final body weight of calves was statistically ( $p < 0.01$ ) higher in curd and probiotics groups as compared to the control group. The average daily weight gains were statistically higher in curd group (410±14.92g) followed by *Lactobacillus acidophilus* (407±15.12g), *Saccharomyces cerevisiae* (393±14.86g) group as compared to control group (301±10.74g). There were significant difference in the faecal score between the treatment group and the control after two weeks of the experiment; subsequently, faecal score became constant in the treatment groups and never exceeded the normal value. However, curd and *Lactobacillus acidophilus* was found to be more effective to control/ reduce the incidence of diarrhea after one weeks of application as compared to *Saccharomyces cerevisiae*. The incremental B: C Ratio was found to be 5.27, 10.55 and 21.77 in group T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>, respectively which appears to be very lucrative. Based on observations, it may be inferred that the traditionally fermented curd, can effectively be used as a probiotic supplement and has a desirable effect in terms of higher growth rate and checking diarrhea in pre ruminant calves.

## STUDIES ON GENETIC VARIABILITY OF SWEET POTATO [*IPOMEA BATATAS* (L.)] GENOTYPES FOR TUBER YIELD AND YIELD COMPONENTS

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### ABSTRACT

An experiment was conducted at the Research-cum-Instructional Farm of S. G. College of Agriculture and Research Station, Jagdalpur, Bastar (C.G.) during the *Kharif* season of 2020-21. The experiment was laid out in randomized block design in three replications with twenty eight genotypes to estimate the genetic variability, morphological characterization, heritability, genetic advance, character association, path analysis and divergence analysis for the character *viz.*, vine length (cm), vine internode length (cm), vine weight per plant (fw) g, length of tuber (cm), diameter of tuber (cm), TSS of tuber (%), starch (%), dry matter of tuber (%), dry matter of foliage (%), No. of tuber per plant, tuber weight per plant (g), harvest index (%), were recorded on five competitive random plants from each replication. Three important characters *viz.*, tuber yield (t/ha), marketable tuber yield (t/ha) and weevil infested tuber yield (t/ha) were calculated on the basis of observed data. Analysis of variance revealed that tuber yield and its component characters were highly significant for the characters *viz.*, vine length (cm), vine internode length (cm), vine weight per plant (fw) g, length of tuber (cm), diameter of tuber (cm), TSS of tuber (%),



Starch (%), dry matter of tuber (%), dry matter of foliage (%), No. of tuber per plant, tuber weight per plant (g), harvest Index (%), tuber yield (t/ha), marketable tuber yield (t/ha) and weevil infested tuber yield (t/ha). Morphological characterization of twenty eight sweet potato genotypes recorded using International Potato Centre (CIP), IBPGR, sweet potato descriptor for twenty seven characters viz., plant type, ground cover, vine internode length, predominant vine colour, secondary vine colour, mature leaf shape, leaf lobe type, leaf lobe number, shape of central leaf lobe, mature leaf size, abaxial leaf vein pigmentation, mature leaf colours, immature leaf colour, petiole length, petiole pigmentation, flower colour, flower habits, shape of limb, sepal shape, sepal apex, sepal pubescence, sepal colour, colour of stigma, colour of style and length of style. Out of twenty-eight genotypes, sixteen genotypes observed for spreading plant type, eight genotypes recorded for semi erect type and one genotype recorded in extremely spreading plant type, on the basis of length of main vine, flower habit absent in four genotypes and remaining twenty-four genotypes had 1-2 cm. length of style. Wide range of variation was found for the characters vine length, vine weight, dry matter of foliage, tuber weight per plant, tuber yield and harvest index. High genotypic and phenotypic coefficient of variations were recorded for the characters diameter of tuber, vine length, vine internode length, number of tuber per plant, starch, dry matter of tuber and length of tuber, dry matter of foliage, vine weight per plant (g), tuber yield tone per hectare, tuber weight per plant TSS of tuber and harvest index showed moderate GCV and PCV. High heritability coupled with high genetic advance was observed for all the traits.

Correlation coefficient analysis revealed that tuber yield (t/ha) showed high significant positive correlation with tuber weight per plant at both phenotypic and genotypic level followed by number of tuber per plant, starch, diameter of tuber, length of tuber, harvest index, dry matter of tuber. In genotypic path, tuber weight per plant showed maximum positive direct effect on tuber yield tone per hectare followed by diameter of tuber, vine length, number of tuber per plant, TSS of tuber percent and length of tuber per plant.

The divergence analysis revealed the presence of appreciable amount of genetic diversity in the tested genotypes. Twenty-eight genotypes were grouped into eight clusters. The intra and inter cluster distance were computed for all the clusters. The result indicated that the genotypes Indira Naveen, Sree Bhadhara and Sree Rethana from Cluster III, Indira Madhur from cluster V, TSP-16-10 from cluster VII, may be utilized as parents for hybridization in future breeding programmes. Inter crossing of genotypes from diversified clusters, showing superior mean performance may help in obtaining higher tuber yield per plant with growth and tuber characters of lead components in sweet potato.

Looking to the study of germplasm characterization, variability and diversity for tuber yield its components in sweet potato was framework for improvement and for getting promising high yielding genotypes of sweet potato with desirable traits under Chhattisgarh plains.

## **EFFECT OF MICRONUTRIENTS APPLICATION ON GROWTH, YIELD AND NUTRIENT UPTAKE OF BLACKGRAM**

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### **ABSTRACT**

Black gram is the third important pulse crop in India after chickpea and pigeon pea. It is a rich protein food. It contains about 26% protein, fat 1.2 %, carbohydrate 56.6 %, Ca 185 mg/100g, Fe 8.7 mg/100g, P 345 mg/100g and vitamin A, B<sub>1</sub> and B<sub>3</sub>. Micronutrients activate plant enzymes which are involved in carbohydrate metabolism and require for the synthesis of growth hormone auxin leading to cell enlargement and increase in normal cell division. Maximum plant height (26.23 cm) was recorded with soil application of zinc sulphate @ 25 Kg/ha which was at par with soil application of mixture of zinc sulphate @ 25 kg/ha and borax @ 10 kg/ha and seed treatment with mixture of ammonium molybdate @ 5gm/Kg seed and cobalt nitrate @ 1 gm/Kg seed reported that maximum number of nodules per plant (33.7) and dry weight of nodules per plant (12.6 mg) was recorded with 2% Urea + 2 % SSP + 0.1 % Zinc EDTA + 0.2 %B (Borax). The MN grade-4 MN Grade-4 (Fe & Zn deficiency) Fe (4%), Mn (1.0%), Zn (6.0%), Cu (0.5%) and B (0.5%) showed the maximum seed yield (14.25 g/plant), (11.31 q/ha) and improve morpho-physiological parameters reported that the application of 2.5 kg ha<sup>-1</sup> of ZnSO<sub>4</sub> as zinc fertilizer could be the best dose for achieving highest and good quality seed yield of black gram. It can be concluded that the Foliar application of nutrients has been proved to be an important asset in fertilizer application with a specific aim of increasing nutrient availability at the time of need especially in the later stage of plant growth, The combined application of micronutrients along with macronutrients proved to be beneficial in increasing the status of available nutrients in soil besides



crop yield, nutrient uptake and grain quality of black gram. Micronutrient gradually rise of fertilizer rates to a certain limit also promotes the percent protein content of black gram seeds.

## PRODUCTION OF PECTINASE, CELLULASE AND AMYLASE BY *TRICHODERMA ASPERELLUM* USING MOSAMBI PEEL AS SUBSTRATE

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### ABSTRACT

The solid waste generated during the processing of mosambi fruit (*Citrus limetta*), creates environmental pollution problems. Since this waste is rich source of carbohydrates, a process was standardized for the production of enzymes viz. pectinase, cellulase and amylase from mosambi peel. Fifteen fungal cultures were isolated from different samples of the biodegrading and organic substrate. These fungal cultures were subjected to primary screening for enzymes production by zone-clearance technique on pectin, carboxyl methylcellulose (CMC) and starch agar plates. The primary screened fungi were subjected to secondary screening on the basis of higher production of pectinase, cellulase and amylase in respective substrate broths. The highest enzyme-producing fungus was identified as *Trichoderma asperellum* NG 125 (NCBI Accession No. MW287256) using molecular characterization technique and scanning electron microscopy (SEM). Parameters viz. temperature, pH, time of incubation and nutrient addition were optimized for enzymes production using fresh mosambi peel as substrate. The maximum activities ( $\text{U}^{-1}\text{ml}^{-1}\text{min}^{-1}$ ) of pectinase (595.7), cellulase (497.3) and amylase (440.9) were observed at pH 5.5, incubation temperature of 30°C after 10 days of fermentation. Macro-nutrients addition @0.1% ammonium sulphate (as source of nitrogen), 0.01% potassium di-hydrogen ortho-phosphate (as source of potassium and phosphorus) enhanced the production of enzymes.

## VELVET BEANS (*MUCUNAPRURIENS*) : AN ADMIRABLE SOURCE TO CURE PARKINSON'S DISEASE

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### ABSTRACT

Among the various indigenous wild legumes, the velvet bean *Mucunapruriens* is far-flung in tropical and sub-tropical regions of the world. *Mucuna species have been known for its bio-active compound L-dopa (L-3,4-dihydroxy phenyl alanine), a non-protein amino acid and an precursor of neurotransmitter dopamine. It is broadly in use for the clinical treatment of the Parkinson's disease (PD), a chronic neurological disorder characterized by a ineptness of movement, muscular stiffness, rigidity, tremor, poor posture and balance and sensory-motor desegregation. Velvet beans seed samples contain high amounts of crude protein ( $25.65 \pm 0.14$ ) and lipids ( $14.52 \pm 0.05$ ) when compared with most of the commonly consumed pulses. RP-HPLC quantification revealed that *M. macro carpa* beans contain a high level of L-dopa [ $115.41 \pm 0.985$  mg/g] and major phenolics such as tannic acid (43.795 mg/g), gallic acid (0.864 mg/g), *p*-coumaric acid (0.364 mg/g) and *p*-hydroxybenzoic acid (0.036 mg/g). Efficacy and safety of single-dose intake of *Mucunapruriens* powder from roasted seeds obtained without any pharmacological processing was evaluated in eighteen patients (13 male, 5 female) with advanced PD. When compared to LD+DDCI; the reference treatment, low-dose MP showed similar motor response, while high-dose MP induced greater motor improvement at 90 and 180 minutes. The therapeutic effects of aqueous extract of *M. pruriens* seeds in Parkinsonian mouse model developed by chronic exposure to paraquat (PQ). Results revealed that *Mucunapruriens* (MP) seed extract treatment significantly reduced the PQ induced neurotoxicity as evident by decrease in oxidative damage, physiological abnormalities and immune histochemical changes and also improved the behavioral abnormalities in the Parkinsonian mouse. *Mucunapruriens* could be a sustainable alternate to marketed levodopa for necessitous individuals with PD in low-income countries, provided that it is tolerated in the long term.*



## **SUSTAINABLE FOOD SECURITY THROUGH BAMBOO SHOOT VALUE ADDITION**

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### **ABSTRACT**

The major burden in uplifting the objective of global food security with this growing population is an indicator to raise the crops production. Presently, very few food crops feed the giant majority of world's population. To liberate the world from this widespread hunger and malnutrition, there is requirement to discover a novel food crop which play a vital role in supplementing the existing food crops for both, nutritional and health security. The evergreen and versatile plant, bamboo, is obscurely associated with humans since from decades. It is one of the fastest growing plants and is estimated to cover 8.96 million ha of the total 63.3 million ha forest area of India. The North-East India anchorages about 43 per cent of the total bamboo wealth in India. The utilization of immature shoots of bamboo as a health food is limited known fact as compared to its use in industries for construction purpose. The shoots of bamboo having high nutritional and therapeutic values can be opted to make up the nutritional deficiencies in the diet and utilized to feed the rapidly increasing human population in the world. Bamboo, which is amongst the highly significant NTFP (non-timber forest produce), can be proved as the biggest ally in our fight against global hunger and food insecurity. Safe to eat bamboo shoots need to be processed and utilized immediately due to their seasonal availability and short shelf-life span. Some edible products such as preserve, candy, chutney, nuggets, cracker (papad) and chukh are analysed for sensory evaluation in one of the studies. The results of which revealed that prepared formulations were nutritionally rich and acceptable by sensory scores. It will offer plenty of scope towards engagement of unemployed directly or indirectly through production, value addition and marketing of the bamboo shoot thereby improves the food, economic and ecological security of the world.

## **ASSESSMENT OF TILLAGE AND CROP ESTABLISHMENT TECHNIQUES FOR PRODUCTIVITY OF WHEAT CULTIVATION UNDER NORTHERN PART OF MADHYA PRADESH**

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### **ABSTRACT**

A field experiment was conducted during the consecutive rabi seasons of 2018 and 2019 on sandy clay loam at Research Farm, College of agriculture, RVSKVV, Gwalior (M.P.) to study the evaluation of tillage and crop establishment techniques for improving productivity of wheat. Variety (V3) MP3336 were resulted in significantly higher grain yield, straw yield and biological yield, which was statistically at par with variety (V1) GW-322 over variety RVW-4106. On the basis of resources conservation technique, maximum grain yield, straw yield and biological yield was observed with Furrow irrigated raised bed (S1) which was at par with Zero tillage (S4) in wheat.

## **IN-VITRO MEAT PRODUCTION HAS SUSTAINABLE BENEFITS OVER CONVENTIONAL MEAT PRODUCTION**

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### **ABSTRACT**

A Need for meat is rising day by day and the production of poultry, cows, pigs and fisheries is reduced as there is no good commercial production. Wider livestock production is becoming unavailable on a global scale in requisites of welfare of





animals, ecological sustenance and human health conditions. Choices for cultured meat are being explored using innovative techniques like stem cells, Embryonic Stem Cells, Induced pluri potent stem cells [(iPSC) derived from skin or blood cells of an animal that have been reprogrammed back into an embryonic-like pluripotent], Totipotent stem cells [immature cells capable of giving rise to any cell type or (of a blastomere) a complete embryo], pluripotent stem cells (immature cells capable of giving rise to several different cell types), satellite cells or myoblasts, etc. In these methods, animal tissue is grown in controlled surroundings using culture cell technology. Several attempts are made to develop different types of media and techniques like the self-organizing techniques and scaffold-based techniques to advance the growth of the cell. Cultured meat is also called in various names like ‘clean meat’, ‘in-vitro meat’, or ‘artificial meat’. The concept is in the budding stage of commercialization. Therefore, along with the improvement in technical phase there is a lot of work is being carried on in the developmental aspects of biological, commercial, social, economic and ethical.

## ASSESS THE PERFORMANCE OF DIFFERENT PEARL MILLET VARIETIES ON DIFFERENT GROWTH STAGE AND POST HARVEST ECONOMICS UNDER DIFFERENT DATES OF SOWING

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### ABSTRACT

Pearl millet is commonly known in India as Bajri or Bajra. It is the most widely grown type of millet. Pearl millet is a good source of protein and carbs and a decent source of fiber. It's also a good source of vitamins and minerals (All India Coordinated Research Project). Overall, millet is a nutritious carbohydrate source. An experiment was conducted during the Kharif season of 2016 at College of Agriculture, RVSKVV, Gwalior. The present investigation aimed to estimate the performance of different pearl millet varieties on growth and economics under different dates of sowing. With the treatment combination of three Date of Sowing (20th, 30th July and 9th August) and five varieties of pearl millet (Big B, Crystal Dhoom, Boss-65, Ankur-045 and 86M86). The result revealed that higher Dry matter (g /plant) at 30,60 DAS and at harvest stage, number of productive tiller / plants at harvest stage was recorded maximum under the variety crystal Dhoom with sowing date of 9 august of pearl millet. And plant population was not affected significantly as per treatment respectively. The economic attributes were also following the same trend as / growth characters and the maximum gross Return (Rs/ha), net Return (Rs/ha) and B:C ratio was obtained under the variety crystal Dhoom, which was followed by Big B, Ankur-045, 86M86 and the minimum was recorded in the variety Boss - 65 and sowing date of 9 august of pearl millet.

## BIODIVERSITY OF ARTHROPOD FAUNAL COMPLEX ON WHEAT AGROECOSYSTEM UNDER TERAJ REGION OF WEST BENGAL

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### ABSTRACT

Insect pests are some of the major constraints limiting yield of wheat (*Triticum aestivum* L.) in India. Among the many biotic constraints hampering the production of wheat, insect pests cause considerable damage. A field trial was conducted in Research farm at Uttar Banga Krishi Viswavidyalaya, kharibari, West Bengal during *rabi* season of 2018-19 and 2019-20 to observe, identify and to document the pests and natural enemies associated with wheat as it gives an additive advantage over pests by adopting preventive measures and timely implementation of management tactics. A total of A total of 1463 specimens belonging to 26 families under 10 orders, representing 44 species were encountered from wheat agroecosystem under terai region of West Bengal. Most of the arthropods belonged to 3 orders such as Coleoptera, Lepidoptera and Hemiptera. In terms of species composition Coleoptera occupied top position (14 species) followed by Lepidoptera (8 species) and Hemiptera (8 species). The result revealed that Aphids as a major pest on wheat agroecosystem. Collection of Aphids revealed the occurrence of two species *Rhopalosiphum maidis* Fitch and *Sitobion avenae* Fabricius under family Aphididae. Three ladybird beetles *Coccinella transversalis* Fabricius, *Micraspis discolor* (Fabricius), *Coccinella septempunctata* Linnaeus and *Cheilomenes sexmaculata* (Fabricius) under family Coccinellidae were found as dominant natural enemies associated with wheat agroecosystem.



## ASSESSMENT OF GENETIC VARIABILITY FOR DIFFERENT BIOMETRICAL TRAITS IN FENUGREEK UNDER LIMITED IRRIGATION CONDITION.

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### ABSTRACT

Fenugreek is a seed spices crop and grown in arid and semi-arid areas of the world. Majority of areas are facing irrigational problems and moisture stress situation remains prevalent in most of the districts during crop growth season. The limited irrigation potential in many of the fenugreek growing areas prompted to conduct the present study which will help in understanding the effects of moisture stress on plant growth in fenugreek. Thirty genotypes of fenugreek were sown in RBD with 3 replications in two environments namely normal and limited irrigation condition during *rabi* season 2019-20 for twelve biometrical traits. The results of ANOVA showed significant differences among the genotypes for all the biometrical traits under study indicating the presence of wide spectrum of variability among the genotypes. High PCV (>20), high heritability (>60) coupled with high genetic advance as percentage of mean (>20%) was observed for proline content in leaves (mg/g) at 60 DAS and maturity, seed yield per plant, number of branches per plant, number of pods per plant, crude protein content and test weight suggesting that these characters are genetically governed by additive gene action and can be utilized for fenugreek improvement through selection.

## MANAGEMENT OF OESTRUS OVISINFECTION IN BLACK BENGAL GOAT

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### ABSTRACT

*Oestrus ovis* is a well-known parasite of the nasal cavities and adjoining sinuses in sheep and goats. A 4-year-old female Black Bengal goat was presented at VCC, Bihar Veterinary College Patna with a history of anorexia, weight loss, in-coordinated movements, nasal discharge for 5 days and recurrent nasal bots expelled during sneezing from 3 days. Upon clinical examination the animal was dull, dyspnoeic, unsteady gait and having blocked nostrils with thick mucoid discharge along with an increased respiratory rate. Parasitological examination revealed it as an *O. ovis* (nasal bots). The animal was treated with single dose of ivermectin (Hitek<sup>®</sup>, Virbac Animal Health India Pvt Ltd) @ 0.2 mg/kg body weight subcutaneously along with supportive vitamin therapy for 7 days and Ceftriaxone @10mg/Kg body wt for 3 days. The animal recovered uneventfully by 2 weeks post-treatment without any complications. The live larvae recovered from the animal were subjected to parasitological examination and were grossly as well as microscopically examined for morphological characteristics. The occurrence of nasal bots in a goat and its successful therapeutic management and public health significance have been reported and discussed in the present communication.

## SUCCESSFUL MANAGEMENT OF SUBCUTANEOUS EMPHYSEMA IN COWS WITH MULTIPLE SKIN INCISION AND ANTIBIOTIC CATTLE

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### ABSTRACT

Five crossbred COWS with subcutaneous emphysema (SE) were found. Two of the cows were given liver extract with B complex (Rumeric) 10 ml, pheniramine maleate 227.5 mg and prednisolone acetate 100 mg intramuscularly (i.m.). Along with these drug applications, the first cow was given Ceftriaxone and sulbactam 4.5 gm intravenous with multiple skin incision and local infiltration of above-mentioned antibiotic and prednisolone acetate. All cows showed signs of recovery from 3 days i.e. reduction in crepitant sound and swelling and had completely recovered within 10-15 days. The occurrence subcutaneous emphysema and its successful therapeutic management and public health significance have been reported and discussed in the present communication.



## IDENTIFICATION OF MULTIPLE RUST RESISTANT LINES OF WHEAT (*Triticum aestivum* L.)

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### ABSTRACT

Among the biotic stresses, rusts are the major bottleneck in harnessing the full potential of the wheat crop. Development of resistant wheat varieties is the most effective method for management of rusts. In India all the rusts, namely leaf rust, stem rust and stripe rust are economically important and are prevalent in one or the other wheat growing zones. Stem rust is important in the central and southern India, stripe rust in the north western plains and northern hills, whereas leaf rust can cause losses across all the wheat growing areas. A total of 1310 advance wheat lines were screened for yellow rust at ICAR-Indian Institute of Wheat and Barley Research Karnal during the crop season 2019-20. Yellow rust severity was recorded following modified Cobb's scale (Peterson, 1948) and response type based on Roelfs *et al.* (1992). The rust score in the infector rows was 60S to 80S. 289 lines showed immune reaction and 56 lines were resistant. 116 lines were moderately resistant whereas 238 lines were moderately susceptible. 611 lines were showed susceptible reaction to the stripe rust. Out of 1310 lines; 104 lines showing high adult plant resistance and appearing to be agronomically better were selected for the seedling resistant test against predominant races of the stripe (238S119, 110S119, T), leaf (12.5, 77-5, 77-9 and 104-2) and stem rust (11, 40A, 117-6 and 295) at IIWBR RS Flowerdale Shimla in the year 2020. Out of 104 lines; 2 (EPC-171MUU/KBIRD//MUTUS\*2/KIRITATI/3/MUCUY and EPC134MUTUS// ND643/2\* WBLL1/3/TAITA) lines were found to be resistant against all the races of three rusts; 5 lines were resistant to leaf and stem rust, 2 lines to stripe and leaf rust; 54 lines were resistant to stem rust only; 8 lines to the leaf rust and 27 lines to the stripe rust. The identified lines would be utilized in the breeding programme.

## MORPHOLOGICAL CHARACTERISTICS OF COLLECTIONS OF MUSHROOMS DISTRIBUTED IN FORESTS OF WESTERN MAHARASHTRA

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### ABSTRACT

Forests are rich in mushroom diversity. The geographical survey was carried from dense forests of Mahabaleshwar, Koyanagar and Gaganbawada of western Maharashtra. Total 50 mushroom samples were collected during monsoon season, 2019 and identified mushroom species on the basis of morphological characteristics. Every mushroom was different from one another and showed variations among morphological characteristics. The commonly found mushrooms are *Marasmius spp.*, *Leptoniaspp.*, *Pleurotus spp.*, *Psathyrella spp.* and *Termitomyces spp.* The *Marasmius spp.* was found in the form of groups (clusters) on wooden stump. Pileus is 5.2-6.0 cm and it is depressed. Gills are attached to the stem, its color is white, base is narrow and basal associated with wood. Spore print shows white color. It is edible but not collected by local people. The *Leptonia spp.* was found on tree trunk and in single form. Pileus is gray brown, 6.0-8.0 cm long. The gills are widely spaced, and the stalk is fragile. Stipe colour is pinkish yellow & Its base is club shaped. Gill colour is black and spore print shows white colour. Basal association is with tree trunk. Little is known about the edibility of this mushrooms group and some are poisonous. The *Pleurotus spp.* found on tree trunk in single form. Pileus 25.0-30.0 cm wide, 3.0-5.0 mm thick, white becoming creamish to brownish on maturity, flabelliform (fan-shaped). Gills are white and narrow, stipe short, lateral, base attached with white mycelium to woody substratum. Edible and also consumed by people. Spore print is white and ring, volva or veil absent. The *Calvatia spp.* was found on pasture land, grass land in single form. Fruit body 6.0-8.0 cm across,



yellow-white colored, spherical shaped, outer wall consisting of scurfy warts. Spores' olive brown. Basal association is with soil. It is edible and medicinal but not consumed by local people. The *Termitomyces spp.* was found in group (cluster) on termatorium soil. Pileus is 15.0-23.0 cm in diameter, spore print is pink white with a brownish tinge. It is edible and consumed by local people. Annulus present, volva absent.

## NANOFERTILIZERS—DIRE NEED OF SUSTAINABLE AGRICULTURE

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### ABSTRACT

Soil fertility and crop production can be improved by an adequate and judicious nutrient supply. Precise nutrient management of crops is still a major global challenge as it depends primarily on various chemical fertilizers. These conventional fertilizers are not only expensive for the producer, but also pose health risks to humans and damage the ecosystem through leaching losses and surface run-off. This has led to the search for eco- friendly fertilizers, particularly those with high nutrient-use efficiency, and nanotechnology is emerging as a promising alternative. Nano fertilizers are the potent nutrient managers as they possess the property of releasing nutrients in a very slow and steady manner as compared to conventional fertilizers. This approach not only enhances nutrient use efficiency, but also prevents nutrient leaching into ground water bodies and thus improves the crop yield. However, the risks of nano fertilizers should be carefully monitored before use, and further biotechnological advances are required for a correct and safe application of nano materials in agriculture.

## REMOTE SENSING, A NEW HORIZON IN CROP DISEASE MANAGEMENT

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### ABSTRACT

Remote Sensing is considered as a very effective tool to detect and quantify biological and physical stresses in plant in modern era. Crop yields are drastically affected by both biological and physical stresses. Different kinds of nutrient deficiencies, infestations of pathogens, insects, weeds are detected by reflected light in visible, near and middle infra-red regions of the electromagnetic spectrum. Biotic stress is assumed by the interference of stress with photosynthesis, physical structure of the plant at canopy area. Those stressed plants show change in absorption of light and alternation of spectrum reflectance. Biotic stresses are characterized by ground based, airborne, satellite sensors which produce narrow bands from vegetations. Pest and disease surveillance methodologies such as field scouting processes are too much time consuming, laborious, expensive and error prone. In that case remote sensing gives a synoptic visualization of crop fields in noninvasive and nondestructive way. Remote sensing provides timely information on spatial variability of disease infestation over many weather parameters in accurate way. We can provide site specific application of fungicides, insecticides, fertilizers according to biotic and abiotic stress status of the crop fields. Remote sensing and precision farming is now practicing widely in USA, Germany, Israel and other developed countries. In India it is not accepting by most of the farmers for lacking of funds, knowledge and skills. Ministry of Agriculture and farmers welfare should take necessary steps for popularizing the remote sensing as a tool of crop protection among farmers.

## CLIMATE CHANGE—ADAPTABILITY, ENERGY SECURITY, FOOD SECURITY AND SUSTAINABILITY

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### ABSTRACT

It occurs when in Earth's climate system result in new weather patterns that last for at least a few decades and may be millions





of years. Earth's climate is now changing faster than at any point in the history of modern civilization, primary as a result of human activities. Global climate change has already resulted in a wide range of impacts across every region of the country and many sectors of the economy that are expected to grow in the coming decades. To mitigate the harmful effects of climate change on its population, India needs to focus upon the major critical areas. Adaptation is anticipating the adverse effects of the climate change and taking appropriate action to prevent or minimize the damage they can cause. India formed the high-level Prime-Minister's council on climate change in June 2007, which was immediately directed to prepare a coordinated response to issues relating to climate change and provide oversight for formulation of action plans in the area of assessment and periodically monitor key policy decisions. The action plan identifies eight core 'national missions' such as solar energy, Enhanced energy; Sustainable Habitat; Water; Sustaining the Himalayan Eco - system, Green India; Sustainable Agriculture; and strategic Knowledge for climate change. On 30<sup>th</sup> June, 2008 India launched its national Action Plan on Climate Change (NAPCC), which outlined existing and future policies and programmes addressing climate mitigation and adaptation. India is facing the ongoing challenge of supplying accessible and affordable energy to abolish poverty and meet the increasing energy demands as a result of economic growth, urbanisation, per - capita consumption and an enhanced livelihood which threaten energy security. Several sub missions under the NAPCC seeks to promote alternative energy resources and develop a robust mechanism to meet the energy demands of the country. The mismatch between demand and supply of water is likely to have far reaching implications on food grain production and India's food security. Archiving food security in the context of climate change will require an improvement in the livelihoods of the poor people. It is promoting environmentally sustainable development and improving the capacity to cope with climate change and disasters. Sustainable development has become part of all climate change policy discussions at three global level, particularly due to adoption of agenda 21 and the various conventions resulting from the UNCED-1992. Three critical components in promoting sustainable development are economic growth, social equity and environmental sustainability.

## **THE STUDY ABOUT SOCIO-ECONOMICAL PROFILE OF THE RESPONDENTS OF DIRECT SEEDED RICE CULTIVATION PRACTICES OF PADDY OF CHHATTISGARH STATE**

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### **ABSTRACT**

The purpose of this study was to study about socio-economical profile of the respondents of Direct Seeded Rice cultivation practices of Paddy of Chhattisgarh state. To serve this purpose, sample sizes of 80 respondents were selected from Patan blocks of Durg district during the year 2019-20. The result of study shows that majority of the respondents (farmers using Seed Drill method of rice sowing) were educated up to high school with medium family size (6-10 members) and having membership in one organization. Most of the respondents were doing agriculture as main occupation with 11 to 20 years of farming experience, however many of them were engaged in subsidiary occupation to support their livelihood. Most of them were having land holding more than 10 acres. The average family income was found between ₹ 500000 to 1000000 per annum.

## **DEVELOPMENT OF INDIAN FLAT BREADS AND THEIR GLYCEMIC RESPONSE IN YOUNG HEALTHY NON-DIABETIC SUBJECTS**

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### **ABSTRACT**

Jerusalem artichoke tuber is considered as healthy and functional crop due to its chemical composition and therapeutic properties. The present study involves development of Indian flat breads (Chapati, Dosai, Girda, Puran Poli and Bakhri by the incorporation of unprocessed and processed tuber flour at 20%, 40% and 60% concentration) and their organoleptic evaluation by 5-point composite score and 9-point hedonic scale. Lastly, glycemic indices of most acceptable flat breads on



normal healthy human subjects were done. Results of the study revealed that UPJ<sub>1</sub>, UPJ<sub>2</sub>, UPJ<sub>3</sub>, BSDJ<sub>1</sub>, BSDJ<sub>2</sub> and ASDJ<sub>1</sub> were found to be highly acceptable and insignificant to each other whereas BSDJ<sub>3</sub>, ASDJ<sub>2</sub> and ASDJ<sub>3</sub> were found to be moderately acceptable by the panel members and registered significant difference at  $p < 0.05$  level. Chapati and Bakhri incorporated by 20% of unprocessed and blanched Jerusalem artichoke tuber flour were selected on the basis of their overall acceptability and were used for the assessment of glycemic response in normal healthy human subjects. The data of glycemic index indicated that between all the test products, the higher significant reduction was seen in BJC and BJB by 22.7% and 23.5% at 120 min when compared to their peak points at 60 min. Considering the incremental area under curve (IAUC) of the reference food (4443 mg.min/100ml), BJC and BJB had low IAUC value (1735.5 and 1645.5 mg.min/100ml) when compared to all test and standard products. Likewise, BJC (39.06 and 12.5%) and BJB (37.07 and 12.1%) had low GI and medium GL when compared to all respective test and standard products. Thus, findings of the study signify that Jerusalem artichoke tuberis recommended as preventable, acceptable and economic measures not for only diabetic populace but also for common community who are health conscious.

## BIO-EFFICACY OF *HETERORHABDITIS BACTERIOPHORA* NEMATODES AGAINST TOMATO FRUIT BORER, *HELICOVERPA ARMIGERA*

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### ABSTRACT

Tomato (*Solanum lycopersicum*), belong to family Solanaceae, is an important vegetable crop which is consumed throughout the world. This crop is associated with great losses caused by various biotic factors like insect-pests and diseases. Among these, *Helicoverpa armigera* is a serious lepidopteran pest and it should be controlled at early stages of infection to avoid the unnecessary damage to tomato crop. *Heterorhabditis bacteriophora* is an important species of entomopathogenic nematodes (EPNs) which is mutually associated with the bacteria, *Photorhabdus luminescens* and used as bio-control of insects-pests globally. So, focusing on virulence potential of this nematode, the present study has been designed to study the bio-efficacy against tomato fruit borer, *H. armigera* under laboratory conditions. Six different inoculum levels of this nematode, i.e. 0, 5, 10, 20, 40 and 60 infective juveniles (IJs) per insect larva, were taken in petri plates. After 48 hours of inoculation, 100 percent death of *H. armigera* larvae was observed in petri plates with 40 and 60 IJs per larva and at same time, 50 percent death was observed in treatment with 20 IJs per larva. After 72 hours, 100 percent killing in 20 IJs per larva and 75 percent in 10 IJs treatment was recorded. After 96 hours, all the *H. armigera* larvae had been killed by *H. bacteriophora* juveniles. Hence, *H. bacteriophora* has been proved an effective biocontrol agent (EPN) for tomato fruit borer, *H. armigera*.

## A REVIEW ON THE IMPACT OF ABIOTIC STRESS ON PLANT GROWTH AND CROP PRODUCTION

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### ABSTRACT

Abiotic stress includes extreme temperature, salinity, drought, water logging, etc. highly influenced the plant growth in affected area. Abiotic stress reduced the development of plant which ultimately results in reduction in yield. Agricultural crops are highly influenced by abiotic stress which is due to the continue change of climate and deterioration of environment caused by human activity. Plants activities such as photosynthesis, flowering, pollination, transpiration, etc. affected by different abiotic stress experienced by plants at these stages. High temperature results in increase in transpiration rate which cause water stress in plant cell. Similarly, high salt condition in the root zone affects the osmotic potential of plant root cell which results in exosmosis in plant root cell. Water logging condition decreases the respiration rate of roots and produces methane gas which is a major gas responsible for climate change. However, to overcome the effects of abiotic stress, plant has developed a number of physiological and cellular changes in their life mechanism. Also, efficient resource management helps in reducing the impact of these abiotic stresses on crop. However, these management practices being long drawn and cost effective, there is a need to develop simple and low-cost strategies for abiotic stress management.



## USE OF ALTERNATIVE MEDICINES IN FIELD CASES OF RECURRENT MASTITIS IN DAIRY COWS

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### ABSTRACT

The present study included 12 cows with 26 numbers of quarters affected with recurrent clinical mastitis, divided randomly into 2 groups. Six cows with 14 quarters were treated with homeopathy (phytolacca 200c @ 10 drops tid po  $\times$  3 weeks or subsidence of symptoms) and other six cows with 12 quarters were treated with herbal medicine (giloy @ 100g bid po  $\times$  7 days). The milk samples were evaluated for California mastitis test, electrical conductivity and pH along with microbial analysis on d0, 7, 15 and 30. The major pathogens in present study were coagulase negative and coagulase positive staphylococci. The values of CMT, EC and pH declined significantly ( $p < 0.05$ ) on d7 to d30 in comparison to d0 in both the groups. The bacteriological cure rate in phytolacca treated group on d7, d15 and d30 was 18.18, 57.14 and 75 percent, respectively. Likewise, in giloy treated group, the bacteriological cure rate was 25, 57.14 and 66.66 percent on d7, d15 and d30, respectively. The mean recovery days and recovery percentage in phytolacca treated group was 17.66d and 75.35 percent, respectively and in giloy treated group was 18.17d and 68.25 percent, respectively. There was moderate increase in milk yield in both phytolacca and giloy treated groups. The average total cost of homeopathic (phytolacca) and herbal (giloy) treatment was Rs. 27 and Rs. 126, respectively. The study concludes that both homeopathy (phytolacca) and herbal (giloy) treatment were found to be effective in cases of recurrent clinical mastitis.

## TEAT TISSUE MEASUREMENTS AND VARIOUS MILK INFLAMMATORY PARAMETERS WITH RESPECT TO QUARTER HEALTH STATUS IN DAIRY COWS

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### ABSTRACT

The experiment involved ultrasonographic evaluation of teat and udder in apparently healthy dairy cows. A total of 32 apparently healthy dairy cows having 121 functional teats were ultrasonographically scanned at university dairy farm. Out of 121 quarters, healthy, latent, nonspecific and specific SCM quarters were 28.92, 27.27, 7.43 and 36.36 per cent, respectively. Upon comparison of teat tissue measurements in relation to quarter health status, the TCL was observed to be significantly increased and CD was significantly reduced in specific mastitis quarters compared to that of healthy ones. While TWT increased in quarters with latent infection and specific mastitis compared to healthy ones. The BTB score was significantly different in both non-specific mastitis and specific mastitis quarters, when compared to both healthy and latent infection quarters. Similar observations were noted with CMT score, EC, pH and Log<sub>10</sub>SCC values. The TWT was found to be significantly more in quarters with SCC 5-10 lac cells/ml of milk and in quarters with SCC > 10 lac, when compared with quarters having <2 lac and SCC 2-5 lac /ml of milk. A significant ( $P < 0.05$ ) reduction in CD and elevation in TWT and FTD values were observed in quarters with CMT score 3 as compared to CMT negative ones. The TCL, TWT and FTD were significantly more and CD less in infected teats in comparison to non-infected ones. Log<sub>10</sub>SCC and CMT were significantly positively correlated with TWT and negatively with CD. So, it was concluded from the results that USG can be used as supplement test for early diagnosis of mastitis.

## EFFECT OF RATIONALE USE OF ANTIBIOTICS ON OUTCOME OF CLINICAL MASTITIS CASES IN DAIRY COWS

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### ABSTRACT

A total of thirty-seven dairy cows having 87 quarters affected with clinical mastitis belonging to four dairy farms near Ludhiana were treated based on culture and sensitivity test results and the outcome of the therapy was observed. Milk samples from 147 quarters of these cows were collected on 0day, 7<sup>th</sup> day and 15<sup>th</sup> day post-initiation of treatment for bacteriological



examination and CMT. Physical examination of the udder and milk was also done to observe recovery after therapy. Severity of the case was determined by categorising animals falling under mild, moderate and severe depending upon clinical signs and symptoms along with physical changes observed. The cows were treated with rationale antibiotics along with supportive therapy like anti-inflammatory drugs, vitamin preparations, and drugs for local application (mastilep gel) depending on nature of case and clinical symptoms. A quarter was defined as bacteriological cured if the same bacterial species detected in the pretreatment milk sample was not present in the follow-up milk sample.

Out of thirty-seven cows, 11 were treated with Tetracycline, 7 were treated with Cefaperazonesulbactam, 9 were treated with Ampicillin sulbactam, 8 were treated with Gentamicin and 2 cows were treated with Enrofloxacin. All the antibiotics were administered parenterally for 5-7 days. The farmers were in contact for the recurrence of mastitis in the treated animals. Out of 122 quarters harbouring infection, 65 (53.27%) quarters showed no growth 7 days post treatment and 93(76.22%) quarters showed no growth 15 days post treatment. Out of 75 clinical quarters, 41 (54.66%) quarters were cured by 7 days post treatment and 59 (78.66%) quarters were cured by 15 days post treatment. CNS affected quarters (n=84) was cured by 54.76% and 85.71% by 7days and 15 days post treatment, respectively. Similarly, *S. aureus* affected quarters (n= 33) were cured by 48.48% and 54.54% on d 7 and d 15 post treatment, respectively. Out of total 37 animals 4 (10quarters), 14 (36 quarters) and 19 (41 quarters) animals were having mild, moderate and severe form of clinical mastitis, respectively. The treatment showed 75% of clinical cure in mild form, 64.28% in moderate form and 31.57% in severe form. There was appreciable improvement in the physical changes of udder and teats affected by clinical mastitis on the successive treatment.

## **GENOMIC SELECTION IN PLANT BREEDING**

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### **ABSTRACT**

Genomic selection is a specialised form of MAS exploiting molecular genetic markers to design novel breeding programmes. It is a method in plant breeding to predict the genetic value of untested lines based on genome wide marker data covering the entire genome, forms the basis of selection. The G.S. scheme was used to rectify the deficiency of MAS and MARS schemes which does not take into account the minor QTL. The accuracy of G.S. has proven to be affected by the data used in the G.S. model, including size of training population, relationships between individuals, marker density and use of pedigree information. It predicts the additive genetic effect of a line whereas the non-additive genetic effects are often disregarded and usefulness to either select new parents or new candidate varieties. G.S. has the potential to improve existing breeding schemes in plants. We postulate that improved breeding using new technique is required to face future challenges, especially the need for increased food and feed production on limited acreage.

## **COMPARISON OF KNOWLEDGE LEVEL REGARDING IMPROVED PRODUCTION TECHNOLOGY OF ARID LEGUME IN JAISALMER**

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### **ABSTRACT**

Agricultural extension services must be designed to develop agricultural skills among farmers, teach them communicate efficiently with producers and stimulate them to acquire new knowledge Extension service in agriculture is indispensable and it offers more than just expert assistance in improvement of production and processing, it also enables a flow of information and transfer of knowledge and scientific findings. A number of 100 farmers has been selected under SCSP (Schedule Cast Sub Plan) comprising both male and female farmers as beneficiary. Arid legume seed has been distributed among them at the rate of 1 kg seed to each farmer free of cost. Same number of the farmers has been selected as control group from same village. Jaisalmer is selected because CAZRI–RRS-Jaisalmer is located in the Jaisalmer. Village basanpeer is selected because SCSP could be implemented in Scheduled Cast dominated village farmers only. Here 100 farmers of the village both male and female has been selected, all belong to Scheduled Cast category Data has been collected with the help of the interview schedule It is found that the knowledge level of the beneficiary farmers was quite high as compared to knowledge of the non-beneficiary farmers. The higher knowledge level of improved arid legume production technology among the beneficiary ,





might be due to the reason that the trainings were given to the beneficiary farmers by the RRS Jaisalmer they have also been provided necessary guidance, literature by scientists and SMS of KVK, Jaisalmer

## **DETECTION OF CROP DISEASES AND PEST BY USING AGRICULTURAL DRONE**

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### **ABSTRACT**

Agriculture is one of the keys to the critical development of human civilization. In this reformist world, automation has started its matchless quality in each field of work. Yet, automation in the field of agriculture isn't as cutting edge nearly. Subsequently, the prerequisite of fostering an automation framework in the field of agriculture is approaching. Probably the greatest difficulty looked by farmers is the detection of diseases and pests in crops during the beginning phases of development. Exact recognizable proof of many plant highlights requires a specific degree of ability, nonetheless. If by some stroke of good luck a modest bunch of human specialists are qualified and able to produce preparing information, the interaction takes any longer than if assignments could be dependably performed by hundreds or thousands of non-specialists. This places a weight on those specialists and makes a bottleneck in the model preparing measure. The problem can be solved by using the drones for detection of diseases and pests. When drones are used for detecting the occurrence of pests and diseases, the information about pests and diseases of crops should be standardized and digitalized. The drones can also be used for spraying of plant protection chemicals, saves time and labour of the farmer, and is very helpful especially in high density orchards or fields where monitoring is very difficult. Drones have been used for wide-ranging applications in the fields of climate simulation monitoring, real-time video monitoring of pests and diseases, and real-time early warning systems for predicting the occurrence of pests and diseases. For agroclimatic diseases (such as wheat powdery mildew), the establishment of climate models through data collected by small climatic instruments arranged in the field can markedly reduce the incidence of disease. Thus drone technology can be very useful for the farmer community.

## **IMPORTANCE OF AWARENESS AND PERCEPTION OF FARMERS ABOUT SCHEMES FOR AGRICULTURE DEVELOPMENT IN INDIA**

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### **ABSTRACT**

In India Agriculture is a very important sector with a majority of the rural people in country depending on it. Most of the farmers are small and marginal. Owing to their limited economic capacity, various types of schemes are launched by government of India. It is very necessary that these schemes need to be utilised by farmers and the concerned implementing agencies should make strong aware about these schemes among farmers. Various schemes viz. Pradhan Mantri Kisan Samman Nidhi Yojana, Pradhan Mantri Kisan Maandhan Yojana, Pradhan Mantri Fasal Bima Yojana, Pradhan Mantri Krishi Sinchai Yojana, Kisan credit card scheme, Pashu Kisan credit card scheme, Paramparagat Krishi Vikas Yojana, National Agriculture market (e-NAM), Dairy Entrepreneurship development scheme, rainfed area development programme, soil health card scheme, National mission for sustainable Agriculture. In India Agriculture is mostly associated with negative outcomes that arise from floods, drought, pests, diseases and a plethora of other natural disasters. Under such a situation, crop insurance is a risk management tool that farmer can use. The Pradhan Mantri Fasal Bima Yojana (PMFBY) launched in 2016 as an insurance service for farmers. Crop insurance is a means to protect oneself against a small probability of large unexpected, unforeseen losses. In order to avail insurance cover for crops, one needs to pay a premium. play a major role in making awareness among farmers. So the service providers have to look on the product innovations and appropriate distribution channel to make crop insurance reach more effectively. Farmers need to be perceived about all these schemes. Pradhan Mantri Fasal Bima Yojana is a good initiative from the government in order to cope with changing climate and risks associated with natural calamities.



## EFFECT OF SOWING TIMES ON QUALITY PARAMETERS AND ECONOMICS OF WHEAT VARIETIES

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### ABSTRACT

The present investigation was carried out during the *Rabi* season of 2016-17 at the research farm of Wheat & Barley Section, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The soil of the experimental site was sandy loam in texture, slightly alkaline in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in a split plot design with four sowing times (5<sup>th</sup> November, 15<sup>th</sup> November, 25<sup>th</sup> November, 5<sup>th</sup> December) in the main plots and four wheat varieties (WH 1105, HD 2967, HD 3086, DBW 88) in the subplots with three replications. Quality parameters viz. sedimentation value (51.8 ml) and hectolitre weight (83.2 kg/hl) were maximum in 5<sup>th</sup> November sowing while protein content (13.2 %) was maximum in 5<sup>th</sup> December sowing. The sowing of the wheat crop on 5<sup>th</sup> November resulted in 27.4 and 20.5 per cent higher grain yield and B:C, respectively, as compared to the 5<sup>th</sup> December sowing. Among varieties, the highest sedimentation value (54.1 ml) and protein yield (679.8 kg/ha) were recorded with WH 1105, while, HD 3086 registered the highest hectolitre weight (81.6 kg/hl). The maximum grain yield (5822 kg/ha), net returns (? 37,320/ha) and B:C (1.40) were obtained from the wheat variety HD 3086, while, the maximum straw yield (8488 kg/ha) was recorded in the wheat variety HD 2967.

## FARMER PRODUCER COMPANIES (FPCS) – CAN EMPOWER FARMERS?

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### ABSTRACT

Farmer Producer Companies (FPCs) can play a crucial role in empowerment of farmers in country like India where agriculture play a predominant role in its economy and most of the farmers are small and marginal and their bargaining power/strength in the market is also low. Farmers have ability and expertise to produce but over decades they are facing the issue of not getting the fair price to their produce. Besides many reasons for this, lack of marketing skills and support is one of the main. In the changing scenario of globalization, farmers also need to empower themselves by improving their bargaining power/strength in the market by their aggregation and collective efforts. To mitigate these issues and to make agriculture sector more competitive and strengthen the economy of the farmers, Government of India has introduced Farmer Producer Companies (FPCs). Producer Companies are governed by new Company Act, 2013 and are owned and governed by primary producer's farmers, fishermen, craftsmen, artisans, milk producers. Farmer Producer Company can be formed by any 10 or more individuals, each of them must be producer. There should be minimum of 5 directors but cannot exceed 15. FPCs will act as a bridge between the market and producers and involve in the activities viz. 1) In the Procurement of the inputs, equipment and machines from both local and global market and provide it to farmers at most competitive prices (2) In the Production and procurement of quality seeds and to provide it to its members (3) Disseminating the market information and provide information regarding use of technology to farmers (4) To Purchase the produce of the farmers and sell it both at local and global level. (5) Dissemination of market information to the members (6) Branding, packing and standardizing the products of farmers to make it more competitive (7) Facilitating Finance to procure the inputs to members.

## IMPORTANCE OF INTELLECTUAL PROPERTY RIGHTS (IPRS) IN THE CONTEXT INDIAN AGRICULTURE

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### ABSTRACT

Intellectual property rights (IPR) is the subject of global trading activities and livelihoods around the world in the new scenario of globalization. IPR grants inventors or creators of that property certain exclusive rights in order to enable them to



reap commercial benefits from their creative efforts or reputation. Intellectual property rights (IPR) have been described as concepts, ideas, and creative expressions on the basis of which the willingness of the public to grant property status is based. In terms of available raw materials, cheap labor, innovative and innovative committed labor, India has all the tools. These rights improve the creative environment by giving the creator or inventor recognition and economic benefits, while the lack of knowledge of IPR and its ineffective implementation can impede the nation's economic, technological and societal developments. There are many ways of protection of intellectual property, such as patents, copyrights, trademarks, geographical indications, industrial designs, trade secrets, layout designs, protection of new plant varieties, etc. The biggest hitch with developing countries such as India is the lack of awareness about IPR. Lacking IPR awareness, outsiders are stealing our money and ideas and offering biopiracy provision. Having IPR in the basic educational framework and supporting IPR registration by encouraging innovators and developers is important for policy makers.

## **WOMEN EMPOWERMENT THROUGH INFORMATION COMMUNICATION TECHNOLOGIES**

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### **ABSTRACT**

In India Agriculture is a very important sector with a majority of the rural people in country depending on it. Information Communication Technology based smart agriculture enhance agriculture productivity and sustainability. ICTs appear ideally suited to the task of enhanced interaction because they can expand communication, cooperation, and ultimately innovation among the growing array of actors in agriculture. Information is a source of power. In modern India, women play an important role in the decision making. In India 50 per cent of women are illiterate. This illiteracy is a big barrier. Proper education is necessary for the development of country. There are Information Communication Technologies which provides information, education and knowledge among the women. In India women are suffering from different types of problems due to lack of knowledge, information and education. Thus, ICTs can be a good tool for empowerment. Emails, chat and Voice over Internet Protocol (VoIP) are boons to the rural areas. ICT makes the role of time and distance less significant in organizing business and production related activities. Women, therefore can work from anywhere and at any time and raise that extra income to become more financially independent and empowered. In India ICT applications such as E-Chaupal, E-Seva, e-Extension, AGRISNET, AGMARKNET, Agri Business Centres, e-KRISHI VIPANAN, Query Redress Services, Kisan Call Centres, Tata Kisan Kendra, AKASGANGA are quite successful in the communication of information, Transfer of Technology, procurement of Input and marketing.

## **IMPORTANCE OF INFORMATION COMMUNICATION TECHNOLOGIES IN THE DEVELOPMENT OF INDIAN AGRICULTURE**

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### **ABSTRACT**

Agriculture is the largest livelihood provider in rural India. Information Communication Technology based smart agriculture enhance agriculture productivity and sustainability. The problem of Indian agriculture is not lack of technology, R&D efforts but inadequacy and inefficiencies in the dissemination of information to the farmers. ICTs appear ideally suited to the task of enhanced interaction because they can expand communication, cooperation, and ultimately innovation among the growing array of actors in agriculture. The Indian telecommunication industry is the world's fastest growing telephone (landlines and mobile) subscribers and millions of mobile phone connections. ICT helps in growing demand for innovation. Numerous electronic tools increase interaction among the actors involved in agriculture. On a macro level, e-Science (e-Research) draws on increasingly connected and extensive digital infrastructure to facilitate collaboration and knowledge exchange nationally, regionally, and globally. On a micro level, m-Agriculture, powered by increasingly affordable mobile digital devices such as phones, laptops, and sensors, connects millions of rural people to sources of information. In India ICT applications such as E-Chaupal, E-Seva, e-Extension, AGRISNET, AGMARKNET, Agri Business Centres, e-KRISHI VIPANAN, Query Redress Services, Kisan Call Centres, Tata Kisan Kendra, AKASGANGA are quite successful in the communication of information. Therefore, ICT in agriculture will act as a driving force in the development process. Information technology is playing a crucial



l role in agricultural production and marketing and it allows farmers to save time for orders and delivery and to receive feedback.

## EFFECT OF SULPHUR ON YIELD AND YIELD RELATED CHARACTERS IN SOYBEAN [*GLYCINE MAX* (L.) MERRILL.]

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### ABSTRACT

During *kharif* season of 2013-2014 an experiment entitled “Response of soil application of various doses of sulphur on morpho-physiological parameters, quality aspects, yield and yield contributing parameters of soybean” to determine the morpho-physiological and bio-chemical, quality and yield of soybean was carried out at Regional Research Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Amravati in the Randomized block design with four replications having six treatments including viz., 0, 30, 40, 50, 60 and 70 kg sulphur/ha. The recommended dose of 30 kg N, 75 kg P<sub>2</sub>O<sub>5</sub> per hectare was given, sulphur was given through the Bensulf 90% (Mahadhan). Highest growth contributing parameters like plant height, number of leaves, number of branches and dry matter per plant and quality parameter like nitrogen, protein and oil content was recorded highest with the treatment 40kg/ha Sulphur application. Similarly highest number of pods, no. of root nodules/plant, Seed yield/plant and seed yield kg per hectare along with net monetary returns and benefit cost ratio was recorded with 40 kg/ hectare sulphur application. Similar studies need to carry out over years for drawing a strong conclusion.

## CONSTRAINTS IN ADOPTION OF KNOWLEDGE AND SKILLS ACQUIRED THROUGH VOCATIONAL TRAINING : A STUDY IN GWALIOR (M.P.)

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### ABSTRACT

Currently, more than 720 KVKs are functioning in the country for the welfare farming community. The KVKs work on principle of ‘teaching by doing’ and ‘learning by doing’ and providing adequate ‘work experience’ and technological support to the farmers, farm women, rural youth especially school dropouts and field extension functionaries through various programmes. The vocational training programme is one of the mandatory activities being organized by the KVKs on various subjects as per need of the area. These trainings are being imparted using most appropriate methodologies and procedures which results in skill development of youth in the concerned district. After completion of the course, the trainees are supposed to put the received knowledge and skills into practice to strengthen their farming-based enterprises. KVK Gwalior is organizing various activities including vocational training programmes as per the need and requirements of the farming community of the district since last two decades. A research study was conducted on 150 ex-trainees of KVK Gwalior to assess the major constraints in adoption of knowledge and skill acquired through vocational training programmes. Sample for the study was selected through proportional random sampling method. The data were collected through structured interview schedule and analysed using appropriate statistical methods. The findings reveals that the major constraints experienced by the respondents are; problem of marketing, packaging and branding of agricultural products, difficult process of getting credit from bank to establish new agro-based enterprises, no cooperation from KVK scientists in establishing enterprise after vocational training, less or no practical experience related to knowledge given in the training and incomplete knowledge in training programmes to establish an enterprise. The respondents suggested that Bank and Government officers should be involved in training programmes to facilitate loan and other procedures to start new enterprises. They also suggested that easy practicing technologies should be given in the training. Other important suggestions like Individual counseling approach should be adopted during training programme, duration of training programmes should not be less than one week for better results from vocational training programmes.





## STUDIES ON SHOOTING BEHAVIOR OF STRAWBERRY CV. WINTER STAR WITH DIFFERENT CONCENTRATIONS OF PLANT GROWTH REGULATORS UNDER IN VITRO CONDITIONS

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### ABSTRACT

The modern cultivated strawberry (*Fragaria × ananassa* Duch.) is one of the most commonly spread soft fruits in the world due to its genotypic richness, exceptionally heterozygous composition and wide variety of environmental adaptations. The study was conducted on strawberry under in vitro condition to find the shooting behavior of runner tip explants in MS medium supplemented with various amounts of auxins and cytokinins, either individually or in combination. The data revealed that the highest number of usable shoots (11.49) was observed in MS medium supplemented with 0.75 µM IAA + 2.0 µM Kinetin followed by MS + 0.50 µM IAA + 1.5 µM Kinetin which is (10.41) and MS + 0.250 µM IAA + 1.0 µM Kinetin i.e., (8.99), whereas, minimum shoots per culture (3.66) were recorded in control (MS basal alone). Also, the maximum number of leaves (9.41) was observed in (MS + 0.75 µM IAA + 2.0 µM Kinetin), which was followed by MS + 0.50 µM IAA + 1.5 µM Kinetin, whereas, minimum number of leaves per culture (3.41) was observed in control (MS basal alone) followed by MS + 0.50 µM BAP + 1.0 µM Kinetin.

## EFFECT OF DIFFERENT COMBINATIONS OF SOIL LESS SUBSTRATES ON FRUITING CHARACTERISTICS IN STRAWBERRY UNDER CONTROLLED CONDITIONS

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### ABSTRACT

Strawberry is widely grown in soil all over the world. It is a fragile plant, with a wide range of species attacking virtually every part of it, including the roots, crown, leaves and fruits. Therefore, five substrates cocopeat, perlite, vermiculite, vermicompost and FYM were used to create the different treatments in different proportion (by volume). Among different substrates combinations (cocopeat + perlite + vermiculite + vermicompost + FYM, 3:1:0:1:0) shows maximum berry weight (15.19 g and 14.24 g) which was followed by (cocopeat + perlite + vermiculite + vermicompost + FYM, 3:1:1:0:0) which was (13.81 g and 13.35 g) and minimum berry weight (9.50 g and 9.45 g) was observed in (Control). Similarly, the highest berry volume (15.98 ml and 14.87 ml) in strawberry cv. Camarosa was observed in (cocopeat + perlite + vermiculite + vermicompost + FYM, 3:1:0:1:0) followed by (cocopeat + perlite + vermiculite + vermicompost + FYM, 3:1:1:0:0) i.e., (14.60 ml and 13.67 ml), while lowest berry volume (10.30 ml and 10.12 ml) was observed in (Control).

## INSECT PEST MANAGEMENT IN ORGANIC AGRICULTURE

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### ABSTRACT

Insecticides used indiscriminately have resulted in various human health and environmental risks. The global concern about such negative consequences has drawn attention to the notion of organic farming, which has gained traction among stakeholders such as farmers, entrepreneurs, policymakers, and scientists. The emphasis on synthetic chemical inputs is reduced, and non-chemical pest control approaches are prioritised, preserving and safeguarding the ecosystem and its accompanying natural flora and fauna. Since genetically engineered crops and synthetic chemical pesticides are not authorised in organic agricultural methods, the threat of insect pests is a major problem. In organic system of cultivation, the major emphasis is laid on the application of ecologically sound practices and tactics such as selection of resistant/tolerant varieties, planting trap crops, following crop rotation, conservation of prevalent biological agents and soil quality management in an integrated pest management (IPM) approach into the cropping system; to minimize the crop damage and to restrain the pest population from reaching economic threshold level. However, the common approach of improving soil quality and changing cultural practises is frequently found to be insufficient to control insect populations and prevent economic harm. In such cases,



the inundative and augmentative release of biocontrol agents aids in the fast control of insect pests. In organic cultivation system, the use of biopesticides or microbials is advocated as a last option when pest population or damage levels are unacceptable. The main advantages of these commonly used *Bacillus thuringiensis*, other Plant-Incorporated-Protections, and biochemical pesticides such as insect sex pheromones are that they have no or low toxicity, affect only the target pest and closely related organisms, are quite effective in micro-quantities, kill quickly, and some even work well on high threshold pests levels. Combining these measures (IPM) is required to keep pest populations below the EIL, and when applied together, these practices may make organic ecosystems less appealing to insect pests.

## **UTILIZATION OF COLOURED MAIZE AS SOURCE OF NATURAL DYE TO DIVERSIFY USES OF MAIZE**

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### **ABSTRACT**

Color is a significant factor in determining the aesthetic appeal and quality of food products. Synthetic colours are commonly employed in food products to make them more appealing and increase customer acceptability across the world. People are becoming more aware of the health risks associated with food additives as quality requirements rise. Because synthetic dyes are hazardous in nature, they are attracting consumer attention as well as regulatory action. As a result, natural colourants have become quite popular in the food business as a way to make food safer. Anthocyanins are natural pigments that produce a variety of colours including red, orange, blue, purple, and even black. Not just for their colourant characteristics, but also for their antioxidant potential, these pigments are gaining in popularity. Anthocyanins are the most abundant group of water-soluble phytochemicals that belong to the most prevalent polyphenol class, flavanoids. Colored maize (*Zea mays*) anthocyanins have a long history as a colouring ingredient. Furthermore, the bioactive chemicals included in flavanoids provide several health advantages, making the colourant more suited for use in the food sector. After wheat and rice, maize is India's third most significant cereal. There is now many research relating to the use of purple corn kernels in the food and pharmaceutical industries across international borders, but their characterisation and comparison studies with other coloured maize and their usage in the food sector as colourants are still missing. Maize has the fastest growth rate and best productivity of all grains. It is mostly used in the feed business (>65%), followed by the distillery sector (12%), and as food (10-12 percent). It is feasible to improve maize's industrial value by diversifying its applications. Basic studies on anthocyanins in maize, as well as adequate documentation, are required in this regard.

## **HI-TECH HORTICULTURE A NOVEL TECHNOLOGY TO DOUBLE THE FARMERS INCOME**

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### **ABSTRACT**

Hi-tech horticulture is now widely employed for the profitable commercial production of horticultural products. Integrated pest control, integrated nutrition management, plasticulture, greenhouse or protected cultivation, hydroponics, microirrigation, fertigation, sub-soil drainage system, precision farming, high density planting, and hi-tech automation are examples of hi-tech horticulture methods. Despite the importance and breadth of diverse horticultural crops, the industry has struggled to break through in terms of production and market chain for a variety of reasons. This is due to the fact that most farmers are not using the most up-to-date production methods, such as Precision Horticulture Practices for soil, water, and planting material choices. Less production and productivity per unit area result from the injudicious application of essential inputs and the failure to embrace new technology. Hi- Tech horticulture entails using the appropriate scientific technologies, inputs, and field data to accomplish the right thing in the right location, at the right time, and in the right way. The emphasis is also on precisely determining the optimal sowing density, estimating fertiliser and other input needs, and more accurately predicting crop yields, thereby avoiding undesirable crop production practices and increasing the efficient use of labour, water, fertilisers, pesticides, and other inputs. By pumping and filling water at a shared water storage structure using a solar pumping system, the centralised drip and automation technology makes the greatest use of available bore well water. This has aided in the delivery of needed amounts of water and soluble nutrients using fertigation techniques, even when the electrical supply has been disrupted. This has reduced lot of problem in drip irrigation even as the stored water will be available throughout the year for drip irrigation. Hi-Tech horticulture includes constructing the green house according to the needs of the farmers, water



management through the installation of a centralised drip irrigation system, the construction of water storage structures, and the operation of drip irrigation, bed preparation, the supply of genuine and quality planting materials, crop specific fertigation scheduling, pest and disease management, and finally harvesting and marketing the produce.

## **BEE-KEEPING : GOLDEN OPPORTUNITY FOR INTEGRATED FARMING OPTION IN GENERATING MORE INCOME FOR LIVELIHOOD**

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### **ABSTRACT**

Beekeeping substantially assists in the diversification of agriculture and provides a great chance to farmers to generate additional revenue since it does not need a high degree of investment and is not labour intensive too. It can produce honey as a primary commodity, as well as bee wax, propolis, and royal jelly as secondary goods, generating additional money in addition to his regular farm activities. The purpose of this study is to distinguish between persons in terms of their readiness and assistance in changing people's attitudes regarding beekeeping as a side job. The report also highlights a number of problems that existing and prospective beekeepers confront. Theft protection, lack of insurance coverage for bees and bee boxes, indiscriminate pesticide usage, issues during honey bee colony migration, hazardous radiation from cellular networks, and a lack of understanding about government support have all been identified as important barriers to beekeeping. The alarming pace of conversion of cultivable land into residential centres decreases bee pasturage for managed bees. The current dangers to managed bees, as well as their solutions, may be used to persuade government officials to take the challenges and difficulties seriously, allowing future beekeepers to realise the benefits of beekeeping.

## **WEED CONTROL IN TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) THROUGH MULCHING AND HERBICIDES UNDER DRIP IRRIGATION CONDITIONS**

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### **ABSTRACT**

The Experiment was conducted on Horticulture Polytechnic, AES, NAU, Paria during the year 2015-16 with eight treatments T<sub>1</sub> Pendimethalin @ 1.0 kg/ha as (Pre-emergence) + 1 hand weeding 45 DAT, T<sub>2</sub> Pendimethalin @ 1.0 kg/ha as (Pre-emergence) and quizalofop-p-ethyl @ 0.04 kg/ha at 45 DAT, (Post-emergence), T<sub>3</sub> Weed free, T<sub>4</sub> Unwedded control, T<sub>5</sub> Black Polythene mulch (50 µ), T<sub>6</sub> Silver Polythene mulch (50 µ), T<sub>7</sub> Red Polythene mulch (50 µ) and T<sub>8</sub> Paddy straw mulch (5 tons/ha) design RBD with three replication. The result revealed that the weed control treatments showed significant effect on growth & yield attributes in tomato var. Abhinav. The data revealed that the highest plant height (69.0.2cm) at 60 DAT, no of fruit (70.52) and total yield per ha (82.45t/h) was significantly the maximum among all the treatments shown in treatment T<sub>5</sub> Black polythene mulch (50 µ). Also showed highest weed control efficiency and lower weed index found treatment T<sub>5</sub> Black polythene mulch (50 µ).

## **YIELD BARRIER-BREAKING TECHNIQUES IN THE CURRENT SCENARIO**

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### **ABSTRACT**

The global population continues to grow, and by 2050, it is predicted to reach 9 billion people. This would considerably increase food demand, posing a serious danger to world food security. A progressive decline in overall arable land, as well as climate change, are posing further issues. As a result, it is critical to review and adapt existing food production techniques in order to incorporate innovative approaches that can assist break crop yield barriers in the near future for global food security. Natural biodiversity is an underutilised, sustainable resource that can enrich the genetic basis of cultivated plants with new alleles that improve production and adaptability. Plant breeding techniques like pre-breeding, de novo domestication, and distant hybridization can be utilised to overcome yield constraints. The concept of "New Plant Type" (NPT) could be an



alternative for breaking the yield plateau of hybrids. First-generation NPT lines developed at IRRI from tropical japonica had large panicles, few unproductive tillers and resistance to lodging but low grain yield due to the limited production of biomass and poor filling of grains. To overcome these problems development of second-generation NPT lines began by crossing first-generation tropical japonica NPT lines with elite indica parents. In this, genes from indica parents have efficiently decreased panicle size, enhanced tiller ability and grain quality along with disease and insect resistance. Plant breeders can use NPT to supplement standard breeding approaches and gain a better comprehension of specific traits as well as diversify trait genetic variation. Despite achievements and benefits of traditional breeding, it is unlikely to meet the requirement for quick production of superior cultivars. Modern breeding strategies based on genomics, as well as biotechnological approaches that enable the identification and usage of candidate genes, should be emphasized in this regard. Furthermore, using molecular approaches such as quantitative trait locus and association mapping to select positive chromosomal regions linked to natural variation for grain yield and stress resistance may increase the possibility of directly selecting positive chromosomal regions linked to natural variation for grain yield and stress resistance. These strategies could be used to generate elite crop types to feed the world's rising population.

## **A STUDY ON MANAGEMENT OF ECO-FRIENDLY PRACTICES IN AGRICULTURE AMONG THE TRIBAL FARMERS OF BETUL DISTRICT OF MADHYA PRADESH**

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### **ABSTRACT**

The present study was conducted in Sahapur and Bhimpur block were purposively selected based on tribal area of Betul district of M.P. The total sample was consisted 120 respondents for the study. Variables like education, social participation, size of land holding, annual income, credit availability, occupation, source of information, material possession, extension contact, extension participation and innovativeness were positively and significantly correlated with knowledge about eco-friendly practices at 1 per cent level of significance and education, social participation, credit availability, extension participation, extension contact and innovativeness were positively and significantly correlated with adoption of eco-friendly practices at 1 per cent level of significance. Majority of the respondents suggested making availability of pest resistant varieties, followed by three-fourth of respondents said organizing training on eco-friendly practices to minimise the ill effect of agrochemicals as perceived by farmers. The development of India is also depending on agriculture and it is engaging about 70 per cent of its population directly or indirectly. It contributes nearly 37 per cent of the net national product. The modern agriculture has been successful in meeting the increased food needs of alarmingly growing population. But the problem associated with modern agriculture like, the high cost of inorganic or chemical fertilizers and plant protection chemicals, stagnated yield level.

## **EVALUATION OF SUNFLOWER VARIETY, RSFH-1887 UNDER FRONT LINE DEMONSTRATIONS IN COMPARISON WITH FARMERS PRACTICE**

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### **ABSTRACT**

The front-line demonstration on sunflower variety RSFH-1887 was conducted on integrated crop management (ICM) in comparison with farmer's practices at Huvinahadagalitaluka of Ballari Dist., Karnataka. The demonstrations were carried out under rain fed situation for the year 2018 and 2019 with recommend package of practices like seed treatment with bio fertilizers, application of FYM @ 3 ton, NPK @ 35:50:35/ ha, proper hand weeding and pest management by spraying of imidacloprid 17.8 SL @ 0.3 ml/lit against the sucking pests, carbendazim 50WP @ 1.0 gm/lit against the alternaria leaf spot. The results of the demonstrations were revealed that, the yield in ICM block was 10.57 quintal per acre compared to farmers practice (9.07 q/acre) during 2018. Whereas, the grain yield of 11.23 quintal per acre and 9.25 quintal per acre in ICM blocks and farmers practice respectively during 2019. The percent yield increase in demo plots compared to farmers practice was 14.19 per cent during both the years.





## EVALUATION OF MAIZE VARIETY, RCRMH-2 UNDER FRONT LINE DEMONSTRATIONS IN COMPARISON WITH FARMERS PRACTICE

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### ABSTRACT

The front-line demonstration on maize variety RCRMH-2 was conducted on integrated crop management (ICM) concept in comparison with farmer's practices at Huvinahadagali and Hagaribommanahallitalukas of Ballari Dist., Karnataka. Totally ten demonstrations were carried out under rain fed situation during the year 2020 with recommend package of practices like seed treatment with bio fertilizers, application of FYM @ 3 ton, NPK @ 100:50:25 kg / ha, application of zinc sulphate 2 10 kg / ha, proper hand weeding. With respect to the pest management, application of poison bait and carbaryl 4% @ 7.5 kg per hectare against insect pests and seed treatment with *Trichoderma harzianum* @ 10g per kg seeds and spraying of mancozeb 75 WP @ 2.5 g per liter against the seed born diseases and leaf spot diseases. After successful conducting of demonstrations in all the spots, the results were revealed that, the grain yield in ICM block was 22.5 quintal per acre compared to farmers practice (19.30 q/acre) with per cent increase in grain yield of 14.22. The farmer's opinion was also collected and they expressed that the demonstration plots were found superior in getting fodder yield and grain yield with the B:C ratio of 1.68.

## MANAGEMENT OF FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (J.E. SMITH) (LEPIDOPTERA : NOCTUIDAE) ON MAIZE

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### ABSTRACT

The investigations on management of Fall Armyworm, *Spodoptera frugiperda* (J E Smith) (Lepidoptera: Noctuidae) on maize was carried out to determine the influence of insecticides and bio-agents in combination with wetting agent and without wetting agent in farmer's field at Huvinahadagalitalukas of Ballari district, Karnataka during 2019 to 2020. The results of experiment revealed that, among all the chemicals screened the emamectin benzoate 5 SG @ 0.2 g per litre proved superior compared to rest of the treatments in all the parameters studied. In best treatment the lowest number of 0.29 larvae per plant at first spray and 0.41 larvae per plant at second spray during 2019. Similarly, the same chemical proved superior and recorded the lowest number of larvae per plant (0.40) at first spray and 0.46 larvae per plant at second spray during 2020. With respect to the egg mass recorded the lowest egg mass of 0.45 per plant at 2019 and 0.27 egg mass per plant at 2020. The per cent defoliation was minimum (3.71%) per plant in first spray and 4.14 per cent per plant in second spray during 2019 and minimum of 3.04 and 3.70 per cent per plant in first and second spray respectively during 2020. With respect to the yield parameter studied, the lowest cob damage (1.68 %) and highest grain yield of 41.25 quintal per hectare was recorded during 2019. Similarly, 1.10 per cent cob damage and 40.50 quintal per hectare grains yield was obtained during 2020 in emamectin benzoate at 0.2 g per litre followed by spinetoram 11.7 SC at 0.5 ml, chlorantraniliprole 18.5 SC at 0.2 ml and spinosad 45 SC at 0.20 ml per litre. The *Metarhizium rileyi* at 2 g per litre was found next best treatment compared to insecticides and recorded the per cent cob damage (1.56%) and grain yield of 33.58 quintal per hectare compared to untreated control (23.66 q/ha). The combination of wetting agent with insecticides showed no remarkable effect significantly.

## ASSESSMENT OF BROAD-SPECTRUM INSECTICIDE (PROPARGITE 50 % + BIFENTHRIN 5% SE) ON THE MANAGEMENT OF SUCKING PESTS IN OKRA

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### ABSTRACT

The present experiment was conducted at the experimental field of Krishi Vigyan Kendra Satna, (M.P.) during *kharif* season of 2020, to assessment of broad-spectrum insecticide Propargite 50%+Bifenthrin 5%SE against sucking pests i.e. Mites, Whitefly and Jassids population in Okra crop. In order to prevent the losses due to these insects, on farm testing at farmers field was



conducted by assessing the technology in application of Propargite 50% + Bifenthrin 5% SE (621 + 62.1 g a.i./ha) in two sprays first in 35 days and second spray at 50 days after sowing at vegetative and flowering stage of Okra crop in effectively control of sucking pest (Mites, Whitefly and Jassids) as against the farmers practices (Use of foliar spray of Lambda-cyhalothrin 4.9 % CS @ 250 ml/ha). The assessed technology (T-3) reduced the incidence of average sucking pests population/three terminal leaves in Okra crop Mites (27.2), White fly (19.8) and Jassids (17.6) and gave an yield of 112.11 q/ha with net returns of Rs 83784 per ha as compared to farmers practice (T-2) which recorded the average mean of sucking pest population of Mites (47), Whitefly (34.4) and Jassids (32.7) per three terminal leaves and thus reduction in yield by 90.44 q per ha. With net returns of Rs.66352.0 per ha.

## THE FUNCTIONAL RESPONSE OF SPIDER, SALTICIDAE (*HYLLUS SEMICUPREUS*) ON APHID, APHIS CRACCIVORA (HOMOPTERA : APHIDIDAE)

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### ABSTRACT

Predation is of great ecological, evolutionary and behavioural interest. Spider has a wide insect host range and thus can act as biological control agents of insect pests in agroecosystems. An experiment was conducted in Biocontrol Research and Production Centre, Department of Entomology, College of Agriculture, Jawaharlal Nehru Agricultural University, Jabalpur (M.P.) India to determine the functional response of spider, *Hyllus semicupreus* (Araneae: Salticidae) as test predator on different densities of aphid, *Aphis craccivora* (Homoptera: Aphididae). The results indicated that the consumption rate of spider, *Hyllus semicupreus* ranged from 8±1 on an average; whereas the maximum predation of *A. craccivora* recorded in 24 h was 91% with type II response.

## MARKETING AND EXPORT PERFORMANCE OF LITCHI IN MUZAFFARPUR DISTRICT OF BIHAR

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### ABSTRACT

The study was carried out to assess the current status of export and marketing of litchi and was based on the primary data collected from 120 randomly selected Litchi growers in Muzaffarpur district of Bihar. The feasibility of export of litchi from Muzaffarpur to European markets has taken a new dimension with the fast-changing technology in the exporting of fruits since 1993. The study also intended to find out marketing system and marketing channels followed by growers in domestic and overseas as marketing, marketing costs, marketing margin incurred price spread and marketing efficiency resulted in domestic markets. Along with, trend in area, production, productivity and export. The producer's share in consumer rupee in channel I<sup>st</sup> is highest since it is the shortest channel (83.64 percent) whereas the producer's share in consumer rupee in channel I, channel II and Channel III are 72.72 percent 65.45 percent and 54.54 percent respectively. The price spread in channel I is the lowest because it is the shortest channel (Rs.900) where as the price spread in channel II, channel III and channel IV are Rs. 1500, 1900, and 2500 respectively. The marketing efficiency for channel I, II, III and IV were 5.11, 2.66, 1.89 and 1.09 respectively. It is observed from this efficiency index that channel first was the most efficient one.

## QUALITY CHARACTERISTICS OF DEHYDRATED RESTRUCTURED PRODUCT FROM SELECTED FISHES

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### ABSTRACT

Fish protein isolates were prepared from pangasius (*Pangasianodon hypophthalmus*), Indian salmon (*Eleutheronema*



*tetradactylum*), Ribbon fish (*Trichiurus lepturus*) and Bombay duck (*Harpadon nehereus*) fish mince by isoelectric solubilization/precipitation method. Restructured products were prepared from fish protein isolate by incorporating salt (1%), sodium alginate (1%) and calcium chloride (0.5%) and freeze dried. Samples were stored in airtight container, kept at refrigeration condition and analyzed up to 3 months. Moisture content of dehydrated restructured product varied from  $2.5 \pm 0.20\%$  to  $3.85 \pm 0.16\%$ . Protein content was ranged from  $63.19 \pm 0.80\%$ – $92.5\% \pm 0.80\%$ . TVB-N value varied from  $4.2 \pm 0.65$  mg% to  $14.7 \pm 0.99$  mg%. Peroxide value was found to be 3.21–25.55 % of oleic acid. Thiobarbituric acid value was found to be high in restructured product from pangasius isolate i.e.  $2.88 \pm 0.02$  to  $6.14 \pm 0.01$  mg malonaldehyde/ kg of fat. Moreover, restructured product from bombay duck had a lower Thiobarbituric acid value of  $0.65 \pm 0.01$ – $1.85 \pm 0.01$  mg malonaldehyde/ kg of fat during storage. Total plate counts were within acceptable limit in all the samples throughout the storage.

## RECENT TRENDS IN PLANT BREEDING FOR NUTRITIONAL ENHANCEMENT IN LEGUMES—A REVIEW

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### ABSTRACT

The biggest challenge of the twenty first century is to meet the global demands for food and nutritional security. With the increasing global population, the constant decrease in natural resources and the effects of climate change has made this challenge really difficult. Perhaps the problem of hidden hunger or malnutrition due to micronutrient deficiencies is quite profound globally and needs immediate attention. With respect to micronutrient deficiencies grain legumes that are an integral part of human diets as well as farming systems play a critical role in addressing the deficiencies associated with nutrients. Focussing more on the rural nutritional security where there are lack of resources selection of nutrient rich grain legumes or developing cultivars which are of good quality and highly enriched with nutritional characteristics is a remarkable approach to deal with the issue of malnutrition. The ongoing research in the field of bio fortification will definitely prove to be an efficient tool in providing nutrient dense legumes to the poorest of the poor. Genomics along with the multi “omics” approaches and next generation genomic sequencing will help the researchers to enrich the edible grain legumes with major bioavailable compounds. Pulses and legumes are important source of plant proteins, dietary fibre, carbohydrates, many bioactive compounds and secondary metabolites. Improving the nutrient content of legumes with the help of genomics, transgenic and recent trends in plant breeding approaches will be a revolutionary step to combat malnutrition. The below literature highlights the various methods used for the quality enhancement of major legumes.

## ASSESSMENT OF HIGH YIELDING RICE VARIETIES FOR THEIR GROWTH AND YIELD PERFORMANCE IN SEPAHIJALA DISTRICT OF TRIPURA

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### ABSTRACT

In Tripura rice is grown in 2.75 lakh ha of area with a production and productivity of 8.21 lakh tones and  $2.9 \text{ t ha}^{-1}$ . High yielding rice variety is grown in most of the area of Sepahijala district but the varieties grown by the farmers either very old or susceptible to various pests and diseases due to that the production from those varieties are less as compared to the new high yielding varieties. Assessment of high yielding rice varieties for assessment of their growth and yield performance was conducted at five different farmers' fields during the year 2019-20 under on farm testing. In the experiment individual farmers are taken as replications and high yielding rice varieties are taken as treatments. From the experiment the results revealed that Gomati recorded the highest values for growth, yield and cost economics traits. Though the growth characters like plant height (140 cm), 50% flowering (74.20 days) and total duration of varieties (138.60 days) in case of Sahalom but the highest yield recorded under variety Gomati ( $5.36 \text{ t ha}^{-1}$ ) followed by Tripura Chickon ( $4.62 \text{ t ha}^{-1}$ ) and Sahalom ( $3.98 \text{ t ha}^{-1}$ ), where variety



Gomati also resulted significantly highest test weight (23.04 g) and number of panicle ( $m^{-2}$ ) (517). In the case of benefit cost ratio, Gomati recorded the highest ratio of 1.71 with the net profit of Rs 41495.32 followed by Tripura Chickon (1.48) whereas local check (Sahalom) observed the lowest B:C ratio (1.27) and net profit of Rs. 15,938.92. Gomati is performed well and increased yield of 35% with good market preference over the farmer's practices. Due to highest yield of Gomati was found to be the most suitable high yielding rice variety under Sepahijala district conditions.

## **APPLICATION OF PROBIOTICS AND PREBIOTICS IN POULTRY PRODUCTION**

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### **ABSTRACT**

The antibiotic residual effects and development of drug resistant bacteria. The alternatives to antibiotics for poultry production. Probiotics is a live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance. The mode of action is to maintain useful microflora in digestive tract with digestive enzyme activity and suppress ammonia production. The characteristics of ideal probiotics are nonpathogenic & toxic, withstand processing & storage and resist gastric acid and bile. It produces lactic acid during fermentation and bactericidal compounds. The probiotics used in poultry like as *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus lactis*, *Streptococcus thermophilus*, *Enterococcus faecium*, and *Bifidobacterium bifidum*. Prebiotics refers to a non digestible feed ingredient that beneficially affects the host by selectively stimulating the growth and activity of one or limited number of bacteria in the large intestine. The mode of action of prebiotics is to prevention of intestinal colonization by disease-producing bacteria and direct inhibition of pathogens and increase disease resistance. The characteristics of ideal prebiotics are beneficially alter the intestinal microbiota & their activities and systemic aspects of host defense system. The mixture of probiotics and prebiotics that improve the survival and implantation of live microbial dietary supplements in the gastrointestinal tract. Pathogen control Probiotics can be used to control pathogen excretion on poultry farms and maintain a microbiome that is beneficial to bird health. The probiotics and prebiotics are beneficially to improvement in intestinal microflora balance and stimulates the immune system with reduce the numbers of pathogenic bacteria colonization in GIT and also improve the growth performance with feed efficiency of broilers.

## **SEED TECHNOLOGICAL INVESTIGATIONS ON EFFECT OF DIFFERENT PRE-SOWING SEED TREATMENT TO IMPROVE THE PLANT ESTABLISHMENT UNDER DIRECT SEEDED RICE METHOD IN KRH-4**

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### **ABSTRACT**

An investigation associated with Seed technological investigations in Rice under DSR method was conducted at I-Block, ZARS, V C FARM, MANDYA, UAS, GKVK, Bangalore during 2019-20. The experiment was laid out in randomized complete block design with one genotype (KRH-4) and nine treatments in three replications. Among all the treatments Seed priming with  $ZnSO_4$  @ 3% ( $T_5$ ) recorded significantly the higher field emergence (91.00 %), plant height at 30, 60, 90 DAS and at harvest (27.92, 75.60, 105.73, 124.47 cm), panicle length (20.80), number of tillers at 30, 45, 60, 90 DAS (5.17, 5.20, 6.80, 10.47), days to 50% flowering (90.33), days to maturity (123.33), number of panicles per plant (13.69), number of seeds per panicle (192.62), number of filled seeds per panicle (172.51), seed yield per plant (36.75 g), seed yield per plot (12.64 kg), seed yield per hectare (63.20 q), seed recovery % (94.09), test weight of 1000 seeds (20.93 g) followed by Seed priming with  $CaCl_2$  @ 2% ( $T_3$  - 88.00%, 29.3 cm, 73.47 cm, 105.40 cm, 122.33 cm, 21.40, 5.13, 5.10, 6.27, 9.40, 89.67%, 122.00, 11.39, 184.77, 172.42, 94.16, 35.23 g, 12.50 kg, 62.50q, 20.74 g) and the lowest was recorded in Control ( $T_1$  - 84.33 %, 29.53 cm, 62.20 cm, 99.87 cm, 104.60 cm, 20.47, 4.30, 4.70, 5.67, 8.33, 85.33%, 114.33, 13.56, 172.32, 143.24, 83.02, 26.61 g, 11.90 kg, 59.50q, 19.79 g respectively).





## EFFECT OF GA<sub>3</sub> ON GROWTH, FLOWERING & YIELD OF GERBERA (*G. JAMSONII*) VAR. *GOLIANTH*

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### ABSTRACT

Evaluate the effect of gibberellic acid on gerbera five treatment combinations i.e. 0, 50, 100, 150 and 200ppm were arranged in an RBD with six replications. T<sub>0</sub> control one-time spray of GA<sub>3</sub> at 15 DAT, T<sub>2</sub> two-time sprays of GA<sub>3</sub> at 15 DAT, and T<sub>3</sub> three times spray of GA<sub>3</sub> at 30, 45 and 60 DAT were used in the present study. It was concluded that foliar spray of GA<sub>3</sub> @ 200 ppm resulted in significantly higher growth parameters such as plant height, number of leaves or branches, stalk length & diameter, fresh & dry weight of stem, leaves/plant of gerbera thereby highest flower yield of gerbera var. *Golianth* (191.38q/ha). The self-life and vase life of gerbera flower were also increased by about 3 days (upto 11.96 and 14.85 days, respectively) due to flower spray of GA<sub>3</sub> upto 200ppm.

## NUTRITIONAL AND MINERAL COMPOSITION OF SPECIALITY RABI SORGHUM GENOTYPES IN NORTHERN DRY ZONE OF KARNATAKA, INDIA

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### ABSTRACT

Drought is a major constrain in sorghum production worldwide. Drought adversely affects growth and yield of crops to various extents. A field experiment was conducted with 20 rabi sorghum genotypes including 4 checks under medium soil to study the variation in key root traits of rabi sorghum genotypes that contributes to the drought tolerance in field condition with the help of rhizotron by maintaining irrigated and stressed condition during 2018-19 at Regional Agriculture Research Station, Vijayapur. Among the genotypes CRS65 and PhuleAnuradha recorded least days for 50% flowering (69 and 68 days, respectively) followed by RL142 and RSV2145 (73 and 69 days, respectively) under irrigated and stressed condition. The root length after harvesting was significantly higher in BJV-362 and CRS 67 (38cm and 56cm, respectively) followed by P.Anuradha (37cm) and STG 44 (55cm) under irrigated and stressed condition compared to other genotypes reflecting that under stressed condition more root length help for absorption of water from deep ground level. Root volume was significantly higher in BJV-125 and P.Suchitra (16.76cm<sup>3</sup> and 7.56cm<sup>3</sup>, respectively) followed by M-35-1 (14.62cm<sup>3</sup>) and STG21 (6.3cm<sup>3</sup>) under irrigated and stressed condition. However the root dry matter was more in P.Suchitra (8.8g) followed by CRS67 (7.7g) and M-35-1 (4.06g) followed by STG44 (3.78g) under irrigated and stressed condition respectively. The yield was recorded higher in the genotype P.Suchitra (102.6g plant<sup>-1</sup>) followed by RV48 (91.00g plant<sup>-1</sup>) under irrigated condition and PhuleSuchitra (80.00g plant<sup>-1</sup>) followed by P.Anuradha and M-35-1 under stressed condition. The experiment concluded that, the root traits indicate the adaptability of the genotypes at drought condition and further can be used in the breeding programme for higher grain yield.

## EFFECT OF PROTEIN SUPPLEMENTS ON FEED INTAKE, WATER INTAKE AND PRODUCTION OF LACTATING GIR COWS

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### ABSTRACT

The study was conducted on 16 lactating Gir cows, which were divided into four groups on the basis of body weight and average milk yield/day at Dairy farm (LPM Deptt.) S.K.N. College of agriculture, Jobner (Rajasthan) and subjected to four dietary treatments i.e. Wheat straw *ad-lib.* + Green Lucerne (5 kg) + Concentrate (T<sub>1</sub>), T<sub>1</sub> + Urea 75 g/cow (T<sub>2</sub>), T<sub>1</sub> + Mustard oil cake 614 g/cow (T<sub>3</sub>) and T<sub>1</sub> + Guar meal 505 g/cow (T<sub>4</sub>). The studied for their feed intake and water intake in Gir



cows. Daily in kg dry matter intake (DMI) was significantly ( $P<0.05$ ) higher in group T<sub>4</sub> (11.87) than groups T<sub>3</sub> (11.76), T<sub>2</sub> (9.83) and T<sub>1</sub> (10.76). The Mean DMI/100 kg body weight was also higher ( $P<0.05$ ) in group T<sub>4</sub> cows as compared to other groups. Voluntary water intake (litre/animal) was significantly ( $P<0.05$ ) higher in group T<sub>4</sub> (32.80) than groups T<sub>3</sub> (31.42), T<sub>2</sub> (31.35) and T<sub>1</sub> (29.91). Average daily milk yield (litre/cow) was significantly ( $P<0.05$ ) higher in group T<sub>4</sub> (7.85) than groups T<sub>3</sub> (7.13), T<sub>2</sub> (7.05) and T<sub>1</sub> (6.67). It can be inferred from this experiment that feeding of concentrate mixture on Wheat straw diet with guar meal supplement increased the milk production. Therefore, It can be concluded that feeding of Guar meal (Group T<sub>4</sub>) increased dry matter intake and water intake as compared to Urea and Mustard oil cake feeding in Gir cows as well as increased the milk production.

## EFFECT OF MUTAGENS ON DEVELOPMENT OF MUTANTS IN TURMERIC CV. PRATHIBHA (*CURCUMA LONGA* L.)

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### ABSTRACT

The present experiment was carried out during *kharif*, 2016-2017 at College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem to assess the impact of mutagens on mutagenicity like Mutation frequency on M<sub>1</sub> population basis, Mutagenic effectiveness, Mutagenic efficiency and Frequency of albino, xantha and chlorina mutants in turmeric. The experiment was laid out in factorial randomized block design and replicated thrice under open field conditions. Rhizomes are treated with gamma rays (25 Gy and 50 Gy) and EMS (250 ppm, 500 ppm and 1000 ppm) along with control. Among the treatment combinations, maximum mutation frequency (20.00 per cent) was observed in 25 Gy gamma rays + 250 ppm EMS concentration. Among the treatment combinations, maximum mutagenic effectiveness (0.420) was recorded in 25 Gy gamma rays + 250 ppm EMS concentration. Highest mutagenic efficiency (0.010) was observed in 25 Gy gamma rays + 250 ppm EMS concentration. In the present study, there were differences in the frequency of chlorophyll mutations due to doses and concentrations of gamma rays and EMS. The occurrence of chlorophyll chimera in the present investigation could be attributed to chromosomal aberrations, change in the route of auxin synthesis, disruption of mineral metabolism or accumulation of free amino acids.

## BIOTECHNOLOGY A MODERN TOOL FOR CROP IMPROVEMENT

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### ABSTRACT

Plant breeding plays a major role in increasing crop yield for over a century. Continue efforts have been made to inculcate desirable trait like diseases tolerant, higher yield, abiotic stress tolerant etc. in a single line or genotype. Crop improvement is based on the criteria novelty, stability, uniformity and utility; which a breeder achieve by combined application of conventional breeding and tools of biotechnology, this emphasis of plant biotechnology supplements breeding for crop improvement. Thus, the integration of both plant breeding and biotechnology, overcome the increasingly sophisticated, and staggering breeding procedure in easiest way. Continuous varietal improvement through conventional breeding needs biotechnology to maximize the probability of success. Tissue culture and genetic engineering are the two major approaches dealing with crop improvement via biotechnology. In plant breeding, biotechnology is more than genetic engineering which address problems in all areas of agricultural production and processing. This includes raise and stabilize yields to improve resistance to pests, diseases and abiotic stresses such as drought and cold and to enhance the nutritional content of foods like protein in pulses, etc. There are three major aspects of biotechnology in crop breeding i.e., Plant tissue culture, transgenic approaches and molecular breeding methods. Several advance tools are being utilized for that purpose including, nanotechnology, bioinformatics tools offers new era of genomics assisted molecular breeding. Next Generation Sequencing and high throughput genotyping approaches are increasing efficiency and output of biotechnological tools in agriculture.



## WEED CONTROL IN TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) THROUGH MULCHING AND HERBICIDES UNDER DRIP IRRIGATION CONDITIONS

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### ABSTRACT

The Experiment was conducted on Horticulture Polytechnic, AES , NAU, Paria during the year 2015-16 with eight treatments T<sub>1</sub> Pendimethalin @ 1.0 kg/ha as ( Pre-emergence) + 1 hand weeding 45 DAT, T<sub>2</sub> Pendimethalin @ 1.0 kg/ha as (Pre-emergence) and quizalofop-p-ethyl @ 0.04 kg/ha at 45 DAT, (Post-emergence), T<sub>3</sub> Weed free, T<sub>4</sub> Unwedded control , T<sub>5</sub> Black Polythene mulch (50 µ), T<sub>6</sub> Silver Polythene mulch (50 µ), T<sub>7</sub> Red Polythene mulch (50 µ) and T<sub>8</sub> Paddy straw mulch (5 tons/ha) design RBD with three replication. The result revealed that the weed control treatments showed significant effect on growth & yield attributes in tomato var. Abhinav. The data revealed that the highest plant height (69.0.2cm) at 60 DAT, no of fruit (70.52) and total yield per ha (82.45t/ha) was significantly the maximum among all the treatments shown in treatment T<sub>5</sub> Black polythene mulch (50 µ). Also showed highest weed control efficiency and lower weed index found treatment T<sub>5</sub> Black polythene mulch (50 µ).

## ROLE AND APPLICATION OF NANOTECHNOLOGY IN THE MODERN AGRICULTURE PRACTICE

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### ABSTRACT

Scientists have used nanotechnology to design a smart delivery system that would release nutrients in a slow and controlled manner to the targeted site to tackle nutrient deficiency in plants. Nanofertilizers increase crop productivity by enhancing the availability of essential nutrients to the plant. A significant increase in the yields of millet and cluster beans was found after the application of nanophosphorus fertilizers in arid conditions. Chitosan nanoparticles suspensions containing nitrogen, phosphorus, and sodium have also increased crop production. The poor awareness of the farmers in general and the excessive use of chemicals has severely affected the agricultural land as the toxic agrochemicals pollute the surface and groundwater. The increased use of chemical pesticides also eliminates beneficial microbes, insects, and other wildlife from the soil. The cumulative effect of all of the above results in major degradation of the ecosystem. In the agricultural sector, polymeric nanoparticles are used in the delivery of agrochemicals in a slow and controlled manner. Some of the advantages of polymeric nanoparticles are their superior biocompatibility and minimal impact on non-targeted organisms. Some of the polymeric nanomaterials used in agriculture are polyethylene glycol, poly(epsilon-caprolactone), poly(lactide-co-glycolides), and poly ( -glutamic acid).

## RESEARCH REVIEW ON PULSES IN RICE (*ORYZA SATIVA*) FALLOW SITUATIONS

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### ABSTRACT

In the South Asia, particularly in India Rice fallow, a rainfed lowland agro-ecology, is presently gaining particular attention for sustainable cropping intensification. The intensification of cropping in rice-fallow areas is largely facing problems in less availability of water for irrigation, the poor soil and financial status of the farmers. In India around 11.695 M ha remains fallow after the harvesting of rice in which around Eastern India has the 82% of the total fallow lands and the rest falls in three southern states viz., Tamil Nadu, Karnataka and Andhra Pradesh. Pulse crops such as lentil, chickpea, lathyrus, mungbean and uradbean have a great opportunity to grow these kinds of crops which require low input and low water requirements. The fallow lands utilization may increase the productivity and make the whole system sustainable. Soil condition and environmental conditions clearly suggest that short duration crop will simply fit in that situation. The establishment strategies included utera, zero-till, reduced-till and conventionally till cropping. Introspection to past research established the



importance of system approach for choice of crops and cultivars and management of tillage, nutrient, water and weed. Timely sowing and selection of good YMV resistant varieties in pulses with short duration are well fitting under limited water sources under rice fallow situation besides improvement in soil health.

## AUGER-TYPE GRANULAR FERTILIZER DISTRIBUTOR FOR PRECISION APPLICATION

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### ABSTRACT

The objective of this study was to model mathematically and to simulate the dynamic behavior of an auger-type fertilizer applicator (AFA). Proposing the angular speed controller  $\dot{\theta}$  for the motor drive shaft for using the variable-rate application (VRA) and reduce the coefficient of variation (CV) of the application. The input model was  $\dot{\theta}$  and the response was the fertilizer mass flow, due to the construction, density of fertilizer, fill factor and the end position of the auger. Simulation of control system was done by using the model in open loop with an electric drive for AFA using an armature voltage (VA) controller. By introducing a sinusoidal excitation signal in VA with amplitude and delay phase optimized and varying  $\dot{\theta}$  during an operation cycle, it is obtained a reduction of 29.8% in the CV (constant VA) to 11.4%. The development of the mathematical model was a first step towards the introduction of electric drive systems and closed loop control for the implementation of AFA with low CV in VRA. The uniformity of application, expressed by the application rate CV can be reduced by acting on the angular speed of the auger's drive shaft during a cycle. By acting appropriately in the armature voltage of a DC electric motor and permanent magnet, the angular speed of the drive during an operating cycle of the fertilizer auger applicator can vary. The actuation signal (armature voltage) can be optimized by adjusting amplitude and lag. The dynamics of the electric motor has no substantial influence on the response application rate.

## OCCURRENCE OF STEM AND ROOT ROT DISEASE OF SESAME IN BUNDELKHAND REGION IN U.P.

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### ABSTRACT

Sesame (*Sesamum indicum*) is one of the oldest crop and is under cultivation from ancient times. It is mainly grown for its high economic value of seeds that contain approximately 52-57% oil and 25% protein. The sesame oil is most stable vegetable oils in the world due to the presence of natural antioxidants such as sesamol, sesamin and sesamol. The chemical composition of sesame oil characterized by a low level of saturated fatty acids (less than 15%) and the presence of antioxidants have been reported to have health promoting effects such as lowering cholesterol levels and hypertension in humans, neuro protective effects against hypoxia or brain damage and reducing the incidence of certain cancers. India ranks first in the area and production of sesame in the world. In India, at present sesame occupies an area of about 16.0 lakh hectares with an annual production of 7.56 lakh tonnes with an average productivity of 473 kg/ha. Banda district has an area of 7780 ha with total production of 685 MT and productivity 1.70 q per ha. The most of the sesame production in the country is used for oil extraction (70-75%) and a considerable proportion is consumed as food (20-25%) in various forms and a very small quantity (2.2%) is retained for the seed every year. Sesame is mainly grown in *Kharif* season under rainfed situation. It is also grown in Semi-rabi, rabi and summer seasons. The growing domestic demand for edible oil, coupled with the emergence of sesame as a potential export crop, provides good opportunity for farmers to take up the cultivation of this crop and be assured of good market value. The productivity of sesame in India is low (473 kg per ha) and fluctuating. The yield variation is very wide. The yield potential of sesame has not been fully realized due to number of biotic and abiotic factors, among the factor's major constraints in the production of sesame is the colossal damage caused by various insect pests and diseases. Despite the potential for increasing the production and productivity of sesame, there are a number of challenges inhibiting sesame production and productivity. Among the many production constraints, the most important include lack of availability of improved varieties and a poor seed supply system. In addition, there are severe biotic stresses, such as root rot /stem rot





(*Macrophominaphaseolina*) (Tassi) Goid, Bacterial blight (*Xanthomonas campestris* pv. *sesame*), Phyllody (a Mycoplasma-like organism), Powdery mildew (*Oidiumerysiphoides*), Alternaria leaf spot (*Alternaria sesame*) and Cercospora leaf spot (*Cercospora sesame*). Sesame diseases cause damage to seed, seedling, root, stem as well as foliage resulting in significant loss. KVK Banda had conducted farmers field survey and diagnostic visits during Kharif 2020-21 in major sesame growing blocks of Banda district viz. Tindawari, Mahua, Badhokharkhurd, Kamasin,. To generate required information a detailed questionnaire is prepared and randomly selected farmers are interviewed. Sesame crop was found severely infected by the stem and root disease and incidence of this disease was recorded about 22-32 percent. Tindawari and Badhokharkhurd blocks of Banda district were more influenced from this disease. Stem and Root rot are caused by *Macrophominaphaseolina* (Tassi) Goid. The symptoms were initiated from ground level in stem and it becomes black, which extends upward rupturing the stem and black dots appear on the infected stem. The roots will become brittle. In disease infected plants, black capsules are seen which open prematurely exposing shriveled seed. The diversity of host species and the geographic range have suggested that *M. phaseolina* is quite hetero-geneous. The disease also causes severe losses right from seedling to maturity of the crop. The use of Ecofriendly pest control method has got tremendous scope since the diseases are management without putting any threat to the quality of produce and surrounding ecosystem.

## EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF BARLEY UNDER DOON VALLEY CONDITION OF DEHRADUN UTTARAKHAND.

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### ABSTRACT

The experiment was laid out in Randomized Block Design replication three with seven different treatments viz. T<sub>1</sub> (Control), T<sub>2</sub> 75% RDF+FYM 10q ha<sup>-1</sup>+ Vermicompost 10q ha<sup>-1</sup>, T<sub>3</sub> 100% RDF, T<sub>4</sub> 75% RDF+FYM 20q ha<sup>-1</sup>, T<sub>5</sub> 50% RDF+FYM 20q ha<sup>-1</sup>, T<sub>6</sub> 25% RDF+FYM 20q ha<sup>-1</sup>, T<sub>7</sub> 75% RDF+ Vermicompost 10q ha<sup>-1</sup>. Among nutrient management practices treatments T<sub>2</sub> recorded significantly higher growth parameters viz. plant height (cm), number of tillers / plant, number of leaves per plant, and dry matter accumulation/plant (g/plant), yield attributing characters like: Spike length, Number of spikelet's per spike and number of grains per spike, grain, straw and biological yield (kg ha<sup>-1</sup>), protein content, N, P and K content in grain and straw, gross returns, net returns and benefit: cost ratio of barley. Performance in terms of growth, yield, nutrient studies, quality and economics of barley in treatment T<sub>2</sub> 75% RDF+FYM 10q ha<sup>-1</sup>+ Vermicompost 10q ha<sup>-1</sup> was at par with treatment T<sub>3</sub> 100% RDF. Treatment T<sub>1</sub> took highest number of days to flag leaf emergence, booting, anthesis and maturity as compared to other treatments. Treatment T<sub>2</sub> being at par with treatment T<sub>3</sub> recorded significantly higher value of malt content of barley than other treatments. But various combinations of nitrogen fertilizer, FYM and vermicompost failed to produce any significant variation in days taken to emergence and tillering, plant population at 20 DAS and quality parameters like hectoliter weight and boldness as well as thinness of barley grain, K content (%) in straw and available N, P and K status of soil after the harvest of barley.

## FACTORS ASSOCIATED WITH LIVELIHOOD SECURITY AMONG THE SMALL AND MARGINAL FARMERS IN BETUL DISTRICT OF MADHYA PRADESH

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### ABSTRACT

In India, 86 percent of farmers are small and marginal and the population needs food, clothing, shelter and fodder for livestock. The study was carried out over 80 respondents sample size in Betul district of Madhya Pradesh to know the factors associated with livelihood security among the small and marginal farmers. The finding indicated that majority of the respondents had medium level of food security (36.25 per cent), economic security, (42.5 per cent), health security (51.25 per cent), educational security (43.75 per cent), social security (42.5 per cent), institutional security (61.25 per cent). The study



also shows that 48.75 percent respondents had medium level infrastructural security. The findings also indicated that the variables, like size of land holding and cropping system were shows positive correlation at 5% level of significance and annual family income was also shows positive correlation at 1% level of significance with the 'livelihood security' of the farmers. The regression analysis showed that experience in farming (3.29), annual family income (3.39), and cropping system (2.26) were the most important factors contributing, significantly, towards the 'livelihood security of farmers. The  $R^2$  (0.4070) indicated that the set of variables explain 40.70 per cent of the total variability towards dependent variable i.e. likelihood security.

## **INTELLECTUAL PROPERTY RIGHTS : OPPORTUNITIES AND CHALLENGES IN AGRICULTURE**

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### **ABSTRACT**

Increasing population and faster economic expansion need improved farming methods to satisfy growing food requirements. The demands are not only about the amount of food provided but also the quality of food produced. It is becoming increasingly evident that some of these problems may be solved by employing more inventive methods to technology development and developing better coordinated dissemination mechanisms to benefit a broader range of stakeholders. The concept of Intellectual Property Right has emerged as a result of the concept of globalization, privatization and liberalization that has necessitated the protection of rights of production, design, copyright, patent and trademarks etc. Information and knowledge are replacing capital and energy as the primary wealth creating assets. "Intellectual Property" refers to all the creations of human mind. These creations can be in the industrial, scientific, literary and artistic domains, which can be in the form of an invention, a manuscript, a suite of software, or a business name. Thus, Intellectual Property Rights (IPRs), very broadly, are rights granted to creators and owners of works that are results of human intellectual activity. IPRs have the most implications in relation to the transfer of traditional and contemporary agricultural technology, and when IPRs are used to assist rather than impede sustainable development. Farmers in developing nations such as India, on the other hand, operate in a less homogenous agro-socio-economic context. While it is now widely acknowledged that intellectual property rights (IPRs) may aid in economic growth and poverty reduction, there are still concerns about their potential harmful influence on Indian agriculture. The operation of IPR systems presents legitimate issues, particularly in the changing models of agricultural research, which are currently evolving in collaboration with numerous agencies. Concerns regarding the influence of intellectual property are becoming increasingly relevant for research result audits. The importance of intellectual property protection in developing nations' scientific and technical capacity development, as well as the advantages obtained from increased levels of growth, is now widely acknowledged. IP systems management is a key driver of a country's economic success since it aids businesses in recouping the costs of their creative expenditures.

## **BIODIVERSITY OF INDIGENOUS MEDICINAL PLANTS IN MALAYADIPATTY, MANAPPARAITALUK, TAMIL NADU**

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### **ABSTRACT**

Medicinal flora demonstrates a crucial role in alleviating a variety of illnesses in living beings. The present study was designed to investigate and systematically document the indigenous knowledge in a scientifically unexplored area of Malayadipatty, Manapparai Taluk, Tamil Nadu which would contribute positively to the field of ethnopharmacology. Regular field visits were conducted during the months of October to December 2020 through direct meetings with the indigenous communities by means of group discussions and semi-structured interviews. A total of 60 medicinal plants belonging to 29 families were recorded in the study. Asteraceae and Lamiaceae were found to be the dominant plant families which was represented by six species each followed by Euphorbiaceae, Solanaceae and Acanthaceae. Leaves were the most abundantly used plant parts (28 %) in medicine preparations. Medicinal plants were administered in the form of juice, decoction, infusion, powder and paste for various ailments. The indigenous populaces depend on medicinal plants for their primary health care. The present study provides the fundamental knowledge for further scientific investigations which shall pave way for the identification and isolation of medicinal compounds thus directing to the discovery of novel drugs. Conservation of medicinal plants were urged



among the indigenous community as deforestation and over exploitation would lead to extinction, so sustainable biodiversity use and maintenance are vital since it is our biodiversity, the nonpareil asset that we bequest to our inheritors.

## PLANT BASED COMPOSTABLE BOTTLE – AN APPROACH OF PACKAGING

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### ABSTRACT

In the recent past, consumer's desires have led to the requirement for more convenient foods having supreme packaging qualities, freshness and harmless packaging material. The plastic packaging material is one of the major environmental problems because of the large production and the degradation time. The need to decrease the environment impacts has increased the solutions in recycling, reuse of materials or bio degradable materials. Thus, the innovation of manufacturing of bottle using plant-based materials is developed. The bottle is made up of Bioplastics. The material consists of lactic acid which obtained from raw materials of vegetables such as sugars and starch. The contact of this packaging material with food is harmless, as lactic acid in its natural form is also present in the human body. In this packaging material, plasticizers such as phthalates, antimony or bisphenol-A and hormonally active substances are not used. These bioplastic bottle has many advantages to offer i.e. it is 10 times cheaper than plastic, 20 times lighter than glass, safe to use and also bio degradable. In addition to these advantages, 50 % of CO<sub>2</sub> emissions are reduced during production, as less heat and energy is required to plastic (PET) production. These plant based bottles have a very low ecological footprint and leaves no traces in body and nature.

## FLUSILAZOLE—A BROAD SPECTRUM FUNGICIDE AGAINST SCAB OF APPLE (*MALUS X DOMESTICA* BORKH.) UNDER KASHMIR CONDITIONS

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### ABSTRACT

Scab caused by *Venturiainaequalis* (Cooke) Wint. is the most destructive fungal pathogen of apple causing huge losses to apple orchards of Kashmir and other states of the country. Keeping in view the importance of the disease, the present study was conducted to find out the bio-efficacy of flusilazole 40EC against the disease under natural epiphytotic conditions. Flusilazole 40 EC was evaluated against apple scab at 0.01, 0.015 & 0.02 concentrations for two consecutive cropping seasons at Shalimar (District Srinagar) and Pohnoo (District Shopian). The tested fungicide was compared for its efficacy against three standards viz., difenaconazole 25 EC @ 0.03%, hexaconazole 5EC @ 0.05% and myclobutanil 10 WP @ 0.07 % concentrations as well as water sprayed checks. The performance of the fungicide was recorded at different phenological stages of apple tree growth starting from green tip to fruit development-IV stage. The response of flusilazole 40 EC at 0.02 per cent concentration provided highest leaf scab control of 89.73 & 93.83 per cent in incidence and intensity as compared to 90.66 & 93.80, 82.25 & 87.48 and 76.58 & 84.45 per cent control observed in standards viz., difenaconazole 25 EC, myclobutanil 10 WP and hexaconazole 5 EC sprayed trees, respectively. Similarly, the tested fungicide at 0.02 per cent concentration provided fruit scab control of 93.40 & 95.67 per cent in incidence and intensity as compared to standards 92.83 & 95.63, 86.15 & 90.00 and 83.70 & 88.40 per cent control were observed in difenaconazole 25 EC, myclobutanil 10 WP and hexaconazole 5 EC sprayed trees. During both the cropping seasons and locations, flusilazole at 0.02 and 0.015% concentrations were statistically superior to standards used for the comparison. Thus, based on two years data each year at two locations in the Kashmir valley and comparison with the standards, it can be concluded that use of flusilazole at 0.015 to 0.02 % concentrations is effective in controlling leaf and fruit scab of apple.



## **GENDER BIASES IN SOCIAL REALM IN WOMEN**

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### **ABSTRACT**

Women benefit less than men from the occupation of advantageous social network brokerage positions. But gender research suggests that women are social specialists who excel in the relational domain, in part because such social activity matches prevailing stereotypes concerning women as communal and warm human beings. Women are underrepresented in corporations, and the share of women decreases with each step up the corporate hierarchy. Women encounter many barriers to advancement into corporate leadership positions, and these barriers include gender-based discrimination as well as unconscious gender bias. They perceive more discrimination in the societal level comparing to household level. Married women perceive more discrimination in mobility, property, occupation, and education. Similarly, unmarried women perceive more discrimination in mobility and way of behaving. They consider gender and customary practices as major factors responsible for discrimination. Many companies have shown their commitment to gender equality by establishing family friendly policies and facilitating women's careers and professional networks. Nevertheless, unconscious gender bias continues to impact women in the workplace, and more must be done to enable highly skilled women to advance into leadership positions. Recent and rapidly developing movements relating to the increasing awareness and reports of gender bias, discrimination, and abuse have reached the academic environments. The consideration that negatives attitudes toward women and abuse of power creates a hostile environment for female scientists, facilitating sexual harassment and driving women out of science, can be easily related to.

## **DISEASE RESPONSE OF INDIGENOUS AND EXOTIC COMMERCIAL APPLE CULTIVARS GRAFTED ON CLONAL ROOTSTOCKS UNDER TEMPERATE CONDITIONS OF INDIA**

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### **ABSTRACT**

Commercial apple cultivars are highly subjected to major fungal foliar diseases (Scab and Alternaria leaf blotch), leading to huge economic losses in apple production throughout the world. Locating the host plant resistance is effective and durable way to manage these diseases viz-a-viz easy way to reduce pesticide application and other input costs. Disease response of twenty four cultivars grafted on dwarfing (M9) and semi dwarfing rootstocks (M7, M4, MM106, MM111) were assessed under natural epiphytotic conditions of Kashmir during the year 2013 and 2020. Experiments were established according to completely randomized block design with three replicates. During the evaluation, no fungicide application was done and the plants were kept unsprayed during the whole year. Disease status of the cultivars under high density revealed the significant variation among the cultivars in terms of their response to major fungal foliar diseases (Scab and Alternaria leaf blotch). Out of 24 tested high density apple cultivars, five cultivars viz., Shalimar Apple-1, Shalimar Apple-2, Firdous, Shireen, Sunhari showed resistant reaction against both scab and Alternaria leaf blotch diseases, seven cultivars (Akbar, Shalimar Apple-1, Shalimar Apple-2, Firdous, Shireen, Sunhari and Chamurac) against scab and five (Shalimar Apple-1, Shalimar Apple-2, Firdous, Shireen, Sunhari) against Alternaria leaf blotch. Rest of the sixteen tested cultivars proved moderately susceptible to highly susceptible to both scab and Alternaria blotch diseases.

## **INTEGRATED APPROACH FOR THE MANAGEMENT OF DRY BUBBLE DISEASE OF WHITE BUTTON MUSHROOM [*AGARICUS BISPORUS* (LANGE) IMBACH]**

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### **ABSTRACT**

Dry bubble disease of white button mushroom (*Agaricusbisporus* L.) is one of the major production constraint in Kashmir





valley. The aim of the present study was to devise and formulate the integrated strategy for the management of dry bubble disease. For that, various fungicide and biological alternatives with minimum inhibitory dosage were screened under *in vitro* studies in which carbendazim, *Pseudomonas fluorescens* and *Artemisia annua* were selected on the basis of their effectiveness against the pathogen (*Verticillium fungicola*). Further, they were evaluated under environmentally controlled mushroom house conditions against the disease and their impact on host fungus. All the experiments, individually or in combinations, reduced the disease to a level significantly lower than that of control and appreciably enhanced the early pinhead formation, number of fruiting bodies and mushroom yield appreciably as compared to control in both the experimental years. The spray combination to both casing and compost with carbendazim 50 W.P @ 0.05% proved best, which gave least disease incidence (09.01 & 11.06 %), maximum number of fruiting bodies 10 kg<sup>-1</sup> compost (154.67 & 152.33) and yield q<sup>-1</sup> compost (15.45 & 15.17) as against the control recording highest disease incidence (73.96 & 76.47 %), lowest number of fruiting bodies (31.67 & 22.33) and yield kg q<sup>-1</sup> compost (3.00 & 2.10). However, the spray combination of casing and compost with *Pseudomonas fluorescens* proved effective, in minimum days taken to pinhead initiation (10.00 & 10.00) in comparison to all other treatments and control, recorded late pinhead initiation (24.66 & 25.66).

## FEEDING POTENTIAL OF LADYBIRD BEETLE, *CHEILOMENESSEXMACULATA* (FABRICIUS) ON DIFFERENT SPECIES OF APHIDS

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### ABSTRACT

A research was conducted to investigate the feeding potential of ladybird beetle, *Cheilomenessexmaculata* (Fabricius) at Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat) during the year 2019-20. The feeding potential of the predator was calculated on four hosts *i.e.*, mustard aphid, *Lipaphis erysimi* (Kaltenbach), cotton aphid, *Aphis gossypii* (Glover), maize aphid, *Rhopalosiphum maidis* (Fitch) and cowpea aphid, *Aphis craccivora* (Koch). Results revealed that highest number of aphids consumed by first instar was *A. craccivora* (20.13±0.61), second instar preferred *R. maidis* (35.27±0.49), while third and fourth instar larvae fed more on *A. gossypii*, with consumption of 57.87 ± 47 and 79.60 ± 1.99. The total consumption of grubs revealed that grubs of *C. sexmaculata* fed more on *A. gossypii* (191.20±4.17) closely followed by *A. craccivora* (177.10±5.48). The consumption capacity of *C. sexmaculata* adult indicated that *A. craccivora* (820.30±44.94) followed by *A. gossypii* (739.93±28.96). The least number of aphids eaten during grub and adult period was of *L. erysimi* (105.73±3.83 and 441.33±40.35). The total consumption by *C. sexmaculata* in its entire life time was more on *A. craccivora* (997.40±45.60). Thus it was concluded that *C. sexmaculata* can control the *A. craccivora* and *A. gossypii*, effectively.

## RIDL : A NOVEL APPROACH TOWARDS FUTURISTIC INSECT-PEST MANAGEMENT

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### ABSTRACT

In agriculture, insect-pests management has always been an important factor for obtaining higher yield. Since earlier, there has been series of evolution of different techniques in order to protect crop plants from varieties of insect-pests. We have utilized various cultural, mechanical, physical, biological and most effective one chemical methods to manage insect-pests. Of all these techniques, synthetic chemicals have polluted our ecosystem and hence now surely, we have to innovate some novel technology which would not only be most effective in controlling target insect-pests but also safer to non-target organisms including human beings. Sterile Insect Technique (SIT) is one of the most efficient and target specific technique for reducing target insect-pests in field. It includes sterilization of insects by exposing them to gamma radiation followed by field release which results in production of sterile eggs and eventually reduction in population of target insect-pest. Lack of any method for separating sterilized males and females before field release makes its practical utility very limited due to probability of intermating of sterilized males and females is high rather than with wild females. A latest technology named Release of Insects carrying Dominant Lethal gene (RIDL) uses biotechnological tools to insert a lethal dominant gene which eventually kills target insect-pest which is also heritable in nature. Besides, it facilitates to separate males and females before field release which is the limitation of SIT. Scientists have developed transgenic mosquito (*Aedes aegypti* OX513A) and diamondback



*Plutella xylostella* OX4319L) moth successfully which are already being used for reducing wild insect-pest population in open field in foreign countries. Other than these, many more transgenic strains of agriculturally important insect-pests are being developed and tested in the laboratory as well as field cage condition.

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### **ABSTRACT**

Water –The Elixir of Life and universal solvent. We have only 2% of fresh water resources available on this land by melting of ice and precipitation. Out of which 10% is used for domestic purpose 20% for industry and 70% for irrigation. To prevent the loss of rainwater through seepage and to make use of it in off season rain water harvesting is necessary. Water harvesting can be considered as a rudimentary form of irrigation. Water harvesting is the collection of runoff water for productive purposes. Rainwater harvesting is a form of water harvesting and is defined as a method for inducing, collecting, storing, and conserving local surface runoff for agriculture in arid and semi-arid regions. The traditional methods include Kuntas, Percolation tanks, Haveli, Risers etc. The modern techniques used are Contour bunds, Semi-circular bunds, Trapezoidal, Contour trenches, Conservation furrows. In-situ moisture conservation methods showed improvements in survival, establishment and growth of fruit crops. Pit depression method showed best results on height, diameter, bud sprouting, bud survival percentage, plant growth and nutrient uptake of aonla in slopy degraded lands and maximum growth, yield, fruit quality in aonla CV.NA7. It was reported that in-situ water harvesting technique of circular basins with 5% slope and local mulch in custard apple showed improved results in plant growth, yield and fruit quality. Polythene mulching in-situ conservation method reported maximum fruit yield and fruit quality in custard apple. It plays an important role in poverty reduction and economic development. It presents a low-cost approach for mediating dry spell impacts in rainfed agriculture and serves as catalyst to improve farm ecosystem services and farm income.

### **NEED OF POLICIES AND PROGRAMMES FOR WOMEN IN AGRICULTURE**

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### **ABSTRACT**

According to the report by FAO, if women farmers in the developing countries have equal access to the productive resources as men then their productivity can be enhanced by 20-30 per cent and production of agriculture could be raised by 2.5 - 4.0 per cent. The gender mainstreaming policy of the nation and systems are also estimated to be structured with gender sensitive guidelines so that the women can also avail the benefits or opportunity along with men counterparts. The application of gender sensitive involvement in a given context of farming can be illustrated by the change essential in the eligibility criterion of selecting farmer representatives to the farmer committees. In the present time, farmers who own land, only get included as representatives in farmer committees. Most of the farm women engaged in farming are landless; but they are cultivating and harvesting on hired land and naturally are stakeholders of the decisions taken by the farmers' committees. Hence it is important that these women should also get included in the committees so that they can make use of opportunities in the decision making of the farmer committees. In such situations specific modifications is to be made in the eligibility factor of such committees membership to accommodate representatives of those 'women farmers who are cultivating and harvesting on hired land. Similarly proactive reforms are also required in the context to enable the women farmers who cultivate and harvest on hired land to access subsidy, inputs of the farm, insurance and procurement of produce. In this way, modifying the existing programmes and service systems of farm improvement sector through a "gender lens" will be so helpful to identify the important issues which leads to biasness of women as farmers and facilitate resolving the constraints by introducing appropriate criterion, reforms and new guidelines. Hence, such type of interventions in effect can allow the women also to avail the development opportunities as equal to their men counterparts in the context of the mainstream.



## **IMPORTANCE OF MILLETS IN HUMAN DIET**

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### **ABSTRACT**

India with its diversified agricultural country in terms of soil, climate and rainfall has abundant crop diversity. A variety of coarse cereals are grown in the country in different agro-climatic condition, but mostly as rain fed crop. Cereals and cereal products are important human food resources and livestock feeds worldwide. The most important characteristic of millets is their 2 unique capabilities to tolerate and survive under condition of continuous or intermittent drought as compared to most other cereals. Millets are mostly food sources in arid and semi-arid regions of the world. Cereals form a major portion of human diet and are a source of starch and dietary carbohydrates, which play a vital role in energy requirement and nutrient uptake in humans. The main cereal grains used for foods comprise corn (maize), wheat, barley, rice, oats, rye, millet, and sorghum. By any nutritional parameter, millets are ahead of other cereals in terms of their mineral content, compared to rice and wheat. Millets play very significant role in human nutrition because of their multiple qualities. Millets are rich in minerals, vitamins, phytochemicals and sulphur containing amino acids and hence are called as “nutri-cereals”. They are nutritionally equal or even superior to staple cereals such as rice and wheat. Each one of the millets has more fibre than rice and wheat. Finger millet has thirty times more Calcium than rice while other millet has at least twice the amount of Calcium compared to rice. Millets have a low Glycemic index. Millets have potential for being utilized in different food systems by good quality of their nutritional quality and economic importance. Millets are rich in B vitamins such as niacin, B6 and folic acid, also good source of minerals especially calcium, iron, potassium, magnesium and zinc. Generally millets are important sources of B-complex vitamins, which are mainly present in the outer bran layers of the grain.

## **STANDARDIZATION OF COMPRESSIVE FORCE FOR FABRICATION OF BIO-COMPOSITE**

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### **ABSTRACT**

The aim of the study was to fabricate rice straw reinforced composite at different compressive force and their properties were assessed. Bio-composites were made by hand layup technique using Epoxy resin and hardener as matrix material and rice straw as reinforcement. The bio-composite were developed with matrix-reinforcement ratio 60:40% at different compressive force i.e 15, 20, 25 and 30kg. The tensile and thermal insulation test was done according to ASTM standard. The results revealed that tensile strength of 15, 20, 25, 30 kg was 6.69, 7.01, 13.81 and 12.19 MPa whereas thermal insulation of 15kg, 20kg, 25kg and 30kg was exhibited 0.23, 0.30, 0.38 and 0.32 m<sup>2</sup>K/W respectively. Hence it can be concluded that tensile strength and thermal insulation of the composite increases with increasing compressive force but at a certain level it starts decreasing. Therefore bio-composite fabricated with rice straw at 25 kg compressive force gave the best results is recommended for further fabrication of fibre reinforced bio-composite.

## **CONCEPT OF ADOLESCENCE AND THEORIES OF ACHIEVEMENT MOTIVATION**

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### **ABSTRACT**

Adolescence is process rather than period, a process of achieving the attitude of belief needed for effective participation in the society. Adolescence is a period which sets everybody's head spinning, younger or older including the adolescent himself. It's the age where young person is caught-up in a biological and social process poised between childhood and becoming an adult; grappling with family life and entanglements beyond the boundaries of his family. Everyone is involved.



## **IDENTIFYING STARS AND BRIDGES WITHIN AN AGRICULTURAL KNOWLEDGE EXCHANGE AND DECISION-MAKING NETWORK OF FARM WOMEN USING NETWORK CENTRALITY**

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### **ABSTRACT**

The use of social network theories dates back to 1930s with the pioneering works of psychosociologist Moreno and others. With the advent of new and advanced technologies, there has been an explosion and expansion of its applications to various disciplines. The study applies social network analysis to analyze agricultural knowledge exchange and decision-making network of farm women. The analysis detects farm women who occupy central and strategic positions and acts as stars and bridges within the network. The study was carried out in the Himalayan regions of Uttarakhand state in northern India. Descriptive research design and multi-stage sampling were adopted. A total of 298 respondents were selected purposively from the two villages of Uttarakhand. Data were collected through survey sociometric method and UCINET (ver.6.05) was used for analysis and interpretations of network data. Network centrality (Degree and Betweenness centrality) was used to identify stars and bridges within the network. The findings showed that high In degree and Out degree centrality was recorded by 24 (12, 12) and 48 (26, 22) farm women within the networks. High Betweenness centrality was obtained by 6.78 per cent (12) and 13.22 per cent (16) of the respondents in the sampled villages. Based on High In degree centrality, twenty-four stars were identified among the farm women who occupied the central position in the network. Total twenty eight farm women acts as a bridge in the agricultural knowledge and decision making network of farm women on the basis of their high Betweenness centrality.

## **EFFECT OF DIFFERENT GROWTH REGULATORS AND STRENGTH OF MS MEDIUM ON SHOOT TIP CULTURE OF STRAWBERRY CV. CHANDLER**

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### **ABSTRACT**

Strawberry is one of the most extensively devoured fruits in the world. It is a rich source of vitamins and minerals. Strawberry is primarily vegetatively propagated by runners, by which it is difficult to meet the current demand from the expanding market for planting material. Thus, an attempt was made to design an effective micropropagation protocol for large scale production of strawberry plantlets of cultivar Chandler. Murashige and Skoog media containing 0, 1, 2, 3 and 4 ppm of 6-benzylaminopurine (BAP) alone and in combination with 0.5 ppm kinetin was used for shoot proliferation and half strength and one-fourth strength MS media supplemented with 0, 0.5, 1.0, 1.5 and 2.0 ppm of IBA was used for rooting. The results revealed that MS medium with BAP @ 2 ppm + kinetin @ 0.5 ppm was the best treatment for shoot proliferation as it produced significant amount of longer shoots and the most effective treatment for rooting was half-strength MS medium with 0.5 ppm of IBA which gave maximum rooting percentage with optimum amount of healthy roots.

## **CLIMATE RESILIENT TECHNOLOGICAL INTERVENTIONS TO ENSURE FOOD SECURITY IN FLOOD AFFECTED AREA – AN EXPERIENCE FROM NICRA VILLAGE, SIRUSUWADA, SRIKAKULAM DISTRICT, ANDHRA PRADESH**

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*Krishi Vigyan Kendra, Amadalavalasa, Srikakulam, AP*

### **ABSTRACT**

The study conducted on “performance of flood tolerant rice varieties in flood affected areas of Sirusuwada village” of Srikakulam District, Andhra Pradesh under National Innovation on Climate Resilient Agriculture (NICRA) project implemented by Krishi Vigyan Kendra, Amadalavalasa for two consecutive years (2018-19 & 2019-20) on clay loam soils.





The demonstrations were organized 20 each in high, medium and low inundation areas. The village was situated under Kothuru sub-division in the district Srikakulam of AP, India N 180 48.037' E 083 53.729' & 203 Ft from mean sea level. Recurrent floods has been the principal constraints in rice production in this villages affecting mainly Kharif rice during the growing season at the time of tillering and panicle initiation and maturity. The prevailing weather patterns of the area were observed to have a strong bearing on the occurrence, intensity and magnitude of floods. About 61 per cent of total rainfall occurs during monsoon period (June to September) and the overflow of river Vamsadhara. Generally, the flooding in the field can be either water logging due to over flow of river Vamsadhara coupled with heavy rainfall. To ensure rice production to climatic variability leading to flood, site specific climate resilient technologies such as tolerant rice variety 'MTU-1061, RGL-2537 and MTU-1064 were tested and demonstrated in the project village of Sirusuwada in 60 locations. The results revealed that the flood tolerant variety MTU-1061 recorded an increased yield of 23% in 2018-19 and 20.02% in 2019-20 compared to check variety MTU-7029. The flood tolerant variety RGL-2537 recorded increased yield of 20.05% in 2018-19 and 11.4% in 2019-20. The performance of these varieties during both the years resulted in more number of panicles/m<sup>2</sup> (403,415) more grains per panicle (196, 200), lodging resistant and pest and disease resistant to the climatic vulnerability as well as farmer's acceptability under medium and low inundation areas, but these varieties were completely failed under high inundation areas. The average yield of the rice variety 'MTU-1061 and RGL-2537' 56.8 and 56.4 q per hectare respectively. As a result of the study and demonstration to endure recurrent flood and climatic variability, flood tolerant varieties have spread over the highest area in the project village.

## **INFLUENCE OF ORGANIC AND INORGANIC FERTILIZERS ON GROWTH AND YIELD CONTRIBUTING CHARACTERISTICS OF CHILLI (*CAPSICUM ANNUM* L.) IN INCEPTISOL**

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### **ABSTRACT**

The field experiment was conducted at College of Agriculture, Latur. The experimental plot was laid out in a randomized block design with three replications and ten treatments. T<sub>1</sub>- Absolute control, T<sub>2</sub>- 100 % RDF, T<sub>3</sub>- 125 % RDF, T<sub>4</sub>-150 % RDF, T<sub>5</sub>- 100 % RDF +20 kg ha<sup>-1</sup> FeSO<sub>4</sub>, T<sub>6</sub>- 100% RDF + 20 kg ha<sup>-1</sup> ZnSO<sub>4</sub>, T<sub>7</sub>- 100% RDF + FYM @ 5 t ha<sup>-1</sup>, T<sub>8</sub>- 75 % RDF + Vermicompost @ 2.5 t ha<sup>-1</sup>, T<sub>9</sub>- 100 % RDF + Neemcake @ 2.5 t ha<sup>-1</sup> and T<sub>10</sub>- 100 % RDF + Tank silt @ 5 t ha<sup>-1</sup>+FYM @ 2.5 t ha<sup>-1</sup>. The Jwala variety of chilli was used for study with alone treatments. The results indicated that the effect of organic manures in combination with inorganic fertilizer was noticed on important growth parameters viz., plant height, number of branches, at different growth stages 40, 60 and 80 DAT of chilli crop. The application of 100 % RDF+ Tank silt @ 5 t ha<sup>-1</sup> + FYM @ 2.5 t ha<sup>-1</sup> recorded highest plant height at 40 DAT (26.77cm), 60 DAT (41.52cm) and 80 DAT (72.37cm). Similarly, maximum result regarding to the number of branches at 40 DAT (6.63), 60 DAT (18.50) and 80 DAT (21.25cm) increased positively up to 80 days and which was significantly superior over rest of the treatment. The yield and yield attributes viz; number of fruits per plant, fruit length, fruit weight, yield per plot, and yield per hectare. Application of 100 % RDF+ Tank silt @ 5t ha<sup>-1</sup> + FYM @ 2.5 t ha<sup>-1</sup> (T<sub>10</sub>) recorded maximum fruit length (12.22cm), fruit weight (132.57gm), number of fruits per plant (50.86), yield per plot (3.00), yield per hectare (88.40qha<sup>-1</sup>) followed by application of 100% RDF+FYM @ 5 t ha<sup>-1</sup>. This clearly indicated that the application of organic manure in combination to inorganic fertilizers improve the growth and yield contributing character of chilly.

## **SCREENING OF SUGARCANE GERMPLASM FOR POKKAH BOENG RESISTANCE**

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### **ABSTRACT**

Sugarcane is an important cash crop of India used as a raw material for sugar and bio-ethanol production. The production of sugarcane is known to be hampered by various biotic and abiotic stresses of which red rot, smut and wilt are of major importance. Recently, Pokkah boeng disease of sugarcane incited by *Fusarium* species complex is emerging as an important disease of sugarcane inciting economic losses in susceptible varieties. Though, the disease could be managed using



fungicides, spraying of fungicides becomes difficult in sugarcane after formative stage of the crop. The use of resistant variety is the most practical and effective method for management of plant diseases. Hence, the present study was undertaken to identify resistant sources in sugarcane germplasm against Pokkah boeng disease. A total of 173 sugarcane germplasm were screened for Pokkah boeng resistance from 2017 to 2020 at Regional Agricultural Research Station, Anakapalli, Andhra Pradesh. Each genotype along with susceptible checks, 2009A 107 and 93A 145, were planted in two rows of 5m length and were allowed to infect naturally for two subsequent years. Pokkah boeng incidence was recorded at fortnightly interval from first appearance of disease till end of September. The cumulative disease incidence in each genotype was recorded and the genotypes were classified into resistant, moderately susceptible, susceptible and highly susceptible based on per cent incidence of disease. Among the genotypes tested, 2012A 319, 2015A 51, 2015A 59, 2015A 228, 2016A 128, 2016A 275, 2016A 291, 2016A 332, 2016A 387, 2016A 238, 2016A 254, 2016A 286 and 2016A 743, have recorded less than 5 per cent disease incidence consistently over 2 years of evaluation and rated as resistant as per the disease rating scale.

## SCREENING OF DIFFERENT RICE ENTRIES AGAINST RICE LEAFFOLDER, *CNAPHALOCROCIS MEDINALIS* (GUENEE)

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### ABSTRACT

In order to identify sources of resistance to rice leaffolder, *Cnaphalocrocis medinalis* (Guenee) some rice entries were screened under natural field conditions at Agricultural Research Station, Nellore, A.P. under All India Co-ordinated Rice Improvement Project during Kharif, 2018-19. Leaffolder incidence in terms of damaged leaves was recorded at 60 and 80 days after transplantation. Sixty rice cultivars along with TN 1 (susceptible check) were sown in a single row of each line. Sowing was done on 24.08.2018 and one month old seedlings were transplanted in length of 330 cm for each line with row to row and plant to plant spacing of 20x15 cm. One seedling was transplanted per hill and susceptible TN 1 was planted as a skip row after every ten cultivars. All recommended package of practices were adapted, but without any insecticide application. Observations on total number of leaves and total number of leaffolder damaged leaves in twenty hills in each line were recorded and mean per cent damage was calculated. Out of sixty entries screened against leaffolder, thirteen entries viz., MSM 139, NEG 186, W 1263, JBB 618, MSM 127, HWR 24, HPR 2720, HPR 2873, HPR 2617, HPR 2613, NWGR 12048, Varundhan, NEG 37 were found to be resistant/immune to leaf folder with below 10 % leaf damage by leaffolder. Five entries viz., NWGR 13137, HPR 2373, JBB 622, HWR 3, RP 5587-b-b-b-50 were found to be moderately resistant with 11 to 20 per cent leaf damage by leaffolder.

## IMPACT OF CLIMATE CHANGE ON AGRICULTURE AND ALLIED ACTIVITIES

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### ABSTRACT

Climate change is a change in the statistical distribution of weather over periods of time that range from decades to millions of years. It can be change in the average weather or a change in the distribution of weather or a change in the distribution of weather events around an average. Climate change may be limited to a specific region, or may occur across the whole earth. It explores how the agricultural growth and environmental sustainability has to be achieved, while coping with the climate change phenomenon. Agriculture sector reveals high sensitivity and resilience to climate change. Agriculture is an important driver of wheels of Indian economy and also treated as back bone of the country. Thus, Agricultural sector needs to be improved steadily on sustainable, viable and in eco-friendly way. Agriculture growth also has a direct impact on poverty alleviation and important factor for employment generation. Addressing the relationship of climate change on agriculture by relating with the crop, soil, rainfall, greenhouse gas, temperature and how the threatening of Agriculture can be mitigate in a sustainable and viable way by adopting suggested agricultural measures like crop diversification, adoption of new crop varieties, drought and flood management, restoration of waste and degraded lands. One of animal agricultures greatest



environmental impacts is its contribution to global warming and climate change. According to the Food and Agriculture Organization (FAO) of the United Nations (UN), the animal agriculture sector is responsible for approximately 18%, or nearly one-fifth, of human-induced greenhouse gas (GHG) emissions. In nearly every step of meat, egg, and milk production, climate-changing gases are released into the atmosphere, potentially disrupting weather, temperature, and ecosystem health. Mitigating this serious problem requires immediate and far-reaching changes in current animal agriculture practices and consumption patterns.

## **PERFORMANCE OF COMMERCIAL BANANA CULTIVARS RAISED THROUGH DIFFERENT PLANTING MATERIALS**

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### **ABSTRACT**

An experiment entitled “Performance of commercial banana cultivars raised through different planting materials” was carried out at the field of the AICRP on Fruits (Banana), at Horticultural Research Station, Odisha University of Agriculture and Technology (OUAT), Bhubaneswar. The experiment comprised of twelve (12) treatments replicated thrice and was laid out in a Randomized block design. The 4 varieties of banana viz., Bantala, Patkapura, Champa, and Grand Naine together constituted 12 treatments using 3 different propagation methods (Macro Propagation, Micro Propagation and Sucker Propagation). The standard recommended packages of practices were followed in each treatment comprising of 10 plants. The results revealed that none of the genotypes were found superior for all traits studied. However among the micropropagated type, performance of Grand Naine was better as compared to other genotype with regards to the vegetative characters like plant height (226.81cm), plant girth (68.82cm), emergence of sucker (2.12), number of leaves produced till flag leaf (43.09), number of leaves present at the time of shooting (12.65), length of the leaf (155.19cm), width of the leaf (60.76cm), number of days taken for shooting (258.21days) along with the yield and yield attributing traits like number of fingers/bunch (264.72), number of fingers/hand (15.81), number of hands/bunch (16.94), finger weight (136.300g), hand weight (2.155kg), bunch weight (36.082Kg) and yield (72.164t/ha). Though cultivar Bantala produced fingers at par in weight with Grand Naine (140.337g) but the yield was lesser i.e. 168.30/bunch, although Champa produced very high number of fingers per hand (18.20) but the bunch weight (14.810Kg) was less due to small sized fingers, cultivar Patkapura yielded less and took maximum time for shooting. Hence micropropagated Grand Naine cultivar is an acceptable genotype under the coastal agro-climatic conditions of Odisha with early bunching habits, dwarfing habits. Among the different propagation methods micropropagation is the best method with respect to vegetative and yield characters along with mass multiplication at a faster rate, hence it can serve as a lucrative method for growers.

## **IMPACT OF SOLAR PUMP SET SCHEME ON VEGETABLE GROWERS IN JAIPUR DISTRICT OF RAJASTHAN**

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### **ABSTRACT**

Rajasthan has the mostly outstanding solar radiation in India and along with the most excellent in the world. Solar pump beside with micro-irrigation systems scheme was ongoing in Rajasthan in the year 2010-11. The present study was conducted in Jaipur district of Rajasthan state. The sample of the present study was selected by multi-stage random sampling procedure. The total numbers of respondents were 120, including 60 beneficiary and 60 non-beneficiary farmers. The primary data was collected from the respondents by using the semi-structured interview schedule. The respondents of the study were dominated by middle age group with moderate level of education and belong to agriculture + Vegetables + Horticulture occupation. The highest number of respondents belongs to low level of farm mechanization. Most of them had middle level income, size of land holding, utilization of information, contact with an extension agent, economic motivation and scientific orientation. Majority of the beneficiary and non-beneficiary farmers had partial to no level of knowledge about vegetable production technology. Majority of the beneficiary and non-beneficiary farmers had partial to no level of adoption about vegetable production technology. In regards to all the profile of the beneficiaries as well as non-beneficiaries respondents the



calculated chi-square value was higher than its corresponding tabulated value at 5 per cent or 1 per cent level of significance indicating the dependency of knowledge as well as adoption of vegetable production technology on education ( $X_2$ ), occupation ( $X_3$ ), annual family income ( $X_4$ ), size of landholding ( $X_5$ ), farm mechanization ( $X_6$ ), utilization of information ( $X_7$ ), contact with extension agent ( $X_8$ ), economic motivation ( $X_9$ ) and scientific orientation ( $X_{10}$ ). Whereas in case of age ( $X_1$ ) the calculated chi-square value was smaller than its corresponding tabular value indicating independency of knowledge and adoption of vegetable production technology of beneficiaries as well as non-beneficiaries farmers with their age.

## **ANIMAL HEALTH MANAGEMENT PRACTICES AMONG SMALLHOLDER LIVESTOCK PRODUCERS IN INDIA**

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### **ABSTRACT**

The smallholder sector encompasses a broad range of livestock keepers, in relation to species and number of animals kept, land size, and motivations for keeping livestock. The risks posed for disease introduction and spread are believed to be higher for smallholder livestock producers than commercial producers. Possible reasons for this is the notion that smallholders do not implement appropriate animal health management practices and are not part of traditional livestock communication networks. These factors contribute to the effectiveness of passive disease surveillance systems. Trying to understand the animal health management and communication practices of smallholders keeping sheep, cattle and dairy goats in India. These practices are crucial for an effective passive surveillance system. Indicate that there is a need for improvement in animal health management practices, such as contact with veterinarians and attitudes toward reporting. These practices differ depending on the livestock species kept, with sheep ownership being associated with lower engagement with surveillance activities and smallholders keeping dairy goats and alpacas having in general better practices. Emergency animal diseases are not a priority among smallholders, however they are concerned about the health of their animals. The effectiveness of on-farm passive surveillance could be enhanced by developing strategies involving both private veterinarians and producers as key stakeholders, which aim to improve awareness of disease and disease reporting responsibilities. Biosecurity and animal health management practices of smallholder livestock producers are often perceived as posing an increased risk for disease introduction and spread. The effectiveness of passive surveillance systems for early detection of disease introductions rely on these practices.

## **USE OF MOBILE APPLICATION IN MITIGATING DRUDGERY IN AGRICULTURAL ACTIVITIES: DESIGNING AND VALIDATION**

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### **ABSTRACT**

In the era of technological advancement, use of mobile phones is increasing at a greater pace. In the pandemic situation, people are benefiting with these technological networks and the use of smart phones in facilitating the agriculture is a great decision. Following this pathway different mobile applications are being developed by various research institutes for helping the farmers. Farmers and the agricultural workers always face difficulty and stress in their working environment due to the less availability of improved farming equipments. These causes the farmers to undergo physical stress and health hazards relating to agricultural based occupational risks. The agricultural operations require intensive muscular force including human energy which affects their work efficiency. Besides these the drudgery experienced by them in their daily work life causes to lowering their working efficiency. The present study deals with the development and validation of mobile application to mitigate the drudgery encountered and recommend adequate postural support for reducing biomechanical load of the body. To serve the decision support system a mobile application named “HPDI Ergon” has been developed with the aim to make the farmers comfortable in their working environment. In this app farmers are assessed based on different physiological parameters and conclusion is drawn regarding their efficiency and constraints. The app is developed using Android Studio and Java programming language. The data generated by different analysis is stored in the database which is implemented using SQLite





database. Based on the results of all the ergonomic analysis and drudgery analysis, recommendation on improvement of physiological and postural load is provided to mitigate drudgery.

## ASSESSMENT OF WILT AND STERILITY MOSAIC DISEASE RESISTANT REDGRAM VARIETY KRISHNA IN CHITTOOR DISTRICT OF ANDHRA PRADESH

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### ABSTRACT

On Farm Trials were conducted on wilt and sterility mosaic disease resistant redgram variety LRG-105 (Krishna) was tested against LRG-41 variety during the year 2019 and 2020 in 10 locations in Chittoor district of Andhra Pradesh. LRG-105 variety was released from Acharya N G Ranga Agricultural University, Guntur, Andhra Pradesh under the name Krishna during the year 2019. Wilt incidence was not observed in LRG-105 variety during both the years whereas in LRG-41 variety 58.6% and 51.98% was recorded during 2019 and 2020 respectively. During *kharif* 2019, 6.38% and 3.42% of sterility mosaic incidence was observed in LRG-105 and LRG-41 respectively whereas during *kharif*, 2020 5.86% and 5.3% of disease incidence was recorded. Redgram variety LRG-105 recorded an average yield of 211kg/acre and 182kg/acre during 2019 and 2020 respectively whereas LRG-41 recorded 123kg and 71kg per acre. Rainfall during flowering stage affected crop yield during the year 2020 in both the varieties. Overall, Redgram variety LRG-105 performed very well in wilt prone areas and recorded good yield at farmer's fields.

## AVAILABLE SECONDARY AND MICRO NUTRIENTS IN SEMI-ARID SOILS OF YAMUNA NAGAR DISTRICT OF HARYANA

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### ABSTRACT

Assessment of secondary and micronutrients status of soils in Yamuna Nagar districts was performed. Two hundred and fifty-two surface soil samples (0-15 cm depth) were collected using GPS during *rabi* 2019-20. The soil samples were analyzed for various soil properties *i.e.* pH, electrical conductivity (EC), Organic carbon (OC),  $\text{CaCO}_3$ , texture and Ca, Mg, S, Zn, Fe, Mn, Cu and B. The higher values for soil pH and EC were 8.5 and 1.87 dS  $\text{m}^{-1}$ , respectively. The mean value of OC was 0.70 %,  $\text{CaCO}_3$  varied from nil to 1.20 % with mean value 0.52 % and texturally soils were loamy sand. Available Ca, Mg, S, Zn, Fe, Mn, Cu and B content of soils varied from 1.0 to 7.2 cmol ( $\text{p}^+$ )  $\text{kg}^{-1}$ , 0.7 to 12.60 cmol ( $\text{p}^+$ )  $\text{kg}^{-1}$ , 3.8 to 153.8 mg  $\text{kg}^{-1}$ , 0.90 to 7.20 mg  $\text{kg}^{-1}$ , 0.70 to 22.90 mg  $\text{kg}^{-1}$ , 4.20 to 20.0 mg  $\text{kg}^{-1}$ , 0.2 to 6.6 mg  $\text{kg}^{-1}$  and 0.60 to 9.5 mg  $\text{kg}^{-1}$ , respectively. Out of total analysed soil samples, 4.0 %, 0.4%, 29.4%, 2.8%, and 0.8% of the soil samples were found deficient in Ca, Mg, S, Fe and Cu, respectively. Maximum number of soil samples was found deficient in available S. Therefore, S containing fertilizers may be applied to correct its deficiency in these soils.

## QUANTIFICATION OF DRUDGERY AND ITS MITIGATION IN CROP PRODUCTION SYSTEM: A CASE OF HILL WOMEN IN NORTH WESTERN HIMALAYAN REGION

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### ABSTRACT

Gender analysis of hill rural women's livelihood identifies a 'triple burden' of work in the productive, reproductive and social spheres due to out migration of male counterparts for search of jobs. In this study quantification of women's drudgery in crop production activities has been the issue of concern for providing technological interventions benefits among them. In the attempt to obtain and analyze the prioritized drudgery experiences in crop production activities through drudgery assessment



and reduction, various ergonomically sound farm tools and implements were provided for crop cultivation and intercultural operations. The study was conducted in North Western Himalayan Region and physiological ergonomics evaluation was done for traditional method and with improved technological support with three replications of fifteen minutes work cycle without rest pause. Various postural ergonomics techniques were used for quantification of musculoskeletal issues with traditional method and postural evaluation of farm women while performing various agricultural activities. Data for indicating musculoskeletal disorders were analysed by android based mobile applications available for ergonomics assessment of postural and biomechanical assessments viz. Rapid Entire Body assessment (REBA), Rapid Upper Limb Assessment (RULA) and Human Physical Drudgery Index (HPDI). After quantification, gender friendly agricultural tools were demonstrated for weeding activities done by women in nutri-gardens. Weeding efficiency was evaluated using traditional and improved agricultural tools developed for women. Different types of weeding tools were evaluated in vegetables crops (Brinjal, Tomato, Capsicum, cauliflower and Okra). The weeding operation with improved technology was observed advantageous in terms of time, quality and weeding efficiency for all the crops.

## SECONDARY AND MICRO NUTRIENTS STATUS OF SOIL AND PLANT IN CULTIVATED AREAS OF SIRSA DISTRICT, HARYANA

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### ABSTRACT

A study was carried out to assess the secondary and micro nutrients status in cultivated soils and, plants of Sirsa districts, Haryana. Total 244 surface soil samples (0-15 cm depth) were collected from Sirsa using GPS during *rabi* 2018-19. The soil samples were processed and analyzed for various physico-chemical properties and available nutrients. Besides this, plant samples (10% of soil samples) were also collected from the soil sampling sites. The data on physico-chemical characteristics of soils revealed that the soil pH ranged between 6.0 to 8.9 and electrical conductivity ranged from 0.11 to 3.90 dS m<sup>-1</sup>. Organic carbon content ranged from 0.15 to 1.35 % with mean value of 0.50 %, CaCO<sub>3</sub> varied from nil to 1.75 % with mean value 0.74 % and soils showed loamy sand texture. Available Ca, Mg, S, Zn, Fe, Mn, Cu and B content of soils varied from 1.2 to 12.0 cmol (p<sup>+</sup>) kg<sup>-1</sup>, 1.0 to 24.0 cmol (p<sup>+</sup>) kg<sup>-1</sup>, 3.8 to 290.0 mg kg<sup>-1</sup>, 0.09 to 2.0 mg kg<sup>-1</sup>, 1.0 to 20.6 mg kg<sup>-1</sup>, 0.99 to 9.4 mg kg<sup>-1</sup>, 0.06 to 6.3 mg kg<sup>-1</sup> and 0.55 to 5.2 mg kg<sup>-1</sup>, respectively. As per established limits, 2.9 %, 17.20%, 20.10%, 27.10%, 9.4% and 8.2% of the soil samples were found deficient in Ca, S, Zn, Fe, Mn and Cu, respectively. None of the plant sample was found deficient in secondary and micro nutrient as tested in present study. Therefore, it is suggested that secondary and micronutrient containing fertilizers could be applied to ameliorate these deficient soils for sustainable agriculture.

## SCREENING OF BARLEY GENOTYPES IN ZINC DEFICIENT LOAMY SAND SOIL OF HISAR

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### ABSTRACT

To identify the barley genotypes to zinc (Zn) stress, a field experiment was conducted during *rabi* 2019-20 on Zn deficient soils of Kharia village of Hisar, Haryana. Soil samples were collected from 0-15 cm depth. Initial analysis of these samples showed that the pH of experimental field was 8.0, electrical conductivity was 0.33 dS m<sup>-1</sup>, organic carbon was 0.27%, CaCO<sub>3</sub> in trace and texturally the soil was loamy sand. The soil of the experimental field was deficient in DTPA extractable Zn (0.42 mg kg<sup>-1</sup>). Twenty promising barley genotypes were tested with application of nil and 25 kg ZnSO<sub>4</sub> ha<sup>-1</sup> for their relative susceptibility to Zn stress. Grain yield of different genotypes was recorded and samples were analyzed for Zn content. In terms of grain yield, genotype BH-393 (43.2 q ha<sup>-1</sup>) performed better followed by genotypes DWRB-91 (42.4 q ha<sup>-1</sup>) and BH-902 (41.7 q ha<sup>-1</sup>). Lowest and equal grain yield was recorded of BH-16-43, BH-17-14 and BH-17-42 i.e. (37.4 q ha<sup>-1</sup> each) with Zn application @ 25 kg ZnSO<sub>4</sub> ha<sup>-1</sup>. The yield response with application of Zn was recorded to the tune of 5.7 to 14.3%. Genotype BH-393 (39.6 q ha<sup>-1</sup>) performed superior in terms of grain yield with nil application of Zn. Based on total economical yield response to Zn, all the 20 genotypes were categorized as tolerant (response < 10%), semi-tolerant (10-25%) and susceptible (> 25%). Out of 20 barley genotypes, 17 genotypes were found tolerant and 3 genotypes (BH-1732, BH-946 and DWRB-92) were semi tolerant to Zn stress.



## INFLUENCE OF LONG-TERM APPLICATION OF FARMYARD MANURE AND FERTILIZER NITROGEN ON TOTAL NUTRIENT STATUS IN SANDY LOAM SOIL UNDER PEARL MILLET-WHEAT CROPPING

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### ABSTRACT

Pearl millet-wheat is one of the major cropping systems in semi-arid region of Haryana. Understanding the nutrient status in soil make sense to decide the adoption of best nutrient management practices for crop production. In present study, the soil samples were collected after completion of 51 cycles of pearl millet-wheat cropping from an ongoing long-term field experiment established in 1967 at Soil Research Farm, CCS Haryana Agricultural University, Hisar. Lowest total N content was recorded in absolute control and application of 120 kg N ha<sup>-1</sup> increased total N by 17.0% over control. Application of FYM in rabi, kharif and both season increased the total N content by 133.6, 123.3 and 162.6%, respectively over control. Incorporation of FYM along with fertilizer N in rabi, kharif and both season increased the total N content by 6.0, 8.9 and 4.9%, respectively as compared to plots FYM applied alone. Regardless of mode of application, total phosphorus (P) content in soil was significantly increased with increasing application rate of FYM from 5 to 15 Mg ha<sup>-1</sup>. Application of FYM in rabi, kharif and both season increased the total P content by 49.2, 41.7 and 67.7%, respectively over control. Incorporation of FYM along with 120 kg N ha<sup>-1</sup> in rabi, kharif and both season increased total P content by 15.5, 11.7 and 13.0%, respectively over FYM sole application. Application of FYM in rabi, kharif and both season increased the total potassium (K) content by 18.1, 12.8 and 25.8%, respectively over control. Among the different modes of FYM application, total sulphur (S) content in soil followed the order: both season>rabi>kharif. Incorporation of FYM along with 120 kg N ha<sup>-1</sup> in rabi, kharif and both season increased total S content by 14.9, 13.7 and 13.5%, respectively over the sole application of FYM. Conjoint application of FYM and fertilizers N was found superior for enhancing the soil total N, P, K and S content under pearl millet-wheat cropping system.

## MUTAGENIC STUDIES IN YIELD AND YIELD CONTRIBUTING CHARACTERS OF BLACK GRAM (*VIGNA MUNGO*)

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### ABSTRACT

Seeds of black gram cv. TAU-1 were treated with three doses of gamma rays viz. 30, 40 and 50 kR. The mean, range, variance and co-efficient of variation were estimated in the M2 generation for four traits. The mean values of all the treatments in M2 deviated towards negative direction in three characters viz., plant height, pods/plant and yield/plant and in branches/pant deviation was towards positive direction. But the variability increased in all the treated population, the highest being in pods/pant. Selection may be effective for all the characters influenced by gamma rays irradiation treatments.

## INFLUENCE OF ORGANIC AND INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON SEED QUALITY PARAMETERS OF PEARL MILLET

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### ABSTRACT

Effects of various modes and levels of farmyard manure (FYM) and fertilizer nitrogen (N) application on seed quality parameters of pearl millet were investigated under pearl millet-wheat cropping system. The grain samples of pearl millet were collected from ongoing long-term field experiment established in 1967 at Soil Research Farm, CCS Haryana Agricultural University, Hisar. The results showed that electrical conductivity (EC) of pearl millet seeds varied from 0.059 to 0.080 m S m<sup>-1</sup>. Irrespective of mode of application, increasing application rate of FYM significantly increased the EC of pearl millet seeds. The test weight and seed germination of pearl millet seeds under the influence of long-term application of FYM and fertilizer N ranged between 9.78 to 11.05 g and 72.67 to 90.67 %, respectively. The lowest and highest test weight was



recorded under absolute control and 15 Mg ha<sup>-1</sup> FYM along with 120 kg N ha<sup>-1</sup> applied in both seasons, respectively. Similar effects were observed on pearl millet seedling length. Irrespective of modes of application, addition of fertilizer N along with FYM significantly increased the seedling dry weight of pearl millet as compared to FYM applied alone. Vigour index-I and II varied from 732 to 1494 and 1284 to 3596, respectively, among different treatments. Irrespective of modes of application, increasing application rate of FYM increased both the vigour index. Addition of 120 kg N ha<sup>-1</sup> along with FYM also resulted in increased vigour index as compared to FYM applied alone. Among the different modes of FYM application, EC, germination, tetrazolium test, seedling length and seedling dry weight of pearl millet seeds followed the order: both season>kharif>rabi.

## **PRODUCTIVITY OF PEARL MILLET-WHEAT CROPPING SYSTEM UNDER LONG-TERM ORGANIC AND INTEGRATED NUTRIENT MANAGEMENT PRACTICES**

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### **ABSTRACT**

The present study was conducted to evaluate the effect of various modes and levels of FYM and fertilizer N on productivity of pearl millet-wheat cropping system. The grain and straw samples of both the crops were collected from ongoing long-term field experiment started in 1967 at Soil Research Farm, CCS Haryana Agricultural University, Hisar. The results showed that application of farmyard manure (FYM) either alone or in combination with fertilizer nitrogen (N) was found efficient for improving soil chemical and biological properties that resulted in increased productivity of this cropping system. After 51 years of continuous fertilization and cropping of pearl millet-wheat cropping system, grain and straw yield of pearl millet varied from 10.13 to 20.60 and 27.40 to 45.50 q ha<sup>-1</sup>, respectively, under various treatments. While, the grain and straw yield of wheat ranged between 24.50 to 55.60 and 34.80 to 72.80 q ha<sup>-1</sup>, respectively. The highest productivity of both the crops was obtained with the application of 10 Mg FYM ha<sup>-1</sup> yr<sup>-1</sup> in combination with 120 kg N ha<sup>-1</sup> yr<sup>-1</sup> in both the seasons. Irrespective of modes of application, grain and straw yield was increased with increasing application rate of FYM. However, it was found non-significant at higher rate *i.e.* 15 Mg FYM ha<sup>-1</sup> yr<sup>-1</sup> in both the seasons. Addition of 120 kg N ha<sup>-1</sup> increased the grain yield of pearl millet and wheat by 60.9 and 79.6 % over control treatment, respectively. Influence of same season application of FYM on increasing the yield was more as compared to previous season application.

## **EFFECT AND AMELIORATION OF ACRYLAMIDE INDUCED REPRODUCTIVE TOXICITY IN WISTAR RAT MODEL**

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### **ABSTRACT**

The study was designed to evaluate the reproductive toxicity of oral acrylamide (ACR) and its amelioration strategies using different antioxidants. A total number of 32 adult male Wistar rats were divided into eight groups (G1-G8) G1 (Basal Diet only), G2 (α-tocopherol+basal diet), G3 (GSH), G4 (Corn oil), G5 (ACR), G6 (ACR+ α-tocopherol), G7 (ACR + GSH) and G8 (ACR + α-tocopherol+ GSH). The study revealed significant reduction in body, testes and epididymis weights in ACR fed rats (G5) compared to control rats (G1-G4) whereas, the weight were significantly restored in (G6-8). A small piece of testes of each rat from the respective groups (G1-8) collected and stored in 10% formal saline during postmortem examination were subject to histopathological evaluations using H & E stain. Microscopic examination of testes of rats in control groups (G1-4) showed normal histoarchitecture of testicular lobes with uniformly distributed seminiferous tubules (Fig 1A, B, C & D). Lumen of the seminiferous tubules was clear and different developmental stages of spermatozoa were visible. Apparently, the testes were physiologically normal without any pathological alterations. Group 5 (ACR fed group) showed desquamation and sloughing of spermatogonial cells within seminiferous tubules. Interestingly, α-tocopherol co-fed with ACR (G6) revealed improvement in testes histoarchitecture, marked reduction in degenerative changes in tubules, mild desquamation of spermatogonial cells in seminiferous tubules and almost restoration of normal architecture of testes. Improvement in testes histoarchitecture was also observed in GSH alone (G7) and in combination groups (G8). Based on the present findings, α-tocopherol can be recommended as ameliorating agent in feed to prevent or reduce acrylamide induced reproductive toxicity and spermatozoa damage.





## CHILI LEAF CURL VIRUS FROM MAHARASHTRA IS BETASATELLITE ASSOCIATED DNA-A BEGOMOVIRUS

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### ABSTRACT

Chili leaf curl disease (ChiLCD) has been a major limitation to chili cultivation in India. Maharashtra, Telangana, Andhra Pradesh, Karnataka and Tamil Nadu are major chili growing states. Epidemics of ChiLCD have been a serious problem observed in various chili growing districts of Maharashtra. Present study detected the presence of *Chili leaf curl virus* (ChiLCV) associated with ChiLCD in Maharashtra. The ChiLCD affected chili plants were exhibiting various symptoms including leaf curling, smaller leaves, stunted growth bearing of least flowers and fruits. Total of nine infected samples, 5 from Vidarbha region and 4 from Marathwada region were collected and subjected to polymerase chain reaction using coat protein (CP) specific primers. The six samples detected with 520 bp size amplicon corresponding to CP gene. The 520 bp amplicon were gel eluted and sequenced. BLAST results of the sequence information revealed 99% similarity with ChiLCV isolates from GenBank database. Sequence analysis of the CP gene revealed the identity of ChiLCV associated with the ChiLCD of chili in Maharashtra, India. Moreover, the phylogenetic analysis suggested the clustering of these isolates from two different regions within same clade and corresponds to the ChiLCV *Geminiviridae*. The PCR results indicated that ChiLCV from Maharashtra governs DNA-A genome along with betasatellite molecule.

## DETERIMENTAL EFFECTS OF ACRYLAMIDE INDUCED TOXICITY ON LIVER AND KIDNEY AND ITS AMELIORATION IN WISTAR RATS

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### ABSTRACT

The present study was designed to investigate and understand the ameliorative potential of  $\alpha$ -tocopherol and reduced glutathione (GSH) against the toxicity and oxidative stress caused by acrylamide (ACR) in liver and kidneys in male Wistar rats. Adult male Wistar rats (32) were divided into eight groups (G1-G8) such as, control G1 (basal diet only), G2 (basal diet +  $\alpha$ -tocopherol), G3 (basal diet + GSH), G4 (vehicle control, basal diet + corn oil), G5 (basal diet + ACR), G6 (ACR +  $\alpha$ -tocopherol), G7 (ACR + GSH) and G8 (ACR +  $\alpha$ -tocopherol + GSH). ACR,  $\alpha$ -tocopherol and GSH were orally administered to rats @ 30 mg/KgBW, 5 IU/ KgBW and 2mg/ KgBW, respectively for 45 days. Rats of all groups were sacrificed after 45<sup>th</sup> day of the study, and liver and kidney tissues were collected for the assessment of histopathological parameters. In Post mortem of the rat's absolute weights of both the organs revealed significant reduction in weight in G5, while in control groups (G1-G4), the weight was normal and constant. Histopathologically liver in G5 showed hepatic degeneration, congestion in central veins, sinusoids, portal triad and infiltrations of inflammatory cells; while in kidney glomeruli fragmentation, degeneration, tubular dilatations, congestion and infiltrations were evident in the ACR fed group (G5) but substantially it was regained and marked improvement was visible with the co-feeding of the ameliorating agents in specific the  $\alpha$ -tocopherol. With the end of this study, it was apparent that,  $\alpha$ -tocopherol and GSH played a substantial role in maintaining the balance between oxidant and antioxidant mechanism and conferred better amelioration from ACR induced hepatotoxicity and nephrotoxicity.

## INFLUENCE OF NITROGEN LEVELS AND SPACING ON GROWTH YIELD AND SEED QUALITY OF FENNEL (*FOENICULUM VULGARE* MIL.)

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### ABSTRACT

India is the largest producer, consumer and exporter of spices in the world market. Fennel is well known essential oil (1.4-4.0%) containing medicinal, aromatic, spice and ornamental plant. It is one of the most interesting research plants having abundant application in medicine, various industries, culinary purpose and animal husbandry. The beneficial property of



fennel seed is due to the two major constituents of essential oil i.e., anethole and fenchone. The medicinal property of fennel includes its use as antispasmodic, carminative, diuretic, expectorant, laxative, stomachic, appetite stimulant, anti-inflammatory, against colic and as a lactation promoter. Essential oil of this plant can be used as a valuable antioxidant, antibacterial and antifungal agent. Nitrogen fertilization and spacing are two most important factors which determine the microclimate in the crop field. Proper optimization of these factor leads to higher seed yield and quality. Nitrogen is the element that mostly limits crop yield as it causes increasement in photosynthesis rate and duration which promote growth, yield and composition of essential oil. Nitrogen fertilization increases the protein content of seeds, perhaps due to an increase in rate of conversion of carbohydrates into the protein and an increased rate of nitrogen uptake by the plant leading to higher protein synthesis. Nitrogen also involves in the metabolic process leading to the synthesis and transfer of energy and plays an important role in synthesis of plant constituents such as essential oil. Plant density is also an important factor in determining fennel yield. A suitable planting pattern is important non-cash input that avoids intra spacing competition, cooperative interaction and competitive interaction. It is of vital importance for the interception of sunlight in the plant canopy. Closer plant geometry increase competition within the crop plant which results in poor growth that decreases the seed yield and quality. Wider spacing favours individual plant performance and produced a higher seed yield per plant than narrow spacing. It is an established fact that there is a positive correlation between fertilizer, spacing and agricultural production. It is concluded that row spacing and nitrogen fertilization has significant effect on vegetative as well as yield attributes.

## ANTIOXIDANT PRIMING EFFECT ON PHYSICAL PROPERTIES OF NATURALLY AGED SOYBEAN SEEDS.

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### ABSTRACT

The laboratory studies were conducted with 20 soybean genotypes for evaluating the physical, physiological and biochemical changes on seed longevity. 5 different testa coloured soybean genotypes had used for the experiment. Among Antioxidant Priming with  $\alpha$ -tocopherol @ 1 %, Ascorbic acid @ 1 % soaking and Salicylic acid @ 1 % soaking, seed priming with tocopherol (1%) increases repair and re-synthesizing ability in low vigour seeds (yellow coloured seeds) compared to high vigour seeds (Black coloured seeds) followed by salicylic acid (1%) and ascorbic acid (1%). Among the genotypes, EC-76756 and PB-5 recorded maximum proportion of seed coat to seed and higher mechanical strength of seed coat (9.89 %, 9.76 % and 74.87, 74.21 respectively). The least proportion of seed coat to seed, mechanical strength of seed coat was observed in 11 5-B (6.12, 52.13) followed by RKS-24 (6.34, 53.23)  $\alpha$ -tocopherol priming. Seed priming also leads to membrane repair and consumption of reserve food to initiate the process of germination, in turn reducing the weight of seed. All this indicates that, seed priming leads to decrease in seed density due to enhanced seed size in turn reducing seed coat to seed ratio as well as inducing brittleness to seed which may decrease seed strength.

## STUDY ON GROWTH, YIELD AND NUTRIENT UPTAKE OF SOYBEAN AS INFLUENCE BY BIOINOCULANTS

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### ABSTRACT

The experiment was carried out during Kharif 2019 in the research filed, Department of Soil Science & Agricultural Chemistry. The experiment was laid out under RBD in 3 replications using 15 treatments comprising of beneficial microorganisms of diazotroph (*R. japonicum*), PSB (*Bacillus* sp.), KSB (*F. aurantia*), PGPR (*P. fluorescens*) and EM culture (component microorganisms: *R. palustris*, *L. lactis*, *S. badius*, *A. niger* and *S. cerevisiae*) in possible combinations applied as seed treatments and additional foliar application of *P. fluorescens* at 20, 40 and 60 DAS of the crop growth stages. The treatment consortium of NPK+EM+PGPR exhibited the best for nodule number, nodule biomass, leaf chlorophyll content, nodules leghemoglobin content, plant height, plant biomass, nutrient (N, P and K) uptake (seed and stover) and yields (seed and stover) by 71, 69 and 59%; 62, 69 and 73%; 25, 29 and 39%; 45, 38 and 50%; 61, 39, 40 and 43%; 47, 61, 53 and 31.0%;



36, 44 and 51% (seed); 66, 58 and 67 % (stover); 39 and 62% (seed and stover), respectively over that of control FUI (8.24,33.32 and 34.73 nodule plant<sup>-1</sup>; 0.57,1.16 and 0.99 g plant<sup>-1</sup>; 2.84, 2.81 and 2.57 mg g<sup>-1</sup> leaf; 2.27,2.72 and 2.07 mg g<sup>-1</sup> fresh nodule;16.2, 48.6,62.4 and 62.6 cm; 1.67, 4.73,6.10 and 7.71 g plant<sup>-1</sup>; 101,11.5 & 32.3 and 60,15.9 & 96.8 kg ha<sup>-1</sup>,1647 and 3026 kg ha<sup>-1</sup>, respectively). Similarly, for soil parameters, the same consortium of NPK+EM+PGPR positively influenced best for available nutrient (N, P and K) contents in soil by 41, 55 and 31% over that of FUI (203,14.4 and 239 kg ha<sup>-1</sup>, respectively) and population of microbial species viz., Rhizobium, Bacillus, Fraturia, Pseudomonas, Rhodopseudomonas, Lactobacillus, Streptomyces, Aspergillus and Saccharomyces by 1.85, 1.38, 1.93, 1.57, 1.85, 2.07, 2.55,1.66 and 1.60 log fold, respectively) over that of FUI ((3.51 log cfu = 32.35x10<sup>2</sup>cfu g<sup>-1</sup> soil), (7.11 log cfu = 12.88x10<sup>6</sup> cfu g<sup>-1</sup> soil),(3.85 log cfu = 70.79x10<sup>2</sup>cfu g<sup>-1</sup> soil), (6.16 log cfu = 14.45x10<sup>5</sup> cfu g<sup>-1</sup> soil), (3.13 log cfu = 1.34x10<sup>3</sup> cfu g<sup>-1</sup> soil), (2.67 log cfu = 4.67x10<sup>2</sup>cfu g<sup>-1</sup> soil), (2.76 log cfu = 6.16x10<sup>2</sup> cfu g<sup>-1</sup> soil), (2.58 log cfu = 3.80x10<sup>2</sup>cfu g<sup>-1</sup> soil), and (3.85 log cfu = 7.07x10<sup>3</sup>cfu g<sup>-1</sup> soil), respectively). These bacteria, actinobacteria, yeast and fungus upon co-inoculating as consortia on seeds benefited the crop in direct as well as indirect beneficial ways viz., enhancing diazotrophy, nutrient (macro, micro and trace elements) solubilization, siderophore formation for Fe availability, excretion of growth promoting enzymes (IAA, GA, ABA, cytokinin, etc.), anti-oxidants against phytopathogens, ACC-deaminase activity for vigorous plant growth, systemic resistance (ASR and ISR) and release of bioactive compounds (vitamins, hormones and enzymes).

## CASE STUDY ON A PROMISING RICE VARIETY NDLR 7 IN WESTERN MANDALS OF CHITTOOR DISTRICT OF ANDHRA PRADESH

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### ABSTRACT

In Chittoor district, Rice is grown in an area of 63000ha of which, majority of the area was growing in eastern part of the district whereas in western part of the district, it was majorly grown for household consumption. Hence, farmers prefer fine grain varieties like BPT-5204 and it occupies major area during *kharif* season. Apart from this variety, private varieties like Sriram Gold, Srikar Gold, Chintu, Kaveri etc were also grown in this area. However, these are more prone to pests and diseases like blast, bacterial leaf blight etc affecting crop yield. In this connection, KVK, Kalikiri has introduced a new rice variety NDLR-7 during the year 2012. From then onwards, the variety has spreaded horizontally among farming community because of its grain type, short duration, cooking quality and now it has spreaded over 1000ha in the district.

Sri M. Rajareddy, M.G Kota, Nimmanapalli (M), Chittoor district (9440387132) had grown NDLR-7 variety in one acre during *Kharif*, 2020. Sowing was done during 1<sup>st</sup> week of July, 2020 and transplanting was done during last week of July, 2020. Along with this, another rice variety IRR93R was also grown in 2acres. During November and December months Nivar, Burevi cyclones affected rice crop adversely which was at harvesting stage. During that time, 50% of rice in the district was damaged *i.e.*, grain discoloration, shattering and lodging of crop was observed. IRR93R variety grown by the farmer was completely lodged and farmer could reap 2.2ton per acre whereas NDLR-7 variety withstood lodging and recorded yield of 3ton per acre. He could able to get Rs.26500/- net income with B:C ratio of 2.2 in NDLR-7 variety.

## USE OF INHALANT ANAESTHESIA IN RABBITS FOR PREPARATION OF SURGICAL MODEL

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### ABSTRACT

In this study sixteen (16) healthy rabbits of either sex weighing 1.5 to 2.0 kg body weight were procured after approval by the Institutional Animal Ethics Committee (IAEC), (vide approval no. - IAEC/C.V.A.Sc/VSR/430 dt. 12. 12. 2020). These animals were maintained on daily ration containing 80-100g (overnight soaked), dalia, seasonal tender green grasses and fresh water *ad libitum*. Rabbits were acclimatize for one week period prior to experiments and were randomly allocated in to two groups; Group-1 and Group-2 having eight (8) rabbits in each group. Anaesthetic protocol of Group-1, animals included inj glycopyrrolate, @ 0.01 mg/kg SC, injection xylazine @ 4 mg/kg SC, inj. ketamine @ 40mg/kg IM with an interval of 5 minutes subsequent to each followed by maintenance of anaesthesia with sevoflurane @ 2-2.5% concentration with 100 % O<sub>2</sub> saturation. Similar protocol was followed for induction of anaesthesia in Group-2 animals, though maintenance of anaesthesia was accomplished with isoflurane @ 1-1.5% concentration with 100% O<sub>2</sub> Saturation. The anaesthesia was maintained for 30 minutes following induction in each group. The anaesthetic efficacy was accessed by induction time, recovery time, clinical



parameters and haematological parameters in each group. Induction of anesthesia with ketamine was found satisfactory in both the groups. During recovery period slight struggle was observed only in Group-2 animals though it was quickly resume. Among clinical parameters Rectal Temperature(RT) showed a significant ( $P<0.05$ ) reduction in both the groups up to 24 hours of observations compare to base line value. Respiration Rate (RR) in Group-1 showed a significant ( $P<0.05$ ) increase at five minute of glycopyrrolate and ketamine administration. Though this increase was non-significant at other time intervals of this study and it reached near to its base value by one hour post induction. In Group-2, RR was found significantly ( $P<0.05$ ) lower at all time intervals and it was reached near to its base line value by 48-hour post induction. In both Group-1 and Group-2 a significant ( $P<0.05$ ) decrease in heart rate (HR) was observed after five minute of ketamine injection and it remains significant up to last observation of this study in Group-1. While in Group-2 this decrease was remain significant ( $P<0.05$ ) up to 24 hours of observation and by 48 hours the values of HR were reach to its baseline value. Values of  $SPO_2$  (oxygen saturation of the blood) were found within normal physiological reference range in both the groups at all time interval of this study. All haematological parameters in both groups were found within normal physiological reference range although significant changes were observed in few of them. Hband TEC values in Group-1 showed a significant ( $P<0.05$ ) decrease at 24 hour as compared to baseline value of it. Monocyte values showed a significant ( $P<0.05$ ) reduction at 24 hour interval and the value of basophils found significantly ( $P<0.05$ ) higher at 0 minute and 30 minute interval in Group-1 compared to Group-2. It was concluded that anaesthetic efficacy with both inhalant agents was comparable although the protocol included with sevoflurane as maintenance agent showed more superior anaesthetic efficacy over isoflurane as maintenance agent.

## **SURGICAL MANAGEMENT OF PERINEAL HERNIA IN CATTLE**

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### **ABSTRACT**

Perineal hernia is protrusion of the abdominal or pelvic organs through the ruptured pelvic diaphragm which supports the rectal wall. Rupture of pelvic diaphragm occurred due to weakness of muscle of pelvic diaphragm. Exact cause of muscle weakness is unknown, but some factor like constipation, congenital predisposition, prostatic disease, neurogenic and muscle atrophy due to aging predispose muscle weakness of pelvic diaphragm. A six-year-old cross bred cow was reported to Veterinary Surgery Department of Bihar Veterinary College Patna with the history of swelling along the left side of vulvar lips and difficulty in micturation. A careful clinical examination was carried out. Physiological parameter like rectal temperature, respiration rate and heart rate was normal limit. Swelling was soft, reducible and animal did not evinced pain on palpation. On lifting and compressing the swelling, animal urinate and there is reduction on swelling. On the basis of clinical and physical examination clinical case was diagnosed as reducible perineal hernia and decide for surgical management. The surgical procedure was carried out under butorphanol and midazolam sedation and epidural anaesthesia with xylocaine. A linear incision was made through the skin over the swelling. An incision was made on skin and subcutaneous tissue and hernial ring identified. The hernial contents were replaced and the defect in the pelvic diaphragm was repaired by placing sutures in two layers using polymide No 3. A standard protocol of postoperative treatment was followed and animal was kept on liquid diet for 3 days. The animal was fully recovered after 10 days.

## **THERAPEUTIC MANAGEMENT OF POLIOENCEPHALOMALACIA IN KIDS**

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### **ABSTRACT**

Polioencephalomalacia is a neurologic non-infectious disease of ruminants characterized by muscle tremor, in coordination, grinding of teeth, impaired vision, reduced feed intake, convulsion and recumbency. Animals of all ages groups may be affected but young animals are more susceptible. Several factor like deficiency of thiamine, lead or sodium toxicity are responsible for the development of polioencephalomalacia. polioencephalomalacia frequently respond by





administration of thiamine regardless of the cause of development. Three clinical case of polioencephalomalacia of kid, age group in between 2-3 months of same owner reported to clinical complex of Bihar Veterinary College Patna. All kids showing the similar symptoms like muscular tremors with weakness of all extremities, unable to stand, nystagmus and recumbency in either right or left side. On clinical examination physiological parameters like temperature, respiratory rate and pulse rate were within normal range. On the change of recumbency, animal retain their recumbency. On the basis of history and clinical sign, cases were diagnosed for polioencephalomalacia. All animals were treated with inj. Vitamin B1 with the rate of 30 mg/kg intramuscularly along with supportive therapy for 5 days. All animals fully recover after three days without showing any complication.

## EFFECT OF DEFICIT IRRIGATION WITH MULCHING ON GROWTH AND YIELD OF GUAVA CV. VNR

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### ABSTRACT

A field experiment was conducted during 2019-2021 at Horticulture Research centre, G.B.P.U.A.T Pantnagar with an objective of improving yield of guava cultivar VNR Bihi under deficit irrigation along with different mulching in semi high-density planting system (5m X 3m). The experiment was laid out in two-factorial Randomized Block Design comprised of three irrigation levels (50, 75 and 100%) along with silver black, black plastic mulch, organic mulch and non-mulch condition. Among different growth parameters viz. plant height, plant spread and canopy volume was found under DI<sub>100</sub> with silver black mulch whereas higher number of fruits, yield and average fruit weight was found under DI<sub>75</sub> with silver black mulch. Plants fertigated through drip irrigation also retained the good quality of fruit as compared to unmulched condition. Considering the positive effect on growth, yield and quality parameters, scheduling deficit irrigation with mulching considered to be the best, and also from economic point of view it is considered as the best way to enhance production of the crop and fetch good price from the market. It is therefore, suggested that under tarai areas of Uttarakhand, scheduling deficit irrigation with silver-black plastic mulch can be adopted for commercial cultivation of guava cv. VNR Bihi.

## ENHANCING SEED VIGOUR INDEX BY PRIMING TECHNIQUES IN SOYBEAN [GLYCINE MAX (L.) MERRILL.]

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### ABSTRACT

The present investigation was carried out during kharif season of 2020 at experimental farm of Regional Research Centre Amravati, (Dr. P. D. K. V.) (MS), India. Different priming treatments were done with eight treatments with three replications viz. (T1) untreated seeds as control, (T2) hydro priming for 2 hr, (T3) seed priming with GA<sub>3</sub> @100 ppm for 2 hr, (T4) seed priming with CaCl<sub>2</sub> @1% for 2hrs, (T5) Seed priming with Potassium nitrate - @ 1% for 2hrs, (T6) Seed treatment with IAA - @ 100ppm for 2hrs, (T7) Seed treatment with Carbendazim - @ 0.2 %, (T8) seed priming with Rhizobium Culture - @ 2.5%. Quality seeds are those which germinate evenly, imbibe water rapidly and produce stand in the shortest possible time under wide range of field conditions (Dighe *et al.*, 1982). Seed priming provides physical and microbial protection to seeds. Similarly it also gives protection against stress and acts as an efficient carrier for nutrients and pesticides. The seed priming can thus be helpful to obtain good crop stand through improved germination and seed vigour. From the experimental observations, it may be concluded that soybean seeds positively responded to treatments of priming. Vigour index found significant in all priming treatments. Higher vigour index I was recorded in treatment T4-CaCl<sub>2</sub>-1% (1630.71) followed by T3-GA<sub>3</sub> 100ppm (1480.29). Vigour index II was also high in treatment T4-CaCl<sub>2</sub>-1% (55.10) and T3-GA<sub>3</sub>-100ppm (50.16). Lower value for vigour index I and vigour index II was recorded by untreated control (1032.98) and (30.36) respectively. The differences in field emergence were found significant. The treatment T4 with CaCl<sub>2</sub> @ 1% was observed that minimum days required for field emergence i.e. (4.63 days) followed by treatment T3-(4.86 days) while the control treatment recorded (6.43) days to germinate.



## COMPARATIVE EVALUATION OF POSITIVE MENTAL HEALTH AMONG IGKV STUDENTS BASED ON PARTICIPATION IN SPORTS

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### ABSTRACT

The positive mental health of varsity students from Indira Gandhi Krishi Vishwavidyalaya, Raipur was evaluated in the background of their participation in sports. This study was carried out on 99 male students of IGKV, Raipur. The mean age of selected students was 22.19 years and the sample comprise of 53 male student athletes and 46 male students nonathletes. The positive mental health of selected subjects was measured with the help of a three-dimensional positive mental health inventory prepared by Agashe and Helode. It was found that the student athletes had significantly better positive mental health as compared to student non-athletes. The mean scores for student athletes group was also found to be higher on self-acceptance, ego strength and philosophy of life dimensions of positive mental health as compared to student non-athletes. It was concluded that participation in sports is a major factor that differentiates positive mental health among varsity students pursuing courses in agricultural field.

## CLIMATE CHANGE AND FOOD SECURITY: A NEXT GENERATION ISSUE

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### ABSTRACT

Agriculture represents a core part of Indian economy and provides food and livelihood activities to more than 70 per cent population of India. Indian agriculture is extremely vulnerable to weather and climate conditions. Climate change impacting basic human needs and directly affects livelihoods of people. In more recent times, climate change phenomenon is regarded as a major threat to food security of the nation. The focus mainly is on natural resources, especially land and water, in the face of increasing population. Rising temperatures and changes in rainfall patterns have direct effects on agricultural productivity and water availability for irrigation. These changes conditions have implication for food and nutrition security, health, water and sanitation, biodiversity needed for enhanced production and incomes. Increased temperature and related heat and drought are known to negatively affect animals and plant health and production. Due to these situations the cost of food production will increase and translate into higher food prices which in turn is likely to impact on food security. To develop climate-resilient strategies and make adequate policy interventions, there is a need for an integrated assessment of the impact of climate change on India's food security.

## EFFECT OF DIETARY INCLUSION OF NANO-CHROMIUM ON GROWTH PERFORMANCE OF BROILER CHICKENS

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### ABSTRACT

Micronutrients are vital components in poultry diet for optimal growth performance. Chromium (Cr) is an essential micro element that plays an important role in metabolism of fat, carbohydrates and protein in animals. It is also integral part of an organometallic molecule known as glucose tolerance factor (GTF) which is potentiating of insulin metabolism. In addition, it has a potent hypocholesteremic and antioxidant properties leading to decrease abdominal fat as well as cholesterol level of blood and muscles. Nano-size of chromium exhibit more bioavailability to absorption and digestibility of other nutrients. Hence, it may be used to produce the lean meat. One hundred twenty-day-old broiler chicks were procured and weighed initially and then randomly distributed into 4 experimental groups of 30 chicks per treatment with three replicates of ten chicks



in each. The experimental diets were formulated according to the BIS (2007) and fed with basal diet ( $T_0$ ), basal diet with 400 ( $T_1$ ), 800 ( $T_2$ ) and 1600 ( $T_3$ ) ppb nano-Cr for a period of six weeks. The response of the Cobb broilers growth performance to nano-Cr supplementation is presented in Table (1). The mean body weight and gain were significantly higher ( $P=0.05$ ) in  $T_2$  and  $T_3$  groups than control and  $T_1$  group. Similarly, average feed intake was significantly increased in  $T_2$  while significantly reduced ( $P=0.05$ ) in  $T_1$  group than control group. Feed conversion ratio was significantly superior ( $P=0.05$ ) in  $T_1$  group followed by  $T_3$  as compared to control group. It is concluded that dietary supplementation of nano-chromium improved performance in terms of weight gain and FCR in broiler chickens.

## ROLE OF *TRICHODERMA HARZIANUM* IN INDUCTION OF PLANT RESISTANCE IN *SOLANUM LYCOPERSICUM* AGAINST *MELOIDOGYNE INCOGNITA*

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### ABSTRACT

Tomato (*Solanum lycopersicum* L.), belongs to family solanaceae, is the second most important vegetable crop grown in India after potato and ranks first in terms of area and production. Various biotic and abiotic factors are responsible for huge losses to this crop. Among biotic factors, root-knot nematode (*Meloidogyne* spp.) is the most damaging plant parasitic nematode (PPNs) which causes 26 percent yield losses annually in India. Among nematode control methods, resistance-based management governed by biocontrol agents is most efficient control of this pathogen. *Trichoderma* spp. can improve plant defense against PPNs especially *Meloidogyne incognita*. *M. incognita* infection increased the levels of reactive oxygen species (ROS), hydrogen peroxide and lipid peroxidation in tomato roots but *Trichoderma harzianum* significantly reduced these levels of ROS, malondialdehyde and electrolyte leakage in tomato roots. This ultimately results into increased accumulation of multiple secondary metabolites in roots such as flavonoids, phenols, lignin and cellulose after infection of juveniles. Prior to nematode infestation, *T. harzianum* significantly increased the activity of pathogenesis-related (PR) proteins such as -1, 3-glucanase, chitinase, protease and amylase to some extent in plant roots. *Trichoderma* also stimulates the levels of salicylic acid and jasmonic acid which results into a positive role in inducing resistance against *M. incognita* by promoting secondary metabolites and activity of defence related enzymes in tomato roots. Hence, *Trichoderma* is considered as effective nematode control agent which plays multiple role in plant defense system and can be useful for developing sustainable agricultural practices.

## IMPROVING SEED GERMINATION BY SEED PRIMING TECHNIQUES IN SOYBEAN [*GLYCINE MAX* (L.) MERRILL.]

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### ABSTRACT

An Experiment was carried out during kharif season of 2020 at experimental farm of Regional Research Centre Amravati, (Dr. P. D. K. V.) (MS), India. Different priming treatments were done with eight treatments with three replications viz. (T1) untreated seeds as control, (T2) hydro priming for 2 hr, (T3) seed priming with  $GA_3$  @ 100 ppm for 2 hr, (T4) seed priming with  $CaCl_2$  @ 1% for 2 hrs, (T5) Seed priming with Potassium nitrate - @ 1% for 2 hrs, (T6) Seed treatment with IAA - @ 100 ppm for 2 hrs, (T7) Seed treatment with Carbendazim - @ 0.2 %, (T8) seed priming with Rhizobium Culture - @ 2.5%. From the data it is revealed that the seed treatment had significant effect on soybean seed germination. Germination percentage was significantly improved with treatment T4 ( $CaCl_2$  @ 1%) exhibited higher germination 81.13% followed by T3 ( $GA_3$  @ 100 ppm) 79.16% and other treatments also reflected in improved performance over control. Higher seedling length was recorded in treatment T4- $CaCl_2$  @ 1% (20.10 cm) and T3-  $GA_3$  @ 100 ppm (18.70 cm). Seedling dry weight was high in treatment T4- $CaCl_2$  -1% (0.678 g) followed by T3- $GA_3$  100 ppm (0.634 g). Lower seedling length and Seedling dry weight was recorded in untreated control (14.10 cm) and (0.414 g) respectively. Vigour index found significant in all priming treatments. Higher vigour index I was recorded in treatment T4- $CaCl_2$ -1% (1630.71) followed by T3- $GA_3$  100 ppm (1480.29). Vigour index II was also high in treatment T4- $CaCl_2$ -1% (55.10) and T3- $GA_3$ -100 ppm (50.16). lower value for vigour index I and vigour index II was recorded by untreated control (1032.98) and (30.36) respectively. The differences in field emergence



were found significant. The treatment T4 with  $\text{CaCl}_2$  @ 1% was observed that minimum days required for field emergence i.e. (4.63 days) followed by treatment T3-(4.86 days) while the control treatment recorded (6.43) days to germinate.

## EVALUATION OF EARLY MATURING MAIZE (*ZEAMAYS*.) HYBRIDS IN TEMPERATE AREAS OF KASHMIR

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### ABSTRACT

Maize is the major crop of Jammu and Kashmir in terms of acreage under any crop. The average yield levels of this crop have also nearly doubled since last decade. The increase in yield has been mainly achieved by increase in the area under high yielding varieties. In this regard, the hybrids are being developed to enhance the production and productivity of maize. A study was conducted to evaluate the performance of 12 maize hybrids and to assess the association between yield and yield component traits of maize hybrids along with two checks viz. VH-39 and PMH-5. The Experiment was carried out in randomized complete block designs (RCBD) with three replications in Kharif 2018 and 2019 cropping seasons. The analysis of variance revealed significant differences between hybrids for all measured parameters. The highest and lowest grain yield were recorded for KDMH-118 (83.47 q/ha) and VH-3815 (81.49q/ha) respectively. The hybrids were ranked in the decreasing order of their yields and the best performing three hybrids will further be evaluated under advanced trials.

## IMPACT OF DIFFERENT BIO-CONTROL AGENTS AGAINST ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* INFECTING CUCUMBER INPOLY-HOUSE

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### ABSTRACT

Cucumber (*Cucumis sativus* L.) is one of the most popular vegetable throughout the world. It is affected by numerous pests but the root-knot nematode, *Meloidogyne incognita* is a most destructive pest under protected cultivation and cause great losses. Biological control is a very effective tool for nematode management. In this study, evaluate the potentials of fungal (*Paecilomyces lilacinus*, *Trichoderma harzianum*, *Pochoniachla mydosporia* and *Trichoderma viride*), bacterial (*Pseudomonas fluorescens*) and arbuscular mycorrhizal fungi (*Glomus fasciculatum*) as bio-agents against root-knot nematode, *Meloidogyne incognita* infecting cucumber in poly-house. The results of present investigation exhibited that all the bio-agents significantly reduced nematode reproduction and enhanced the plant growth of cucumber over untreated check. The highest reduction in root galls 60.63%, egg masses 55.46%, egg mass contents 27.54% and nematode population 66.29% were recorded with *Trichoderma viride* at 5.0g per plant over untreated check on cucumber in poly-house followed by *Paecilomyces lilacinus* and *Trichoderma harzianum*. The fungal, bacterial and arbuscular mycorrhizal bio-agents found effective to manage *Meloidogyne incognita* and consequently improve the growth of cucumber under poly-house. The result of experiment advocates the use of bio-agents in eco-friendly vegetable production and nematode management in polyhouse.

## HIGH YIELDING VARIETY OF COWPEA TPTC 29

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### ABSTRACT

In Chittoordt, Cowpea is grown in an area of 200 ha. But farmers are growing local non-descriptive varieties which are highly susceptible to pests and diseases because of which they are giving low yielding. Local varieties are also fetching low market price as the pod size and seed size are small. In order to overcome these problems, a new variety of Cowpea TPTC 29 (Tirupati





Cowpea 1), released by RARS, Tirupati in the year 2017 was introduced in the Chittoor district by KVK Kalikiri, which is photo insensitive, short duration (80-90 days), bushy line suitable for different cropping systems and seasons, suitable for dual purpose with bold seed and long pod, moderately resistant to dry root rot suitable for *Rabi* season with yield potential of 500-600 kg/ac. TPTC 29 is suitable for green vegetable, seed purpose and green manure crop also. TPTC 29 has low pest and disease incidence compared to local varieties. As the pod size, seed size, pod and seed quality are more and superior than local varieties this variety is also fetching higher price in market. KVK, Kalikiri assessed the performance of TPTC 29 over Meghana in Front Line Demonstrations from 2018-19 to 2020-21. TPTC 29 has shown advantage over Meghana in terms of yield attributes and yield. Yield of TPTC 29 was 9.0 q ha<sup>-1</sup> with net returns and C: B ratio of 28763 Rs ha<sup>-1</sup> and 1:2.15, respectively. Whereas, Meghana recorded yield of 7.7 q ha<sup>-1</sup> with net returns and C: B ratio of 20263 Rs ha<sup>-1</sup> and 1:1.79, respectively.

## EFFECT OF BORON AND ZINC ON SOIL NUTRIENT DYNAMICS, YIELD AND QUALITY OF SOYBEAN (*GLYCINE MAX.*)

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### ABSTRACT

A Field experiment was conducted in *kharif* season 2019-20 at experimental farm of Department of Soil Science and Agril. Chemistry, College of Agriculture, Badnapur using soybean test crop to study effect of boron and zinc growth yield and quality on soybean. The experiment was conducted in randomized block design with different treatments as (T1) RDF, (T2) RDF+5kgBoron, (T3) RDF + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> soil application, (T4) RDF+ Borax 5@ kg ha<sup>-1</sup> +25 kg ha<sup>-1</sup> ZnSO<sub>4</sub> soil application, (T5) RDF + 0.5% ZnSO<sub>4</sub>+ 0.2% Boric acid foliar application. The results emerged out clearly indicated that various parameters like plant height, number of pods, number of nodules, dry matter kg ha<sup>-1</sup>, protein, seed yield and straw yield was increased due to application of micronutrient fertilizer. It was inferred from the results that application of RDF+ Borax 5 @ kg ha<sup>-1</sup> +25 kg ha<sup>-1</sup> ZnSO<sub>4</sub> soil application, showed synergistic effects on nutrients (N, P and K) and boron and zinc uptake growth and quality on soybean was also found to be improved due to application of boron and zinc on soybean crop.

## ICT IN AGRICULTURE EXTENSION

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### ABSTRACT

Agriculture plays an important role in the Indian economy. According to the UN Food and Agriculture Organization global population will be increased to 2 billion by 2050. However only 4% of the land will come under cultivation additionally. Today most of food producers are struggling to manage threats caused to crops because of diseases and pests which is made severe by climate change, mono-cropping, and excessive pesticide use. As the world population is increasing at a faster rate, demand for food is also being increased. So to fulfill these food requirements of the people present traditional methods which were being used by the farmers are not sufficient. Because Agriculture is facing many challenges like Pest and Disease Control, Improper soil treatment, Soil erosion, inadequate water supply, and improper drainage facilities. This leads to severe crop loss along with environmental hazards due to excessive use of chemicals. Thus, Agriculture automation is being a game-changer in other countries, Indian government has also realized the importance of these and started to leverage this technology in the developing sector. AI-powered technologies can assist the agriculture sector to yield healthier crops, control pests, monitor soil, and growing conditions, organize data for farmers, aid with the workload, and advance an outsized range of agriculture-related tasks within the entire food supply chain. In this process farmers can detect pests and diseases and poor plant nutrition's of farms. So for the past few years, these technologies is being used in developed countries to satisfy the requirements of food production but our country is still trying to adopt these technology completely. Once we adopt and use the Artificial intelligence to agriculture we will not only succeed in food production but also it can provide employment opportunities to many people. AI-based equipment and machines, has taken today's agriculture system to a different level. This technology has enhanced crop production and improved real-time monitoring, harvesting, processing and marketing.



Due to Covid-19 farmers are facing so many problems that they cannot harvest their produce timely and are not able to sell their produce in the market. So this technology can be used as a platform for at least some of the farmers. In this paper, we will discuss the importance of Artificial Intelligence and its challenges and applications in agriculture.

## **MODERN BIOTECHNOLOGICAL TOOLS FOR CROP IMPROVEMENT: -CHALLENGES AND OPPORTUNITIES**

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### **ABSTRACT**

By 2050, the human population is anticipated to reach over 10 billion people. Climate change has an impact on agricultural output, posing a threat to food security. Traditional breeding for food crop genetic development is a lengthy and complex procedure with disadvantages due to high heterozygosity. Furthermore, due of their extended generation period, field crop development utilising traditional breeding methods is a lengthy procedure. Conventional breeding will not be enough to close the gap between present crop output and projected food production levels in the next decades. The development of new biotechnological tools (NBTs), such as RNA interference (RNAi), cisgenesis/intragenesis, and genome editing tools, like zinc-finger like effector nucleases (TALENs), zinc-finger nucleases (ZFNs), and meganucleases (MNs) and CRISPR/Cas9, have enabled plant scientists to manipulate desired genes in crop plants. This is especially important when it comes to introducing or changing certain features in crops while keeping the cultivar's overall characteristics the same. Over the decades biotechnological tools have advanced rapidly over the years, with new and important approaches for plant breeders being added on a regular basis. This allows for the rapid and efficient development of attractive crop types in order to fulfil the requirement for long-term agricultural production. Despite the fact that NBTs have a common aim of accurate, quick, and efficient crop improvement, their approaches and features are vastly different. However, these methods are costly and time-consuming, requiring complicated procedures for proper editing.

## **SHORT-TERM INTERACTIVE EFFECT OF TILLAGE AND N SOURCES ON YIELDS, SOIL FERTILITY, ENZYMIC ACTIVITY AND NITRATE-NITROGEN ACCUMULATION IN THE PROFILE AFTER TWO MAIZE AND RICE CROPS GROWN IN A MAIZE-RICE ROTATION**

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### **ABSTRACT**

Field experiments were conducted at research farm of UBKV, Pundibari (26°39'N, 89°38'E; 41 m msl), Cooch Behar, West Bengal, sub-tropical eastern India with maize as the 1<sup>st</sup> crop followed by rice in a maize-rice rotation for two successive years 2017-18 and 2018-19 with the objectives: a) to study the short-term effect of tillage and sources of organic and fertilizer N on yield of maize and rice grown in a maize-rice rotation and b) to determine the interactive effect of tillage and N sources on overall changes in soil C and N status, accumulated NO<sub>3</sub>-N in soil profile and some soil quality parameters (MBC, MBN and enzymatic activity; viz. dehydrogenase, acid-phosphatase and urease) after two cycles of maize and rice in a crop rotation. This field had a long history of continuous cropping with cereals, jute and oilseeds under conventional tillage with mineral fertilizer use. The field experiment was laid out in a split-plot design. Three tillage practices viz. zero tillage (ZT), conventional tillage (CT) and alternate tillage (AT; maize under zero- and rice under conventional-tillage) were fixed in the main plots. Five N treatments consisted of NS<sub>0</sub> – control, with no nitrogen; NS<sub>1</sub> – recommended level of fertilizer (160:50:100); NS<sub>2</sub> – recommended level of fertilizer and crop residue (6 Mg ha<sup>-1</sup>); NS<sub>3</sub> – 75% of recommended N as fertilizer (120 kg ha<sup>-1</sup>) and 25% N (40 kg ha<sup>-1</sup>) as FYM and NS<sub>4</sub> – 75% of recommended N as fertilizer and 25% N as vermicompost were allotted in the sub-plots. There were altogether 15 treatments and each had 3 replications. In case of succeeding rice crop, a uniform dose of NPK (80:40:40) was applied to all plots, except to the treatment plot with no N application (control). Rice was grown with standard cultural management practices. Results revealed that average (pooled of two years) maize grain yield varied among the tillage practices. Literally there was no difference between CT (8.26 Mg ha<sup>-1</sup>) and AT (8.25 Mg ha<sup>-1</sup>), while ZT (7.91 Mg ha<sup>-1</sup>) recorded significantly lower average grain yield as compared to former ones. Of N sources, vermicompost



with fertilizer N treatment (NS<sub>4</sub>) produced the highest average grain yield (10.01 Mg ha<sup>-1</sup>) and it was significantly higher than all other N treatments. Tillage showed significant effect on soil dehydrogenase (DHA), acid-phosphatase (AP) and urease (UR) content at the end of two maize-rice crop cycles. The highest average content for each of these 3 enzymes was with AT at 0-10 cm soil depth. At 10-20 cm depth, however, tillage practically had no effect on enzymatic activity in soil. Residual effect of N sources on mean rice grain yield was evident only in crop residue (NS<sub>2</sub>) and vermicompost (NS<sub>4</sub>) treated plots, the highest (5.31 Mg ha<sup>-1</sup>) being with NS<sub>2</sub> followed by NS<sub>4</sub> (5.05 Mg ha<sup>-1</sup>); this two were significantly higher than that obtained by sole application of fertilizer N (NS<sub>1</sub>). After the harvest of 2 maize-rice crops, higher content of DHA and UR was observed in soil under AT as compared to other two tillage practices, but AP did not show any variation due to tillage practices at 0-10 cm soil depth. At 10-20 cm soil depth, no change in any of the soil enzymes studied was noted as compared to their initial status. Similarly, MBC and MBN also recorded positive changes in their status as compared to initial values at 0-10 cm soil depth, significantly higher values than the initial ones being with NS<sub>2</sub> and NS<sub>4</sub> treatments. After the harvest of two maize and two rice crops total soil C at 0-10 cm depth showed significant variation among the tillage practices. Alternate tillage (8.10 g kg<sup>-1</sup>) showed the highest total soil C which was significantly higher than CT (6.73 g kg<sup>-1</sup>) and ZT (5.98 g kg<sup>-1</sup>), an increase of 20 % total soil carbon due to AT over CT was evident. Although there was a carbon build-up under ZT as compared to the initial status but it was least among three tillage practices. Of N sources, crop residue and FYM based fertilizer N treatment recorded a depletion of total Soil C as compared to recommended fertilizer N application treatment. Although total soil N was higher than the initial one, but no apparent change in total Soil N at 0-10 cm depth was noted either due to tillage or N sources was visible at the end of 2 crop cycles. Nitrate nitrogen accumulation beyond the root zone (80-120 cm) did not record any changes due to tillage, while N inputs showed higher accumulation in the respective soil layer. The highest being with crop residue based (NS<sub>2</sub>) fertilizer N treatment and the lowest was with FYM based (NS<sub>3</sub>) treatment. Sole application of recommended fertilizer N and vermicompost based treatment was almost at par with each other.

## **A STUDY ON THE KNOWLEDGE REGARDING HYGIENE DURING MENSTRUATION AMONG RURAL WOMEN**

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### **ABSTRACT**

The study was planned to assess the knowledge of rural women regarding hygiene during menstruation. The study was conducted in village Kharbadiya of Girwa block of Udaipur district of Rajasthan. For this, a sample of 50 rural women was selected randomly. The data was collected through interview technique. Seven components i.e. Concept of menstruation and menstruation cycle, managing menstruation and products used during menstruation, Benefits of sanitary napkin, Availability of vending machine in school and colleges, Hygiene during menstruation and ways of disposal the sanitary napkin, Problems during menstruation and coping with discomfort and Nutrition during menstruation were selected for assess the knowledge of rural women about hygiene during menstruation. Results revealed that majority of the respondents (54%) exhibited poor knowledge (less than 33.33%), 42 per cent exhibited average knowledge and only 2 per cent had good knowledge of all the components of hygiene during menstruation. It can be concluded that knowledge of the rural women about hygiene during menstruation were unsatisfactory. Women should be educated about the proper hygienic practices as well as to bring them out of traditional beliefs, misconceptions, and restrictions regarding menstruation so that they can prevent herself from many infections such as fungal or bacterial infections of the reproductive tract and the urinary tract.

## **PERFORMANCE ANALYSIS OF FARMER PRODUCER ORGANISATION**

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### **ABSTRACT**

Small and marginal farmers in India who account for a whopping 85.0 percent of the total farm holdings in India (Government of India, Agricultural Census, 2011) are highly vulnerable to risks and face multifold problems. A variety of approaches have emerged in response to the problems faced by them. Collectivization of small and marginal farmers into Producer Organizations has emerged as one of the most effective pathways to address the challenges of them as POs improve access to



investments, technology and inputs and markets. The intervention and role of Farmer Producer Organizations (FPOs) has been acknowledged as crucial for upliftment of the agrarian community. A study on Performance analysis of FPOs in Uttarakhand was conducted where two districts from Uttarakhand state viz. Haridwar district from Garhwal region and Pithoragarh district from Kumaon region was selected randomly and all the eight FPOs of Haridwar and Pithoragarh were studied. The performance of FPOs was measured based on the fifteen parameters of the FPO grading tool set up by the NABARD. As per the marks obtained, the FPOs were categorised into four grades i.e. A, B, C and D. It was found that Bhumrit Farmer Producer Company was the best performing FPO followed by Jivamrit Organic Farmer Producer Company, Pithoragarh Beej Utpadak Nidhi Swayatt Sahkarita and Agrarian Farmer Producer Company. There was one FPO i.e. Sugandh Uttrapath Kisan Swayatt Sahkarita who scored in the range of 60-75% and required little capacity building for credit linkage. It was also found that there were two FPOs namely Jai Chamu Baba and Nidhi Swayatt Sahkarita and Nanda Maiya Swayatt Sahkarita which came under C grade with a score ranging from 50-60%. These two are FPOs which require further capacity building. Laksar agro Farmer Producer Company was the only Farmer Producer Company which needed detailed assessment for further capacity building as it came under grade D with a score of <50%.

## RESPONSE OF OKRA TO PLANT GROWTH REGULATORS AND MICRONUTRIENTS

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### ABSTRACT

Okra [*Abelmoschus esculentus* (L.)] is an important vegetable crop grown throughout the tropical and sub-tropical regions and is especially valued for its tender and delicious fruits in different parts of the country and are generally marketed in the fresh state, but sometimes also in canned or dehydrated forms. India is the largest producer of okra in the world. Okra has a tremendous export potential as fresh vegetables and accounts for about 60 per cent of exchange in case of vegetable crops. Fruit quality plays an important role in okra productivity and marketability. Its fruit are rich in vitamin A, vitamin C, calcium, potassium and other minerals. Although PGR and micronutrients have great potential for improvement in growth and production of vegetable crops but their application has to be planned sensibly in terms of optimal concentration and stage of application. Therefore, the present study was planned with the objectives to study the effect of PGR and micronutrients on growth, yield and quality of okra (cv. Kashi Kranti). Keeping the above fact in view the present investigation was framed with two levels of PGRs of GA<sub>3</sub> (100 ppm, 150 ppm), NAA (100 ppm and 150 ppm) along with three levels of micronutrients ZnSO<sub>4</sub> (20 kg, 30 kg and 40 kg), borax (5 kg, 10 kg, 15 kg) and along with control having 35 treatment combination. The experiment was laid out in RBD (Factorial) and replicated thrice having plot size of 3.00 m x 2.5 m with spacing 50 cm x 50 cm. The research work was laid out at vegetable seed production area BAU, Sabour, during *Kharif* season. The result revealed that the interaction effect of PGRs and micronutrients showed significant effect on number of leaves, plant height, number of branches, number of fruit and other parameters. The maximum number of leaves (25.85), number of branches (4.5), plant height (112.44 cm), number of fruit (27.98), fruit fresh weight (20.65 g), fruit yield (148.56 q/ha), seed yield (77.48 g), chlorophyll-a (2.60), zinc content (38 ppm), boron (46 ppm), copper (25 ppm) and germination (92%) while days taken to first flowering showed non-significant effect. The combined effect of GA<sub>3</sub>-100 ppm and borax-15 kg i.e. G<sub>3</sub>M<sub>6</sub> gave best result, being significantly superior to all the treatment combinations.

## BIOCHEMICAL DIVERSITY IN BRASSICA LEAFY GREENS AND SENSORY EVALUATION OF ITS SAAG QUALITY

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### ABSTRACT

The present work deals with comparing nutritional status of edible leaves from twelve Brassica accessions of Indian and exotic origin and its exploration as a diet for humans. A wide variation was recorded for crude protein (6.41 to 18.08%),





glucosinolates (9.34 to 28.44 moles/g), phytic acid (7.23 to 12.05%), chlorophyll (11.54 to 22.15 mg/g), carotenoids (1.18 to 2.59 mg/g), ascorbic acid (50.64 to 115.58 mg/100 g), total antioxidants (1.74 to 4.82 mg/g), totalphenols (3.38 to 8.15 mg/g) and  $\alpha$ -carotene (16.23 to 63.53 g/g) content. Out of twelve, 3 of the promising accessions, namely, PAU Chinese Cabbage, KPT 9 and Saag sarson were identified to have rich antioxidative profile with low quantity of antinutritional compounds. A significant difference in the compositional pattern of key minerals was observed in the accessions. The brassica leaves accumulated significantly higher contents of Ca and Fe among all macro- and micro-nutrients. In addition, leaves of GSC 7 was considered a good source of Ca (859.25 mg/L), K (187.05 mg/L), Mg (81.59 mg/L), Fe (4.95 mg/L), and Zn (0.65 mg/L). The presence of less concentration of antinutritional factors such as glucosinolates (10.04 moles/g) and phytic acid (8.32%) in leaves of GSC 7 might be effective in enhancing the mineral absorption from the soil. Organoleptic evaluation of saag prepared from the leaves of these Brassica plants was conducted by a panel of ten judges using 9-point Hedonic rating scale test. The results revealed that the maximum overall acceptability was shown by Saag sarson, China sarson 1 and PAU Chinese Cabbage No. 2. Our findings, conclusively suggest that our local Brassica leafy greens viz., PAU Chinese Cabbage No. 2 and Saag sarson are good source of nutrients with high overall acceptability as diet and thus their consumption could be encouraged.

## **MORPHOLOGICAL CHARACTERISTICS OF SOILS AS AFFECTED BY DIFFERENT LAND USE SYSTEMS IN NANDURBAR DISTRICT**

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### **ABSTRACT**

The Present study was undertaken in Nandurbar district of Maharashtra State during the year 2019-20. The Climate of Nandurbar District is generally hot and dry. The average annual rainfall is 767 mm throughout the district. Agriculture, Horticulture, Forest and Pasture land use systems were selected being the most predominant. Two sampling sites were selected under each land use system at different locations of Nandurbar district. The soil samples were collected at a vertical interval of 20 cm from surface to the bedrock. The depth of the soil under agriculture, horticulture and forest land use system is deep up to 100 cm, whereas, under pasture it is up to 80 cm. The colour of the soils varied from very dark grayish brown (10YR3/2) to very dark gray (10YR3/1), except yellowish brown (10YR5/4) in pasture land use system and grayish brown (10YR5/2) in horticulture land use systems. Structure of soil was sub-angular blocky to angular blocky. The soils texture varied from clay to silty clay. The consistence varied from slightly hard to very hard, friable to very firm and slightly stick to slightly plastic in dry, moist and wet conditions. Most of the soils showed slight to violent effervescence. The pores were fine to medium in size and few to common in quantity. Available soil moisture content varied from 13.03 to 19.1 per cent and it increases with depth of soil.

## **TRAINING NEEDS OF RURAL YOUTHS IN AGRICULTURAL ENTERPRISES**

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### **ABSTRACT**

The present study was conducted in Samastipur district of Bihar with an objective to training needs of rural youths in agricultural enterprises: a study in Samastipur district of Bihar. Two villages from every two blocks were selected. Total numbers of four villages and two blocks were selected for the research study. In total 22 rural youths from each village were selected randomly to comprise a sample of 88 respondents for study purpose. The information was collected through the personal interview to get the required data. Ex-post-facto research design was adopted for this study. It was noticed that (64.77%) were young age group (23-31 years), (59.09%) were in OBC category, (51.13%) were engaged in cultivation/farming, (34.09%) were illiterate, (65.91%) had medium size family, (57.96%) belonged to joint family, (57.96%) had a small size of land holding, (81.82%) had medium annual income, (52.27%) had a medium level of innovativeness, (63.63%) had a medium level of achievement motivation, (71.59%) had a medium level of occupational aspiration, (71.59%) had a medium farming experience, (71.59%) had medium contact with extension agency, (67.04%) had medium mass media exposure. It was noticed that regarding leisure-time activities (43.19%) had informal groups, (23.87%) conducted group meetings in the temple, (31.81%) were discussed about sports, (43.18%) were engaged in cricket, (46.59%) were engaged in



TV and Mobile, (61.37%) were used mobile phones for chatting, (48.87%) were used WhatsApp in social media. It was noticed that among the major areas of training need in agriculture, the maximum need of training of rural youth was found to be in mushroom production (2.80) followed by both poultry and cattle farming (2.51), goat farming (2.47), beekeeping (2.45), vermiculture (2.43), fishery (2.32), floriculture (protected cultivation) (2.22) and fruit and vegetable production (2.07). It was noticed that for the organization of training in agriculture related areas village was the most favourable area in receiving training for about a month in Kharif season at the morning time. Scientists were preferred to receive training and regular training were the most required follow-up support for the respondents.

## **ADVANCEMENT OF MICROBIAL BIO-PESTICIDES FOR SUSTAINABLE AGRICULTURE AND ENVIRONMENT**

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### **ABSTRACT**

Over the past 50 years, Increased crop production is centered on the recommended dose of fertilizers, improved crop varieties, effective control of disease, and effective pest management. Among these, pesticide use has surely contributed towards improving agricultural production, in terms of both yield and quality, hence pesticides play an important role in enhancing agricultural income also. Despite of high yield, expanded uses of pesticide leads to the resistance among the organisms and the rejuvenation of new pest problems. It also results in the destruction and elimination of their natural enemies with negative impacts on the human health as well as environments. Therefore, there must be an alternative of chemical pesticides which can minimize the risks of synthetic pesticides and could lead to the sustainable agriculture and safe environment. The use of microbial pesticides is quite suitable and appropriate for the researchers, farmers as it is eco-friendly method for control of pest population in the agricultural industries. The beneficial microorganism having the multifarious plant growth promoting attributes such as biological nitrogen fixation, phosphorus solubilization, potassium solubilization, zinc solubilization and hydrolytic enzymes production are suitable bio-resources under the natural as well as abiotic stress condition of draught, low temperature, saline and different multi-stressed conditions for sustainable agriculture and environment. These organisms facilitate the crop quality and also enhance the yield per year in the agricultural industries. Therefore, it is very essential to replace these chemical insecticides with bio-pesticides. Management of different groups of pests or insects is done by applying large varieties of micro-organisms including fungi, bacteria, viruses, protozoan, and nematodes as microbial pesticides.

## **GREEN PESTICIDES : A SAFE AND ECO-FRIENDLY APPROACH FOR PEST MANAGEMENT**

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### **ABSTRACT**

Today's trend for food safety and control of pests is changing from traditional pesticide usage to biopesticide usage. The indiscriminate use of chemical pesticides has caused ill-effects not only to soil microflora, animals and human life, but also contributed to a number of side effects, viz. development of resistance by the insects/weeds/pests, resurgence and outbreak of new pests, toxicity to non-target organism and hazardous effects on environment endangering the sustainability of ecosystem. To overcome these ill-effects, the green pesticides or botanical pesticides or plant-based pesticides are identified as alternative and safe technology over the chemical pesticides of today.

Higher plants contain a wide spectrum of secondary metabolites such as phenols, flavonoids, quinones, tannins, essential oils, alkaloids, saponins and sterols. Such plant derived chemicals may be exploited for their different biological properties. Biopesticides are also known as "Green Pesticides". Plant derived bioactive substances (phyto-chemicals) offer great promise for pest control. Some of the biopesticides like Neem, Bel, Senwar, Pyrethrum, Tobacco, Karanj, Mahua and Sweet flag etc. have already attained the status of potential pesticides of biological origin. These bioactive secondary metabolites act as insecticides, antifeedants, insect growth regulators, juvenile hormones, ecdysones, repellents, attractants, arrestants, etc. Due to the multiple activities of plant molecules, green pesticides can be considered as important alternative source for the chemical pesticides.



Different botanical pesticides formulations are available in the form of granules, wettable concentrate (wc), dusting powder (DP) and emulsified concentrate which is used conventionally for pest management. New generation green pesticides could be in the form of microemulsions, nanoemulsions, controlled release formulations (CRF), Suspension Concentrate (SC), capsule suspension (CS) etc. Therefore, development of green pesticides will promote, ecofriendly, safe and cost effective biopesticides that can minimize the harmful effects of conventional pesticides.

## RESPONSE OF PADDY STRAW MULCHING AND FARM YARD MANURE IN COLOCASIA UNDER JHUM FIELDS IN ZUNHEBOTO DISTRICT OF NAGALAND

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### ABSTRACT

This on Farm Trials were conducted in jhum fields of Zunheboto district under rainfed conditions to observe the Effect of Paddy Straw Mulching and FYM in Colocasia crop. Three locations in the jhum fields of Lumami village were selected of 1 hectare area. Colocasia being an important crop of this area was selected for the trial. It was observed that the use of Paddy Straw Mulching @ 12t ha<sup>-1</sup> at 3 cm thickness and FYM@ 10t ha<sup>-1</sup> increased the soil moisture and reduced the soil temperature as compared to the farmers practice. The mean temperature at 15, 30 and 45 DAP in the trial plot ranged from 26.2, 30.3 to 31.7 °C and mean soil moisture at 45 DAP from 5cm depth was 28.9 % as compared to the farmers practice where mean temperature was higher ranging from 27.0, 32.3 and 32.5°C and mean moisture of 22.2% where paddy straw mulching was not used. The mean yield, net income and B:C ratio were also increased from 1822 kg ha<sup>-1</sup>, Rs 40,793.33 and 1.81 over farmers practice of 1292 kg ha<sup>-1</sup>, Rs 14,473.33 and 1.34.

## BIO-EFFICACY OF INSECTICIDES AGAINST ONION THRIPS AND THEIR EFFECT ON NATURAL ENEMIES AND BULB YIELD

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### ABSTRACT

A field experiment was conducted at Horticultural Research Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during Rabi 2019-20 and 2020-21 to study bio-efficacy of insecticides against onion thrips (*Thrips tabaci* L.) and their effect on natural enemies and onion bulb yield. Seven insecticides including were tested along with water spray treatment in RBD. Among insecticidal treatments the minimum mean thrips population i.e., 4.59 and 2.59 thrips/plant were recorded during Rabi 2019-20 and 2020-21 respectively. In plots treated with T<sub>1</sub>-Lambda cyhalothrin 5% EC+Fipronil 5% SC(17.5%ZC)@ 300 ml/ha recorded maximum mean coccinellid population (2.16 and 2.02 no./plant) and spider population (1.81 and 1.13 no./plant) and were found promising regarding its safety to predators during 2019-20 and 2020-21, respectively. The highest yield of onion was recorded in the plot, treated with T<sub>2</sub>- Lambda cyhalothrin 5% EC+ Fipronil 5% SC(17.5%ZC) @400 ml/ha (12.09 t/ha) followed by T<sub>6</sub> Fipronil 5% SC @ 1000 ml/ha (11.98 t/ha) indicating the significance of thrips management in rabi onion.

## EVALUATION OF LINSEED GERMPLASM FOR DROUGHT STRESS TOLERANCE BASED ON PHYSIOLOGICAL AND AGRO-MORPHOLOGICAL TRAITS

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### ABSTRACT

Linseed or flax is one of the most imperative minor oilseed crop as a rich source of nutrition and fibre. In India, it is extensively cultivated in rain-fed (63%) and moisture scarce *utera* (25%) conditions. Soil moisture fluctuations can negatively



impair yield potential, oil content and fatty acid composition. As drought is an erratic and unpredictable phenomenon, selection should target genotypes with high drought tolerance while maintaining yield. Keeping this in view, a set of 133 diverse germplasm accessions of linseed was selected from national collection of 2612 accessions screened against drought stress at ICAR-National Bureau of Plant Genetic Resources, New Delhi. This set comprised of 115 indigenous and 18 exotic collections including 8 accessions of wild linseed (*L. bienne*, *L. grandiflorum* and *L. lewisii*), registered genetic stocks (3 accessions), yellow seed coat (14 accessions) and released cultivars (11). Contrasting accessions for important phenological, agronomic and physiological traits were selected to constitute a diverse panel. A few promising accessions identified included IC0585303, IC0499077, IC0096602 (NDVI>0.48); IC0096494, IC0591125 (Chlorophyll concentration >80); IC0498548, IC0498744 (seed yield>15 g); IC0584773, IC0096618 (early maturity<125 days). This panel will be further evaluated for the study of germination parameters, root-shoot biomass and root system architecture (RSA) under Polyethylene glycol (PEG-6000) induced drought stress using hydroponics culture. This study would help in identification of germplasm with better RSA under drought stress, which may be of potential use for linseed improvement. Further, potential SNP haplotypes of abiotic stress responsive genes associated with drought tolerance will be identified by sequence variation analysis across the selected accessions.

## SOIL CARBON : AN INDICATOR OF SOIL HEALTH

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### ABSTRACT

As land degradation, biodiversity loss and climate change is becoming increasingly severe, soil has turned into one of the most vulnerable resources in the world. Soil is a major carbon reservoir containing more carbon than atmosphere and terrestrial vegetation combined. Soil organic carbon is dynamic and human impacts on soil can turn it into either a net sink or a net source of atmospheric greenhouse gases. After carbon enters the soil in the form of organic material from soil flora and fauna it can persist in the soil for decades. It can be lost as carbon dioxide or methane by emitting back into the atmosphere, soil erosion or by being dissolved as organic carbon and washed into rivers and oceans. Forests and stable grasslands are referred to as carbon sink because they can store large amount of carbon in their vegetation and root system for long period of time. As an indicator for soil health, soil organic carbon is important for its contribution to food production, as mitigation and adaptation to climate change and for achieving the goals of sustainable development. A high soil organic carbon provides nutrients to plants and improve water availability, both of which enhance soil fertility and ultimately improves crop productivity. Soil organic carbon enhances soil structural stability by increasing aggregate formation which together with porosity ensure sufficient aeration and water infiltration to support plant growth. Land restoration and land use changes encourages the conservation and improvement of soil and maximizes carbon storage on land. There is an equilibrium between soil health and soil organic carbon and it should be maintained for achieving sustainability.

## BIOCIDE RESISTANCE IN MASTITIS PATHOGENS AGAINST POST-MILKING TEAT DISINFECTANTS

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### ABSTRACT

Post-milking teat dipping is regarded as one of the most effective preventive measure for curtailing the incidence of subclinical and clinical mastitis in lactating dairy animals. However, despite implementation of post-milking teat disinfection as a method of mastitis control, mastitis outbreaks continue to be a major crisis in dairy farms. One of the possible reasons could be development of resistance against teat disinfectants in mastitis pathogens. Prolonged *in vitro* exposure to germicidal teat dips has been shown to enhance the resistance of some bacteria to chemical disinfectants. Several passages of bacterial isolates with sub-lethal concentrations of disinfectants have been found to induce resistance. Further, genetic resistance against disinfectants, primarily QACs, has been attributed to expression of biocide resistant genes like *qacA/B* and *smr*. Microorganisms are limitlessly adaptable and demonstrate different mechanisms of resistance to various disinfectants; the concern is that these mechanisms may give rise to cross-resistance to clinically important antibiotics as well, and contribute to antimicrobial resistance (AMR). AMR in food-producing animals is also a topic of public health concern. Resistance to teat





disinfectants such as chlorhexidine (CHX), quaternary ammonium compounds (QACs), amidines, and acridines has been observed in antibiotic-resistant strains of *Staphylococcus aureus* and *Staphylococcus epidermidis* and it has been postulated that strains in which *qac* genes are present might have enhanced survival in the clinical environment. Extensive use of these disinfectants could lead to the selection of bacterial strains showing resistance to both antibiotics and disinfectants. There have been some studies where use of disinfectants caused selection pressure leading to spread of resistant gram-negative bacteria. Antimicrobial resistance in mastitis has been the focus of research for decades but studies on resistance against teat disinfectants have been inadequate. Previous studies have suggested a link between resistance against disinfectants and antibiotics but further studies are needed to confirm it.

## **VARIATION IN THE RICE VARIETIES RELEASED BY AGRICULTURAL RESEARCH STATION, NELLORE, ANDHRA PRADESH**

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### **ABSTRACT**

Andhra Pradesh is the rice bowl of India. Particularly in Andhra Pradesh Nellore district located in the southern part is known for its rice cultivation in three different seasons viz., edagaru (April to August), Late kharif (August to January) and rabi seasons (November to February/march). Agricultural Research Station, Nellore, ANGRAU was established in 1937 with a view to improve molagolukulu rice varieties and presently working on development of rice varieties suitable for all the three seasons. A total of 28 rice varieties were released from this station. Among them 16 genotypes under long duration group (150-155 days), 4 genotypes under medium duration group (140 days) and 8 genotypes under short duration group were present. The varieties under long duration group are suitable for late kharif season, varieties under medium duration group for kharif and rabi seasons whereas the varieties under short duration group are suitable for edagaru and rabi seasons.

Among the rice varieties released, the days taken for 50% flowering varied from 85 days (NLR 33358-Somasila) to 134 (BCP-5; Buchireddypalem selection-5), Plant height varies from 66cm (NLR 3041-Nellore sona) to 153 days (BCP-2; Buchireddypalem selection 6). Lowest test weight was recorded by NLR 3041 (Nellore Sona:14g) and highest test weight with NLR 145 (Swarnamukhi:25g). Panicle length ranged from 12cm (NLR 3041: Nellore sona ) to 33cm (BCP4 (Buchireddypalem selection-4). Short grain as well as kernel was observed in the variety NLR 3041 (GL:6.5mm, KL:4.6mm) whereas longest grain and kernel were observed in NLR 33358 (9.5mm) and NLR 145 (8.2mm) respectively. Grain breadth and kernel breadth was low in case of NLR 33358 (Somasila: GB:1.8mm, KB:1.5mm) while, more grain breadth was observed in NLR 33654 (3.7mm) and wide kernel was observed in NLR 28600 (3mm). NLR 33358 recorded highest Kernall/B ratio of 4.13 and lowest was recorded by BCP 2 (Buchireddypalem selection 2:1.89). Finally maximum grain yield was recorded by NLR 4001(Nellore Siri: 7857 kg/ha) and lowest yield was observed in case of Land race pombal (3250 kg/ha). There is a wide variation present in the rice varieties released from this centre. Hence, these can be utilized for further improvement of rice varieties in the breeding programmes.

## **CONSTRAINT ANALYSIS ON LOW PRODUCTIVITY OF RAGI IN VISAKHAPATNAM DISTRICT OF ANDHRA PRADESH**

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### **ABSTRACT**

Millets are the promising ones for fighting hunger, malnutrition and for ensuring food and nutritional security for masses. In spite of these admirable qualities and its importance in food and nutrition security at regional level the crop is neglected in our policies and programmes both at national and regional levels. Finger millet is one of the important traditional, nutritious and drought tolerant food crop grown by small scale farmers in NC Zone of A.P. Despite availability of improved high yielding and recommended varieties, the productivity of ragi is very low in these areas. With this backdrop, the present study is focused on investigating the constraints for low productivity of finger millet. The research was carried out in Visakhapatnam district of Andhra Pradesh in the year 2019. From selected three mandals, four villages were selected randomly. In order to identify constraints faced by Ragi growers, 120 respondents as a sample size for the study. The results observed that Major constraints



faced by the Ragi growers are, unavailability of high yielding varieties (50.0%) followed by lack of knowledge regarding improved package of practices (41.0%) and distress sale due to lack of demand and lack of capital for purchase of inputs etc. The important strategies expressed by the respondents for overcoming the problems are establishment of primary processing facilities at the village level, supply of good varieties of ragi seed, capacity building programmes for enhancing knowledge on recommended package of practices etc.

## DEVELOPMENT, EVALUATION OF SENSORY PARAMETERS OF MILLET BASED INSTANT SOUP MIXES

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### ABSTRACT

**Background :** Variety and taste are key trends in convenience food segment. Millet based convenience foods not only provide convenience, variety, taste but also provide nutrition at economic value.

**Materials and Methods :** Cleaned Kodo millet and green gram dhal were roasted and were made into flour individually. Vegetables were blanched and dried in tray drier for 12-24 hours at 50°C then were ground coarsely. Spices were also dried and made into fine powder. Soup mixes were prepared by mixing the ingredients in the following ratios.

**Control soup mix :** Corn starch: Green gram dhal: Dehydrated vegetables and spices - 60:20:20

**Kodo millet Soup mix 1:** Kodo Millet: Green gram dhal: Dehydrated vegetables and spices - 60:20:20

**Kodo millet soup mix 2 :** Kodo Millet: Corn starch: Green gram dhal: Dehydrated vegetables and spices - 50:10:20:20. A reconstitution ratio of 1:20 and 1:25 was used to prepare soups.

**Results:** Sensory evaluation revealed that reconstitution ratio of 1:20 was found to be more acceptable. Statistically there was significant difference between the soups only with respect to consistency and overall acceptability ( $p=0.05$ ). The mean consistency scores of the control, soups with 50 and 60% Kodo millet were 7.61, 7 and 6.62 respectively. Overall acceptability was higher in Control soup (7.3) followed by soup containing 50% Kodo millet (7.1) and 60% Kodo millet (6.7).

**Conclusion:** Kodo millet can be used effectively to develop instant soup mixes that are tasty, nutritious and convenient.

## WORK MOTIVATION AMONG THE TEACHERS OF SRI KARAN NARENDRA AGRICULTURE UNIVERSITY, JOBNER

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### ABSTRACT

Work motivation of teachers not only enhances the productivity, growth and development of whole institution, but also trigger students' perception regarding teaching as a profession. The present research study was conducted in Sri Karan Narendra Agriculture University, Jobner, Rajasthan with 92 participant teachers of nine constituent colleges (both accredited and non-accredited colleges). To get the responses from teachers, Work Motivation Questionnaire (WMQ)-Agarwal 1988 was used. The data so collected were classified, tabulated and statistically analyzed which led to the following findings:

The study divulged that majority (45.65 per cent) of the agriculture teachers were from middle aged category, majority (90.22 per cent) were male, majority (89.14 per cent) of agriculture teachers possessed Ph.D. as their educational qualification, and also most of them (65.22 per cent) were designated as Assistant Professors. Equal distribution of agriculture teachers was seen from the both nuclear (50.00 per cent) and joint (50.00 per cent) type of family, majority (54.35 per cent) of agriculture teachers were having their work experience less than 10 years. It was further concluded that majority (61.96 per cent) of total agriculture teachers were having rural background in their upbringing and 65.22 per cent were having income less than Rs 10 lakh per annum, while majority (66.30 per cent) were having their place of permanent residence within the reach of their



workplace and majority (86.96 per cent) of them were having distance of present stay less than 20 km from the work place, majority (36.96 per cent) of total respondents were accommodated in their own house and 82.60 per cent of total agriculture teachers were having accessibility of own vehicle to reach at their workplace.

Study also revealed that majority (97.83 per cent) of agriculture teachers were reported to had high level of work motivation, while the rest (2.17 per cent) were having medium level of work motivation. Study further analyzed the impact of various dimensions of work motivation and it was found that the dimension “Material incentives” had a major contribution and the dimension “Dependence” had least impact or least contribution, on the measuring the level of work motivation of the agriculture teachers. Twelve independent variables were correlated with the level of work motivation of the agriculture teachers and following results were concluded :

(i) There was significant relationship between “Gender” and “Distance of work place from present stay” with the level of work motivation of teachers, respectively.

(ii) There was non-significant relationship between “Age, Education, Work experience, Family type, Background, Annual income, Place of permanent residence, Accommodation and Mode of transport” with the level of work motivation of teachers, respectively.

Majority of teachers perceived “inadequate ministerial and supporting staff” as the major constraint in work to achieve high level of work motivation, whereas “lack of autonomy in teaching” was perceived as least important constraint.

Based on the findings it was recommended that university administration should look at seeking more recruitment in increasing supporting staff, as well as it was recommended that university should constantly keep a watch on causes, lacunas that result in dissatisfaction, stress and over work load upon agriculture teachers and further steps should be taken ideally to mitigate them.

## **ASSESSMENT OF SOIL QUALITY INDEX OF ALIRAJPUR USING PRINCIPAL COMPONENT ANALYSIS**

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### **ABSTRACT**

Information regarding spatial variability and distribution of soil properties is critical for stakeholders attempting to increase nutrients use efficiency and crop productivity. Application of fertilizers on the basis of soil characteristics maps associated with fertilizers recommendation may aid to curtail fertilizers inputs without surrendering the crop yield. The present study was focused on geo-spatial assessment of soil quality index of Alirajpur district of Madhya Pradesh India using geo-statistical approach. 272 GPS based surface (0-15 cm) soil samples were collected from six blocks (Alirajpur, Bhabra, Jobat, Kathiwar, Sondwa, and Udaigarh) of Alirajpur district after harvest of crops during rabi season 2016-17. The samples were processed and analyzed for fertility parameters, spatial variability maps generated using GIS, correlations between nutrient content in soil and were worked out and soil quality index was analyzed using PCA. The soils of Alirajpur district having the bulk density, pH, EC, OC and CaCO<sub>3</sub> varied from 4.70 to 8.40, 0.03 to 0.90 dSm<sup>-1</sup>, 0.47 to 12.92 g kg<sup>-1</sup> and 5.0 to 115 g kg<sup>-1</sup> soil, respectively. Available N, P, K and S content in soils of Alirajpur district ranged from 76.0 to 382.0 kg ha<sup>-1</sup>, 1.34 to 62.13 kg ha<sup>-1</sup>, 53.52 to 529.85 kg ha<sup>-1</sup> and 0.55 to 33.90 mg kg<sup>-1</sup> soil, respectively. Zn, Cu, Fe, Mn and B contents in soil varied from 0.03 to 1.98, 0.06 to 3.74, 1.07 to 36.0, 1.34 to 43.0 and 0.03 to 4.76 mg kg<sup>-1</sup> soil, respectively. The categories of the soil fertility status were made with respect to N, P, K and S as medium, high, medium and low (M-H-M-L). The 64.71%, 93.01% and 25.37% soil samples were noticed to be low in S, Zn and Fe, respectively. The results revealed that none of the samples were tested low in Cu and Mn and these are not a major problem in Alirajpur district as a whole. Correlation analyses among the above highly weighted variables were done to remove the redundant variables, accordingly OC and N, Fe and Mn, CaCO<sub>3</sub> and Zn were highly correlated, and finally OC, Fe and Zn were retained owing to their high factor loading. The sensitive indicators (Minimum dataset) under the soils of Alirajpur District in descending order of importance as revealed by factor analysis were as follows: OC > Fe > Zn > B > EC > K > MBC. The sensitive indicators under the soils of Alirajpur district in descending order of importance as revealed by factor analysis were as follows: OC > Fe > Zn > B > EC > K > MBC. This suggests that these indicators may be used in future for characterizing the state of soil conditions of district. Soil quality index rating ranged from 0.22 to 0.31 under the different blocks and 0.22 for district as whole and with including biological parameter soil quality index 0.31 for district as whole.



## NUTRIENT MANAGEMENT IN CHRYSANTHEMUM (*CHRYSANTHEMUM MORIFOLIUM* RAMAT) CV. BIDHAN MADHURI

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### ABSTRACT

An investigation entitled “Nutrient management in chrysanthemum (*Chrysanthemum morifolium* Ramat) cv. Bidhan Madhuri” was conducted at Bio-Technology-cum-Tissue culture centre, Department of Floriculture and Landscaping, OUAT, Bhubaneswar during winter of 2017-18. The experiment consists of eleven treatments having different combinations of N, P and K fertilizers (Kg/ha) which was fitted to RBD replicated thrice. The data was recorded and analysed for plant growth yield and quality attributes. The data recorded in this trial indicates that, among all the treatments Treatment T10 having a fertilizer combination of N= 120, P=125, K=140 Kg/ha i.e. the optimum dose of fertilizer higher than that of the RDF (N= 100, P=125, K=100 Kg/ha) found to be best. Most effective results were obtained in Treatment T10 producing vegetative growth such as plant height (66.253cm), East-West spreading (34.333cm), North-South spreading (32.526cm) as well as in other floral attributes i.e. minimum days taken for flower bud appearance (48.267 days), minimum days taken for flower bud opening (61.4 days), maximum flower diameter (5.847cm), dry (1.173g) and fresh (3.256g) weights of flower, number of flowers (67.733), flowering duration (74.333 days) and vase life period (20 days). Hence, for obtaining optimum growth, desired flowering and yield attributes Treatment T10 having fertilizer combinations of N= 120, P=125, K=140 Kg/ha is suggested for Chrysanthemum crop in Bhubaneswar condition.

## IMPACT OF GIBBERELIC ACID (GA<sub>3</sub>) ON QUALITY PRODUCTION OF WONDER LILY (*ORNITHOGALUM THYRSOIDES* JACQ.) UNDER TERAI REGION OF WEST BENGAL

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### ABSTRACT

The experiment was conducted at the instructional farm of the Department of Floriculture, Medicinal and Aromatic Plants, Uttar Banga Krishi Viswavidyalaya, India, in 2018-2019 growing season, to investigate the effect of bulb dipping and foliar application with GA<sub>3</sub> on quality production of Wonder Flower under Terai region of West Bengal. Bulb dipping for 6 hours followed by foliar application of GA<sub>3</sub> at monthly intervals after sprouting at the concentrations of 0ppm, 100ppm, 200ppm and 300ppm were considered as treatment combinations. Results revealed that early sprouting (35.33 Days) and maximum number of leaves (8.24) per plant were recorded with the treatment combination of bulb dipping with GA<sub>3</sub> @300ppm followed by foliar spraying with GA<sub>3</sub> @100ppm. Out of sixteen different treatment combinations, the flowering parameters like early floral bud primordial initiation (47.23 Days after planting), early bud development (10.58 Days) and days for first floret opening (3.92 Days) were recorded from the treatment combinations of bulb dipping in 200ppm and foliar spraying with 300ppm GA<sub>3</sub>. However, the maximum spike length (34.60 cm), vase-life (15.33 Days) and field-life (45.52 Days) of whole spike were recorded with the treatment combination of bulb dipping followed by foliar spraying with GA<sub>3</sub> @300 ppm.

## SOIL HEALTH CARD (SHC) : A SCHEME FOR DIAGNOSIS AND SUSTAINABILITY OF SOIL HEALTH

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### ABSTRACT

With the ever-increasing population, the necessity for self-sufficiency in food production becomes a greater challenge. The importance of soil health has been amplified due to inappropriate or intensive cultivation practices with the imbalance use of





chemical fertilizers thereby deteriorating soil quality. In India, efficiency of inputs like fertilizer is additionally low due to their indiscriminate use, weak extension services and inadequate infrastructure. Keeping this in sight, to protect soil health and for sustainable agriculture, the Government of India has introduced Soil Health Cards Scheme (SHCS) nation-wide on February 19, 2015 with a view to extend efficiency of fertilizer use and for fostering the crop yield. Soil Health Card (SHC) are issued for farmers containing the information about soil type, cropping pattern, crop sequence, fertilizer dose on the basis of soil analysis etc. SHC is field-specific detailed printed report of soil fertility status and it advises the farmer on the dosages of fertilizer, micronutrient, soil amendments that should be applied to maintain of soil health in the long run which will help to increase crop productivity. It presently depicts the status of 12 essential parameters i.e. pH, EC, organic carbon and available N, P, K, S, Fe, Zn, Mn, Cu and B along with the farmer's personal details and plot details. Thus, SHCs are introduction to the new era of healthy soil management with the dream of 'Doubling the Farmer's Income' within the country and to menace of overuse of fertilizers.

## CONSUMER PREFERENCES IN PURCHASING FRUITS AND VEGETABLES FROM ORGANIZED AND UNORGANIZED RETAILERS IN NAVSARI CITY

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### ABSTRACT

In India the supply chain of fruits and vegetables is fairly one dimensional and there is very little value-added activity since distribution remains fragmented and unorganised. So, for reducing the wastage in fruits and vegetable sector and providing high share to farmers in consumer rupees there is urgent need for establishing an efficient supply chain that links farmers, retailers and consumers. In this regard this study aims to find the Consumer Preferences in Purchasing Fruits and Vegetables from Organized and Unorganized Retailers in Navsari City. The primary data were collected by survey method with a pre-designed structured questionnaire. The sample size of this study was 100 consumers selected purposively from Navsari city of South Gujarat. The analytical tools employed include tabular analysis and relevancy rating used to rank the factors and retail formats. Also the association between profile of consumers and their preferences of unorganized and organized retail stores was analysed by using Pearson Chi-square test. The data analysis shows that there is a difference between the consumers' perception towards both organized and unorganized retailers regarding purchase of fruits and vegetables. Also it was found that income, gender and education plays a significant role in selecting the different retail formats while purchasing fruits and vegetables. So, it could be concluded that both the organised and unorganised retail stores need to upgrade their facilities according to the requirements of the customers. Also there is need for the development of a robust supply chain which in turn will integrate farmers into the modern retail practices to ensure farmers receive higher prices for their produce.

## PREVALENCE AND DRUG RESISTANCE OF *STAPHYLOCOCCUS AUREUS* ISOLATES FROM BOVINE MASTITIC MILK AND UDDER SURFACES

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### ABSTRACT

*Staphylococcus aureus* is one of the most important contagious pathogens causing mastitis in dairy animals with the potential to develop resistance to almost all the antimicrobial agents, hence a major challenge in the treatment of bovine mastitis. The present study was conducted on 51 *S. aureus* isolates recovered from mastitic milk samples (n=80) and 35 *S. aureus* isolates from udder surfaces (n=66) from cows from different farms in Bikaner, Rajasthan. The isolates were presumptively identified as *S. aureus* on the basis of cultural and biochemical properties followed by 23S rRNA ribotyping and PCR amplification of *nuc* gene. The recovery rate of *S. aureus* was 63.8% and 53.03% from mastitic milk and udder surfaces, respectively. These isolates were subjected to antibiogram studies using 32 antibiotics belonging to different categories and generations. The mastitic milk isolates showed 100% sensitivity towards six antibiotics i.e. cefotaxime+clavulanic acid, gentamicin, imipenem, oxacillin, piperacillin+tazobactam and vancomycin. While except for gentamicin, the other five antibiotics were found to be 100% effective against isolates from udder surfaces. Apart from these six antibiotics, 11 antibiotics were found effective against more than 80% isolates while remaining 15 antibiotics showed lesser efficacy. A high resistance towards ampicillin



(90.2%) and penicillin (88.2%) and least resistance towards clindamycin and cefazolin (2% each) were observed for mastitic milk isolates. While 97.1% and 88.6% of udder isolates were resistant to penicillin and ampicillin, respectively. Hence it is recommended to record drug sensitivity and resistance patterns for different classes of antibiotics frequently used in a given geographical area against *S. aureus* associated mastitis cases. This may help in understanding and tracking the development of drug resistance in *S. aureus* strains in a particular geographical area.

## COMBINING ABILITY AND GENE ACTION STUDIES FOR YIELD AND YIELD CONTRIBUTING TRAITS IN BITTER GOURD (*MOMORDICA CHARANTIA* L.)

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### ABSTRACT

The present investigation was carried out to get information regarding magnitude of combining ability and nature of gene action for fruit yield and its contributing traits in bitter gourd following Line x Tester mating design involving six lines and three testers. All the new 18 hybrid combinations along with their parents evaluated in Randomized Block Design with three replications during summer 2019 at College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem, AP, India. Significant differences were observed for all the characters under study. The characters viz., days to opening of first female flower, node at which first male flower appeared, average fruit weight (g), fruit yield per vine (kg) and fruit yield per hectare (t) were controlled by non-additive gene action and there is a scope for heterosis breeding. Out of nine parents IC 505637 and IC 470553, Pusa Vishesh and Pusa Do Mausami were observed to be best general combiners as they have made significant contribution in yield and yield contributing traits. High *sca* effects for fruit yield per vine and average fruit weight were manifested in two crosses, IC 50520 x Co-1 and IC 470553 x Pusa Do Mausami. These crosses can be exploited as desirable hybrids.

## EFFECT OF TEMPERATURE HUMIDITY INDEX (THI) ON PRODUCTION PERFORMANCE IN RED SINDHI CATTLE

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### ABSTRACT

According to the IPCC report, currently, global warming is likely to impact the productivity of dairy animals due to their sensitivity towards the temperature changes. THI (Temperature Humidity Index) is one of the indicator or a single value depicting the integrated effect of air temperature and humidity associated with the heat stress in case of the dairy animals. Red Sindhi is one of an important milch breed of cattle in India which was maintained at Division of Animal Husbandry and Dairy Science, College of Agriculture, Dhule, (M.H). The data collected from 1991-2013 on different production traits were utilized to study the effect of THI on production performance of Red Sindhi cattle. The value of THI were calculated using NRC formula which is adopted by various NICRA project in India. The least square technique as suggested by Harvey (1990) were used to study the significant effect of period of calving, season of calving and lactation order on production traits. The corrected data for the different significant effect was used to study the effect of THI on production performance in Red Sindhi cattle. The least squares mean of lactational milk yield (kg), 300 days' milk yield (kg), peak milk yield (kg), lactation length (days) and dry period (days) were estimated by considering the effects of period of calving, season of calving and lactation order. The frequency distribution patterns for PMY according to THI were worked out. The overall least squares mean for lactational milk yield (kg), 300 days' milk yield (kg), PMY (kg), lactation length (days) and dry period (days) were 1892.57  $\pm$  35kg, 9.56  $\pm$  0.14 kg, 305.84  $\pm$  5.80 (days) and 83.33  $\pm$  5.41 (days) respectively. The effect of period of calving was significant on LMY, 300 days' milk yield, lactation length and peak milk yield ( $P < 0.01$ ). The variation due to season of calving was non-significant on all production traits in Red Sindhi cattle. The influence of lactation order on lactation length was significant ( $P < 0.01$ ) while on LMY, 300 days' milk yield, dry period, and peak milk yield were non-significant. The effect of



THI on all the production traits under study showed non-significant effect which indicate that the Red Sindhi cows were acclimatized to the local climate if optimum feeding with sound management are provided. The frequency distribution pattern for PMY according to THI indicated maximum number of cows giving PMY more than 8 kg which lies under THI5 (>89), THI3 (83-86) and THI4 (86-89). Total of 51 (85.00%) cows yielded more than 8 kg PMY in THI5 (>89), 45 (88.23%) cows yielded more than 8 kg PMY in THI3 and THI4. This might be indicating that Red Sindhi cattle are comfortable between THI 83- THI 89.

## EFFECT OF NUTRITION ON GROWTH, SEED YIELD AND QUALITY IN CARROT CV. PUSA KESAR

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### ABSTRACT

Nutrition plays an important role in enhancing the seed yield and quality. Application of organics such as FYM and vermicompost is becoming popular especially among the vegetable crop growers owing to high cost of chemical fertilizers. Role of organic manures in improving soil structure and texture and fertility is well understood and organic manuring has positive influence on soil texture and structure. Experiment was conducted in UAS farm, Dharwad with different combination of treatments and one control and results obtained shown that treatment N<sub>4</sub> ( 50% VC+ 50% RDF) showed good plant height ( 89.7 cm) , no of leaves (15.35) , root length (24.55 cms) , root weight (78.08 g), root diameter 13.25 cms), no of umbels per plant ( 39.06), no of seeds per plant (26.13), umbel diameter ( 35.13 cms), 1000 seed weight ( 4.35 g), seed yield per plant ( 40.03 g), seed yield 480.44 kg/ha etc. and quality parameters like germination (86.67), speed of germination (21.63), root length ( 10.30 cms), shoot length (9.50 cms), seedling vigour index ( 1715), seedling dry weight (12.58 g), field emergence of 80.43 % respectively were highest in the same treatment.

## GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN RESTORER LINES OF PEARL MILLET [*Pennisetum GLAUCUM* (L.) R. BR.]

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### ABSTRACT

Sixty restorer lines of pearl millet [*Pennisetum glaucum* (L.) R. Br.] obtained from Rajasthan Agriculture Research Institute, Durgapura, Jaipur were evaluated for grain yield and its quality characters in Randomized Block Design with three replications during *kharij* 2017. The data were subjected to statistical analysis to obtain estimates of variability, heritability (broad sense) and genetic advance as percentage of mean for yield and quality attributing characters. Correlation and path coefficient were also worked out to ascertain the nature and degree of association between different characters. Present investigation indicated that all the characters showed significant variability for restorer lines. The estimates of GCV were high for dry fodder yield per plot followed by grain yield per plot and iron content and PCV were high for dry fodder yield per plot followed by grain yield per plot and harvest index whereas low for days to maturity. Heritability was high for days to maturity followed by panicle length, iron content and plant height; while lowest value of heritability was observed for harvest index. High estimate of heritability along with high genetic advance as percentage of mean were observed for dry fodder yield per plot, iron content and grain yield per plot where as high heritability values with low genetic advance as percentage of mean were observed for days to maturity. The grain yield per plot was found positively correlated with harvest index, dry fodder yield per plot, panicle girth at maximum point, 1000 grain weight, plant height and number of productive tillers per plant. Path coefficient analysis revealed that harvest index, dry fodder yield per plot and days to maturity were the important characters for selection of high yielding accessions as they exerted high positive direct effect as well as showed positive correlation with grain yield per plot. Based upon the genetic variability, heritability, genetic advance as percentage of mean, correlation and path analysis it was concluded that dry fodder yield per plot, grain yield per plot, harvest index, number of productive tillers per plant and panicle girth at maximum point are most important yield components in pearl millet breeding programme. Based upon genetic diversity, lines included in the diverse cluster III for yield, VII for quality and IX for both parameters hold good promise as parents for obtaining potential hybrids and thereby of creating large variability for these characters in pearl millet



based on cluster mean values. Based on the mean performance of the restorer lines, RIB-11096, J-2290 and RIB-335/74 were found to be superior for both yield and quality parameters and it should be utilized in further pearl millet breeding programme.

## MANAGEMENT OF PLANT DISEASES BY RNAI

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### ABSTRACT

The fast-growing human population requires the development of new agricultural technologies to meet consumers demand, while minimizing environmental impacts. Plant diseases are one of the main causes for losses in agriculture production and current control technologies based on pesticide application or the use of transgenic crops are facing efficacy challenges. Novel approaches to control pests are urgently necessary. RNA interference (RNAi) is a gene silencing mechanism triggered by providing double-stranded RNA (dsRNA), that when ingested into pathogen can lead to death or affect the viability of the target pathogen. RNAi triggers such as artificial microRNAs (amiRNAs), hairpin-structured RNAs (hpRNAs) and dsRNAs can be specifically designed to selectively target the expression of specific genes or groups of similar gene sequences in a target organism. As such, a target species or a group of species could be targeted while leaving non-target species unharmed.

This sequence-dependent mode of action, based on a natural molecule as the active ingredient, gives RNAi unique features of efficiency and selectivity compared to other conventional agrochemicals. Transgenic plants expressing dsRNA version of pest specific target genes are the new generation of resistant plants. Recently Aflatoxin-free transgenic maize using host-induced gene silencing is became more successful. Furthermore, challenges still lie ahead to assess and minimize the risk of off target silencing and also to avoid the possibility of resistance emergence to RNAi-based control. It is also worth noting that RNAi-based control strategies are not envisaged as standard disease control strategies, but should rather be part of synergistic approach in an integrated disease management (IPM) context, to improve the sustainability of future pest control.

## MUTAGENIC STUDIES IN M<sub>1</sub> GENERATION OF *LATHYRUS* (*LATHYRUS SATIVUS* L.)

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### ABSTRACT

Studies on induction of Mutation in Lathyrus by gamma ray was undertaken with objectives to assess the mutagenic efficiency and effectiveness of different mutagenic doses of gamma rays. The experiment was conducted to screen the mutant population to identify the desirable mutant for both qualitative and quantitative traits in Lathyrus in rabi season. Dry healthy and genetically pure 500 seeds of cultivar NLK-73 of lathyrus for each treatment were irradiated with 150 Gy, 200 Gy, 250 Gy, 300 Gy and 350 Gy. The observations on mutagenic doses of gamma rays. Germination rate and survival rate more pronounced whenever decreases doses in gamma rays. It concluded that as increases, the concentration of doses of gamma rays increases the mortality rate and decreases germination rate.

## IMPORTANCE OF MUTATION BREEDING FOR CROP IMPROVEMENT IN TURMERIC

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### ABSTRACT

Turmeric (*Curcuma longa* L.) is one of the major spices crops exporting from India to different countries as a whole, powder, oleoresins and curcumin and play a major role in the national economy. The export demand is continuously increasing





for turmeric since it has anti-inflammatory, hepatoprotective, antitumor, antiviral, wound healing, anti-cancerous and immunity boosting properties. Even though India is a leading producer, consumer and exporter of turmeric and few high yielding cultivars are available in this crop, the average productivity and quality are not enough to compete in world export market. Hence, there is a lot scope for crop improvement in turmeric to improve quality parameters like curcumin, oleoresins along with yield, reduce duration of the crop and resistance to biotic and abiotic stresses. Since, turmeric is an asexually propagated triploid ( $2n=63$ ) crop with reproductive sterility, clonal selection is the major mode of crop improvement. The first step in the crop improvement of clonally propagated crop is to exploit the variability existing among the land races. So, creation of variability for those characters is possible only through induced mutations. The use of mutagens for inducing variability assumes greater significance in vegetatively propagated crops like turmeric. The success of mutation breeding mainly depends on understanding of the process of induction, recovery of mutants and the screening methods for evaluating the desired mutants. So, in turmeric mutation breeding is an important alternative tool in crop improvement.

## BIODIVERSITY OF MUSHROOM FLORA OF MAHABALESHWAR KOYANA NAGAR AND GAGANBAWADA FORESTS OF MAHARASHTRA

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### ABSTRACT

The geographical survey was carried out with the object to study biodiversity of mushrooms in forests of Mahabaleshwar, Koyananagar and Gaganbawada area of western Maharashtra to identify mushroom species on the basis of morphological characteristics during July to October, 2019. Total 50 mushroom species were collected and identified up to species level. The mushroom collected from Gaganbawada, Koyananagar and Mahabaleshwar are identified and named as *Temitomyces* spp.- 3, *Leucocoprinus* spp.- 1, *Lepiota* spp.- 3, *Dacryopinax* spp.- 1, *Marasmius* spp.- 4, *Pleurotus* spp.- 5, *Parasola* spp.- 1, *Volvariella* spp.- 1, *Polyporus* spp.- 2, *Psathyrella* spp.- 3, *Coprinopsis* spp.- 2, *Stereum* spp.- 2, *Agrocybe* spp.- 1, *Tremella* spp.- 1, *Ramariopsis* spp.- 1, *Cortinarius* spp.- 2, *Neolentinus* spp.- 1, *Hygrocybe* spp.- 1, *Hygrophorus* spp.- 1, *Chlorophyllum* spp.- 2, *Lentinus* spp.- 1, *Coprinellus* spp.- 1, *Psilocybe* spp.- 2, *Leucoagaricus* spp.- 2, *Chlorophyllum* spp.- 2, *Leptonia* spp.- 1, *Pluteus* spp.- 1, *Bolbitius* spp.- 1. The collected species has showed variations among their morphological characteristics i.e. pileus, stipe, lamellae, basal association, edibility and spore prints. Other characteristics include form of mushroom i.e. single, group or connate (united), smell of mushroom (pleasant or odd smell) and mushroom habitat i.e. on soil, grassland, dung, dead tree trunk or wooden stumps or on plant. The environmental factors like light, temperature, nutrients and relative humidity greatly influence the growth. They appear in all seasons; however, rains favor rapid growth when organic matter or its decomposition products are easily available. This study provides the baseline information on wild edible mushroom diversity.

## NUTRITIONAL VALUE OF LATHYRUS GRAIN FOR ANIMAL FEED

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### ABSTRACT

Livestock is a key component of farming systems in South Asia and in Africa, and most particularly with small and marginal farmers, estimated about 678 million, and indicates importance of livestock to their livelihoods. *Lathyrus* (*Lathyrus sativus* L.) is an important legume crop with low cost and easy cultivation grown in India, Bangladesh, China, Ethiopia, Nepal, and Pakistan for human food and animal feed. Inherently *Lathyrus* possesses resistance to drought, excess moisture, salinity, diseases, and insect pests. As *Lathyrus* has an ambivalent reputation due to ODAP content in its plant parts, efforts are on to develop low or ODAP free *Lathyrus* varieties with high biomass for dual purpose for human food and animal feed. Older published animal feeding studies are of limited use, since the presence and role of ODAP was unknown until the 1960s. More recent feeding studies indicate that low ODAP lines of *L. sativus* can be safely incorporated at inclusion rates up to 40, 30 and 70% of the diet of poultry, pigs and sheep, respectively, without growth reductions. *Lathyrus* is known as excellent feed and



fodder crop for centuries as a main concentrate for horses. *Lathyrus* is increasingly recognized as an important feed and fodder crop by there source poor farmers of semi-arid and dry areas. Acceptability of low ODAP varieties by the farmers of non-traditional *Lathyrus* growing areas and high nutritional composition makes the *Lathyrusa* perfect dual purpose for crop securing food, feed and fodder security in the region. As world demand for legume feed protein is likely to increase, due to increasing demand for animal food products, *L. sativus* are crops that should be considered in regions with suitable environments.

## BIOCHEMICAL TRAITS AND YIELD PARAMETERS IN PIGEONPEA AS INFLUENCED BY FOLIAR APPLICATION OF CHITOSAN AND IBA

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### ABSTRACT

The Physiological response of foliar sprays of chitosan (25, 50, 75, 100 and 125 ppm) and IBA (25, 50, 75, 100 and 125 ppm) on the chemical, biochemical and yield contributing parameters of pigeonpea cv. PKV-Tara was studied during *kharif* 2018-2019 at farm of Botany section, College of Agriculture, Nagpur. Experiment was laid out in RBD design with three replications and eleven treatments. Spraying of chitosan and IBA was done two times i.e. on 45 and 65 DAS. Observations about chemical and biochemical parameters like leaf chlorophyll, N, P, K content in leaves, protein content in seed were also estimated. Observations on yield contributing parameters like 100 seed weight, number of pods plant<sup>-1</sup>, number of seeds pod<sup>-1</sup>, seed yield plant<sup>-1</sup>, plot<sup>-1</sup> were recorded. Foliar sprays of 25 ppm IBA followed by 50 ppm chitosan significantly enhanced chemical and biochemical parameters and yield contributing parameters when compared with control and rest of the treatments under study.

## VERMICOMPOST PRODUCTION : A SAFER WAY TO MAKE SOIL NUTRIENT RICH

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### ABSTRACT

Vermicompost is a decomposed material that is obtained when earthworms (mainly *Eisenia fetida* known as red wiggler) feed on soil and excretes the enriching material called vermicompost. Vermicompost is stable, fine granular organic manure, which enriches soil quality by improving its physicochemical and biological properties. It is highly useful in raising seedlings and for crop production. Vermicomposting is basically a managed process of worms digesting organic matter to transform the material into a beneficial soil amendment. The scientific community all over the world is desperately looking for an economically viable, socially safe & environmentally sustainable alternative to the agrochemicals. Applying vermicompost can enhance soil fertility physically, chemically and biologically.

## A STUDY ON INFORMATION SECURITY OF AGRICULTURAL LABOURERS IN SELECTED DISTRICTS OF ANDHRA PRADESH

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### ABSTRACT

The present study was conducted in Andhra Pradesh state during the year 2018-20 with an objective to study the attitude of agricultural labourers towards their livelihood. An *Ex-post facto* research design followed for the study. Three districts from



the three regions of Andhra Pradesh, Srikakulam from North Coastal, Guntur from South Coastal and Kurnool from Rayalaseema region were purposively selected based on the highest number of agricultural labourers and a total of 240 agricultural labourers were selected for study. The results stated that majority (67.50%) of agricultural labourers of North Coastal Region had above medium information security followed by those had low (18.75%) and high (13.75%) information security. Whereas, in South Coastal Region, majority (66.25%) of the agricultural labourers had above medium information security followed by those had low (18.75%) and high (15.00%) information security. Similarly, in Rayalaseema Region, more than half (58.75%) of the agricultural labourers had above medium information security followed by those had low (25.00%) and high (16.25%) information security. The overall analysis in revealed that nearly two-thirds (64.16%) of the agricultural labourers in Andhra Pradesh had medium information security followed by those had low (20.84%) and high (15.00%) information security in Andhra Pradesh. This condition might have been due to the education and access to sources of such output. The mean score values of information security in different regions were 47.80 in Rayalaseema region, 51.03 in South Coastal region, 42.50 in North Coastal region and 45.41 in Overall Andhra Pradesh.

## CRISPR CAS9 SYSTEM – A DESIRABLE TOOL FOR GENOME EDITING IN WHEAT

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### ABSTRACT

CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats. This new genome editing technique is so much faster, easier and more accurate than anything that comes before. CRISPR is a specialized region of DNA with two distinct characteristics: presence of nucleotide repeats and spacers. Components of CRISPR CAS9 system are CRISPR RNA, tracr RNA, sgRNA and CAS9 protein. CRISPR accelerate plant breeding by allowing the introduction of precise and predictable modifications directly in the elite background. It helps in the development of biotic and abiotic resistant features in agricultural plants as well as viral resistant crop varieties, such as wheat, in order to lower gluten content in order to prevent coeliac disease. The only treatment is a gluten-free diet that must be followed for the rest of one's life. Consumption of whole grain foods lowers the incidence of chronic diseases, hence there is a growing demand for coeliac safe whole grain wheat-based goods. Gene editing for the creation of coeliac safe wheat is also studied in the context of food production and in light of current national policy.

## ASSESSMENT OF GENOTYPIC AND PHENOTYPIC CORRELATION OF *LYCOPERSICON ESCULANTUM* MILL

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### ABSTRACT

Vegetables play an important role in the balanced diet by providing not only energy but also vital protective nutrients. Tomato (*Lycopersicon esculentum* Mill.) belongs to the family Solanaceae, which is one of the most widely cultivated vegetable crops. Tomato is grown all over the world including tropical, sub-tropical and temperate region. Tomato grows best in the dry season under day temperature of 21-25°C and night temperatures of 15-20°C. Correlation coefficients are used to measure how strong a relationship is between two variables. There are several types of correlation coefficient, but the most popular is Pearson's. Pearson's correlation (also called Pearson's R) is a correlation coefficient commonly used in linear regression. In fact, when anyone refers to the correlation coefficient, they are usually talking about Pearson's. A correlation coefficient varies between +1 to -1. Zero means that for every increase, there isn't a positive or negative increase (Fisher, 1918 & Wright, 1921). Correlation coefficients analysis measures the mutual relationship between various characters at genotypic (g), phenotypic (p) and environmental levels with the help of following formula suggested by Miller. Days to first flowering had highest positive significant genotypic correlation (0.954) with days to 50 % of flowering which was followed by significant genotypic correlation (0.592) of no. of primary branch with no. of secondary branches. Maurya also evaluated that there was higher genotypic correlations as compared to the respective phenotypic correlations for most of the traits. Average fruit weight, fruit width, fruit length, number of locules per fruit and number of seeds per fruit showed significant positive correlation with yield (q/ha) which indicated that the selection for higher yield through these traits would be effective. These traits may be given more emphasis for direct selection of high yielding tomato genotypes in future breeding programmes.



## ASSESSMENT OF DIFFERENT FOLIAR FUNGICIDES AGAINST EARLY BLIGHT OF TOMATO CAUSED BY *ALTERNARIA SOLANI* ELLIS AND MARTIN

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### ABSTRACT

Early blight of tomato is the most important disease in tropical and subtropical areas. Early blight is strongly influenced by different environmental conditions causing the leaf blight, stem blight and apical fruit rot. A field trial was conducted at the experimental field of Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M. P.), during *Rabi* season of 2018-19 to be find out the effective fungicidal application for its management. Six treatments including control with three replications were taken up by using randomized block design (RBD). The fungicides namely, tebuconazole + trifloxystrobin (Nativo 75 % WG) @ 0.1 % (T1), metiram + pyraclostrobin (Cabrio Top 60 % WG) @ 0.3 % (T2), hexaconazole + captan (Taqat 75 % WP) @ 0.2 % (T3), difenoconazole (Score 25 % EC) @ 0.1 % (T4), chlorothalonil (Kavach 75 % WP) @ 0.2 % (T5) and untreated control (T6). The fungicidal spray was given twice. The first spray was given as soon as appearance of the disease symptoms and second spray was given 10 days after the first spray. Observations were recorded at 10 and 20 days after the spray. All fungicides significantly reduced the per cent disease intensity (PDI) over control. The results revealed that, the lowest percent disease intensity was observed in tebuconazole + trifloxystrobin (Nativo 75 % WG) (16.34 %), followed by metiram + pyraclostrobin (Cabrio Top 60 % WG) (23.62 %), respectively. Similarly, the highest yield of tomato fruits were recorded with tebuconazole + trifloxystrobin (Nativo 75 % WG) (248.30 q/ha), followed by metiram + pyraclostrobin (Cabrio Top 60 % WG) (226.55 q/ha), respectively.

## INTEGRATED MANAGEMENT OF WILT / DRY ROOT ROT OF CHICKPEA

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### ABSTRACT

Chickpea (*Cicer arietinum* L.) is one of the most important pulses mostly grown in dry lands. The crop suffers from biotic and abiotic factors that affect the crop in all growth stages. Among them soil borne disease dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler is a serious biotic constraint for chickpea production in Northern Karnataka. Therefore the present study was conducted with *Trichoderma* strains and fungicide concentrations for the management of wilt/ root rot complex in chickpea. Percent disease incidence was less in seed treatment with *Trichoderma harzianum* T-6 + Propineb (@ 10g + 1.5g) per kg seed (9.17%) and significantly superior to rest of the treatments followed by seed treatment with Hexaconazole + Zineb (Zinzco) @ 3g/kg seed (15.83%). Seed yield of 980.6 kg/ha was found to be maximum in seed treatment with *Trichoderma harzianum* T-6 + Propineb (@ 10g + 1.5g) per kg seed followed by seed treatment with Hexaconazole + Zineb (Zinzco) @ 3g/kg seed (845.0 kg/ha).

## STUDIES ON RESISTANCE OF APPLE ROOTSTOCKS TO SEEDLING BLIGHT DISEASE UNDER TEMPERATE CONDITIONS OF KASHMIR

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### ABSTRACT

Seedling blight is one of the major nursery diseases of apple which affects the quality production of planting material. An extensive survey conducted during the month of September, 2019 in three districts of Kashmir valley, viz., Pulwama, Srinagar and Shopian, revealed the prevalence of the disease in all the surveyed nurseries with varied levels of incidence which ranged from 01.33 to 15.00 percent. The fungus inciting the disease was identified as *Sclerotium rolfsii* Sacc. on the basis of its





cultural and morphological characteristics. The pathogenicity test of isolated fungus *S. rolfsii* was established by proving Koch's postulates on potted apple seedlings (M9 rootstock). Symptom at ological studies of *S. rolfsii* on artificially inoculated potted apple seedlings (M9 rootstock), revealed the initiation of characteristic symptoms of disease after 27 days of inoculation as drooping and brown discolouration of leaves which was followed by brown to reddish brown discolouration along with upward curling of leaves and ultimately death of the plants after 48 days of inoculation. Of the various inoculation techniques tested, mycelial disc inoculation technique with least incubation period (27-29 days) and highest disease incidence (100%), proved the most efficient technique for rapid and effective screening of apple rootstocks against seedling blight disease. Screening of thirteen apple rootstocks comprising of seven clonal rootstocks (M9, M7, M27, M26, MM106, MM111 and Merton 793) and six seedling rootstocks (Golden harnet, Manchurian, *Malus floribunda*, Golden delicious, Red delicious and Red gold) under artificially inoculated pot conditions, showed the highly susceptible nature of all the test rootstocks, however, the rootstock varied with respect to disease incidence which ranged from lowest of 50 per cent in *Malus floribunda* rootstock to 100 per cent in M9 rootstock. Host range studies of *S. rolfsii*, isolated from the apple seedlings on different temperate fruit crops viz., cherry, plum, peach, apricot, almond and quince revealed the specificity of the pathogen to apple only as pathogen was unable to infect any other test fruit crops.

## ETIOLOGY AND NON-CHEMICAL MANAGEMENT OF WILT COMPLEX DISEASE OF CHILLI UNDER KASHMIR CONDITIONS

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### ABSTRACT

Chilli crop in Kashmir is subjected to many diseases, primarily of fungal origin. Of this fungal disease, wilt a complex disease, occurs in epiphytotic form in several chilli growing areas of the valley and has forced many cultivators to abandon its cultivation. Studies were carried out on etiology and management of the disease. The pathogens associated with the disease were isolated and identified as *Fusarium pallidoroseum* (Cooke) Sacc. and *Sclerotium rolfsii* Sacc. on the basis of their morphological and pathological characteristics. Among the aqueous extracts of four locally available botanical extracts viz., *Urticadioica*, *Artemesiaannua*, *Allium sativum* and *Allium cepa*, tested at four different concentrations (2,4,6,8 and 10 per cent) under *in vitro* conditions against the causal pathogens, *A.sativum* extract was the most effective with 100 per cent inhibition of mycelial growth at 10 per cent concentration of both the test fungi. The pot experiment was also conducted to test the efficacy of effective botanicals (from *in vitro* study) on wilt incidence, when applied through seedling dip and soil drench method. *A. sativum* extract at 10 per cent concentration provided 55.39, 64.52 and 70.59 per cent disease control, when plants were inoculated with *F. pallidoroseum* + *S. rolfsii*, *F. pallidoroseum* and *S. rolfsii*, respectively.

## MANAGEMENT OF SEEDLING BLIGHT OF APPLE (*MALUS DOMESTICA* BORKH.) UNDER KASHMIR CONDITIONS

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### ABSTRACT

Apple is prone to number of soil borne diseases under nursery conditions. Amongst this soil borne diseases, seedling blight caused by *Sclerotium rolfsii* Sacc. has emerged as a major limiting factor under Kashmir conditions, which limits the production of quality planting material. The practice of monoculture and non-adoption of protection measures seems to have given flip to the spread and development of this disease in the valley. The present investigations were carried out during 2019-20 in the Division of Plant Pathology, SKUAST-K Shalimar. The pathogen associated with seedling blight of apple was



isolated, morphologically characterized and identified as *Sclerotium rolfsii* Sacc. The pathogenicity of isolated fungus was established by confirming the Koch's postulates on potted M9 apple rootstock. Five fungi toxicants viz., Carbendazim 25% + Flusilazole 12.5% 37.5 SC, Captan 70% + Hexaconazole 5% 75 WP, Metiram 55% + Pyraclostrobin 5% 60 WG, Carbendazim 12% + Mancozeb 63% 75 WP and Hexaconazole 4% + Zineb 68% 72 WP were evaluated at 100, 200, 300, 400, 500  $\mu\text{g ml}^{-1}$  concentrations against the test pathogen. Among these fungitoxicants, maximum mycelial growth and sclerotial germination inhibition of 98.66 and 100.00 per cent, respectively was achieved by Zineb 68% + Hexaconazole 4% 72 WP followed by Metiram 55% + Pyraclostrobin 5% 60 WG (97.77 % and 96.67 %). Under *in vivo* evaluation studies, soil drenching of Zineb 68% + Hexaconazole 4% 72 WP @ 0.1% proved most effective by providing 92.00 per cent disease control followed by soil drenching of Metiram 55% + Pyraclostrobin 5% 60 WG @ 0.1% (84.00%).

## SOIL BORNE DISEASE MANAGEMENT IN PULSES THROUGH BIOAGENTS IN NORTH KARNATAKA

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### ABSTRACT

The pulse hub north Karnataka having more areas of Pigeon pea based cropping system. Soilborne diseases are considered as a major limitation for good crop production. Soilborne plant pathogens such as *Rhizoctonia* spp., *Fusarium* spp. *Sclerotinia* spp. and *Phytophthora* spp. can cause 50%–75% yield loss in pulse crops such as specially in green gram, pigeonpea, black gram and soybean. Soilborne plant pathogens are responsible for about 70% of the 150 major diseases of the principal crops. They often survive for long periods in host plant debris, soil organic matter, free-living organisms or resistant structures like microsclerotia, sclerotia, chlamydospore or oospores. Accurate diagnosis of a particular disease is difficult due to the similarity in symptoms such as seedling blight, stem canker, wilts, blights, root blackening, root rot, bark cracking which in turn makes the disease harder to manage. The biocontrol agents developed by UAS Raichur and KSDA Biocontrol labs gaining more importance in Kalaburagi, Yadagir, Raichur pulse growing tracts. The seed treatment campaign organized by KVKs and ATMA Project, RSKs in village level successful in controlling the major soil borne diseases up to 60%. The combating of soil borne pathogen with biocontrol agents and insitu incorporation of green manures such as sun hemp. The powdered *Trichoderma* and liquid *trichoderma* both are now a days used for controlling the soil borne diseases. The Talc based *Trichoderma* with soil amendment increases the soil beneficial microbes thus decreasing the harmful pathogens.

## STUDIES ON PLANTING GEOMETRY OF TALL FESCUE GRASS AND SEED RATES OF WHITE CLOVER IN WET TEMPERATE CONDITIONS

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### ABSTRACT

A field experiment was conducted under All India coordinated Research Programme during *grabi* 2014-15 for a period of Five Years at Dry land Agricultural Research Station, Rangreth in coordinated mode to evaluate the productivity, quality and compatibility of tall fescue grass planted at different spacing with variable seed rates of white clover in wet temperate conditions. All possible combinations of three spacing of fescue grass (20 cm x 30 cm; 30 cm x 30 cm and 40 cm x 40 cm) and three seed rates of white clover (1.0, 2.0 and 3.0 kg/ha) with sole stand of tall fescue grass (30cm x 30 cm) and white clover (6kg/ha sown by broadcast) were evaluated in randomized block design. It was found that treatments comprised of tall fescue grass + white clover the legume was over sown by broadcast in tall fescue after transplanting of this grass. Tall fescue grass planted at 20 cm x 30 cm spacing with white clover @ 1 kg/ha produced highest green, dry fodder yields, economic returns



and benefit:cost ratio. Further improvement in soil organic carbon, available N,P and K in all the treatments over initial status was observed. Increase in available soil nitrogen was observed with increase in seed rate of white clover in each treatment.

## STUDIES ON THE PRODUCTIVITY AND CARBON SEQUESTRATION OF SILVI-PASTORAL SYSTEM IN HILLS OF NORTH WESTERN HIMALAYAS

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### ABSTRACT

A field experiment was conducted at Two locations viz; Dry land Agricultural Research Station, Rangreth, Kashmir and Palampur under All India coordinated Research Programme for a period of five years. In this experiment, three tree species viz; Salix and Mulberry along with five species viz, Setaria, Fescue, white clover, Fescue+ white clover and Natural grasses were planted to study the system productivity and carbon input to soil through silvi-pastoral system. It was observed that under temperate Kashmir conditions, Mulberry tree based silvi-pastoral system resulted in more green fodder, dry fodder, crude protein yields and economic returns compared to Grewia/Salix/ based system. Among different range species, Setaria grass recorded significantly highest green fodder, dry fodder, crude protein yields and economic returns. Planting of tree species (Grewia/ Salix and Mulberry) resulted in almost similar value of total soil organic carbon content at both the location. Planting of tall fescue grass resulted in higher total organic carbon content than the treatment consisted of local grasses at both the locations. The mean data indicated that tall fescue grass resulted in 6.58, 8.81, 9.42 & 10.51 percent higher total soil organic carbon content over tall fescue grass + white clover, white clover, Setaria grass and local species, respectively.

## MUTAGENESIS FOR YIELD AND YIELD ATTRIBUTING CHARACTERS IN TAG-24 CULTIVAR OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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### ABSTRACT

Groundnut has been exposed extensively to mutagenic treatments for induction of variability. Mutation breeding has been widely used for the improvement of plant characters in various crops. It is a powerful and effective tool in the hands of plant breeders. In any mutation breeding program, selection of an effective and efficient mutagen is very essential to produce high frequency of desirable mutation. Groundnut (*Arachis hypogaea*) var. TAG 24 was treated with different concentration of physical and chemical mutagen namely gamma rays 20,30 and 40 kR and Ethyl methane sulphonate (EMS). For inducing mutation various concentration of EMS such as 0.05, 0.1 and 0.2 %. The morphological and yield characters like seedling survival, days to first flower, plant height, Pod weight, size etc were observed.

## BREEDING OF PEARL MILLET HYBRIDS FOR RUST DISEASE

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### ABSTRACT

Rust caused by *Puccinia substriata* has emerged as second most serious disease affecting both forage and grain production in Pearl millet. In the present study, one hundred twenty-six Pearl millet genotypes were screened for rust resistance under field condition at Regional Agricultural Research Station, Vijayapur during kharif, 2019. These one hundred twenty-six genotypes



comprising of thirty minicore collection restorers, three female lines, ninety experimental hybrids developed from these parents and three checks. The disease severity in the parents, hybrids and checks for rust disease was recorded using 0-9 scale (Mayee and Datar, 1986) at maturity stages of the crop growth and percent disease indices at various stages were calculated. The results revealed that, out of one hundred twenty-six genotypes screened, neither of them were immune. About thirty-eight genotypes (8 testers, 2 lines and 28 hybrids) were revealed to be resistant for rust disease and seventy-one genotypes (18 testers, 1 line, 49 hybrids and 3 checks) were reflected to be moderately resistant. While, twelve genotypes (2 testers and 10 hybrids) were displaying moderately susceptible reaction. Further, five genotypes (2 testers and 3 hybrid) were fell under susceptible reaction for rust disease. Whereas, none of the genotypes were found to be highly susceptible for rust disease. The twenty-eight hybrids will be resynthesized and evaluated for yield and rust disease under sick plot for further their confirmation to rust resistance. The present investigation helped in identification of Rust resistant Hybrids for Northern Karnataka.

## DEVELOPMENT OF PEARL MILLET HYBRIDS PROMISING FOR BLAST DISEASE

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### ABSTRACT

Around 111 diseases triggered by different biotic elements have been described on pearl millet, out of these, Blast caused by *Pyricularia grisea* (teleomorph: *Magnaporthe grisea*) has emerged as serious disease affecting both forage and grain production in Pearl millet. In the present study, one hundred twenty-six Pearl millet genotypes were screened for blast resistance under field condition at Main Agricultural Research Station, Dharwad during *kharif*, 2019. These one hundred twenty-six genotypes included thirty minicore collection as restorers, three susceptible B lines, ninety experimental hybrids developed from these parents and three checks. The disease severity in the parents, hybrids and checks for blast disease was recorded using 0-9 scale (Mayee and Datar, 1986) at maturity stages of the crop growth and percent disease indices at various stages were calculated. The results revealed that, out of one hundred twenty-six genotypes screened, neither of them was immune. Only four hybrids were revealed to be resistant for blast disease and eighteen genotypes (6 testers and 12 hybrids) were reflected to be moderately resistant. While, seventy genotypes (16 testers, 52 hybrids and 2 checks) were displaying moderately susceptible reaction. Further, thirty-four genotypes (3 lines, 8 testers, 22 hybrid and 1 check) were fell under susceptible reaction for blast disease. Whereas, none of the genotypes were found to be highly susceptible for blast disease. This investigation helped in identification of Blast resistant Hybrids for commercial cultivation.

## INFLUENCE OF OSMOTIC DEHYDRATION ON DRYING OF APPLES

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### ABSTRACT

Apples have high moisture content due to which they deteriorate very quickly and there is a great need to increase their shelf life. Drying is a well-known technique used to increase the shelf life as it involves removal of moisture and lowering of water activity which readily increases shelf life by plummeting microbial activity. Drying alone resulted in poor quality of the apple so osmotic dehydration technique has been employed in combination with drying. Osmotic dehydration, also termed as “Dewatering and Impregnation Soaking Process” (DISP), is a useful technique for removal of water from the fruit by placing the fruit slices in hypertonic solution. Osmotic dehydration alone cannot help in attaining the safe storage moisture content. It should be followed by drying process in order to reduce the moisture content to the safe storage level. Generally, air drying method is employed for drying the fruit products after osmotic dehydration. For apples there is great chance for enzymatic browning and this can be prevented by employing vacuum drying method assisted by microwave heating. Microwave-vacuum drying of osmotically pre-treated apples combines the benefits of both unit operations. Selecting the conditions during osmotic treatment offers the possibility of influencing both the efficiency of microwave dehydration and the properties of the final product. High-quality products in terms of color, taste, texture and volume can be obtained. With the combined osmotic and microwave-vacuum drying, volume can be preserved by up to 60% of the fresh apples.





## **POST HARVEST HANDLING AND VALUE ADDITION OF HORTICULTURAL PRODUCE—A HELPFUL STRATEGY TO FOOD PROCESSING INDUSTRIES.**

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### **ABSTRACT**

India is among the topmost vegetable and fruit producer in the world. India's food processing sector covers fruit and vegetables. After harvest, fruits and vegetables are liable to accelerated physiological, chemical, and microbial processes that invariably lead to deterioration and loss of wholesomeness. Postharvest quality and shelf life of the fruit/vegetable in part will depend on some postharvest handling practices and treatments carried out after harvest. Handling practices like harvesting, pre-cooling, cleaning and disinfecting, sorting and grading, packaging, storing, and transportation played an important role in maintaining quality and extending shelf life. Using appropriate postharvest treatments like refrigeration, heat treatment, modified atmosphere packaging (MAP), 1-methylcyclopropene (1-MCP) and calcium chloride ( $\text{CaCl}_2$ ) application was also vital. Apart from handling of produce, value addition to food products has become necessary in order to improve the product value. It is not merely to satisfy producers and processors by way of higher monetary return but also with better taste and nutrition. The processing of the food in the forms which are preferred by the consumer, have long shelf life and involve low cost of production. Some value-added products like dehydrated carrot powder, tomato and ginger powder, tomato ketchup and sauce, fenugreek leaf powder, potato flour, potato grits, chips, granules, sweet potato powder have been prepared as per consumer taste and to reduce the post-harvest losses. It was concluded by this study that the quality of the harvested produce can be maintained and shelf life extended by using appropriate postharvest handling practices, treatment methods and value addition.

## **IMPORTANCE OF CROP BREEDING FOR RAINFED AGRICULTURE IN CHANGING CLIMATIC SCENARIO FOR GLOBAL FOOD SECURITY**

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### **ABSTRACT**

Fifty one percent of India's net sown area is rainfed and accounts nearly forty percent of the total food production. Even after achieving the full irrigation potential, around fifty percent of the area will remain rainfall dependent. Rainfed areas are highly diverse and complex. Changing climatic conditions have caused frequent drought resulting in high yield losses for many crops. Potential of rainfed areas is still underutilized and can contribute a larger share in food production. To enhance the productivity of rainfed areas most important strategy is to breed variety suitable for rainfed conditions tolerating drought. Drought is a complex trait and is under control of many genes showing different levels of expressions in variable environments. For example, Wheat (*Triticum aestivum* L.) is one of the most important staple food crops feeding the world, and has contributed immensely for global food security. A principle constraint to global wheat productivity is the recurring drought like condition with changing climate. Significant progress can be achieved in wheat productivity if classical breeding is supplemented by QTL analysis, high throughput techniques, next generation sequencing, transcriptomic, proteomic, metabolomic, and phenomic approaches along with genome engineering technologies. Dissemination of drought tolerant crops and varieties in rainfed conditions enhances the resilience of agriculture and helps farmers to cope up with the risks of extreme climatic events.

## **EFFECT OF MULCHING IN SOIL AND TUBER YIELD ON POTATO**

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### **ABSTRACT**

Mulching, which has become more popular lately, is an important way of soil protection in the plant production. Surface



mulching is one of the most cost-effective means, because of a range of positive effects on the soil fertility and other factors important for plant production. Besides, mulching massively reduces soil erosion and it may also act as a tool for the control of nitrogen losses by immobilization of post-harvest nitrate (Döring et al., 2005). Moreover mulch improves soil conditions, especially reduces water evaporation from soil and helps to maintain stable soil. Experiment was conducted in 2019-20 and 2020-21 in Randomized Block Design at Zonal Agriculture Research Station, Chhindwara. Four type of mulches i.e. Maize Straw Mulch, Polythene Mulch (25micron), Woven Mulch&Silver Mulch are used with two fertilizer level 75% & 100% RDF of NPK (RDF 120:100:100 Kg/NPK ha) in the experiment. Mulching was found significantly superior over without mulch. Use of maize straw or polythene sheet mulch between two rows of potatoes recorded highest yield of 35.3 and 34.8 tones/ha, both treatments were at par. Maize straw mulch increased 6.4 t/ha additional yield over the without mulch. Highest yield 35.8 t/ha recorded by application of 100% RDF (120:100:100 Kg/ha). It was significantly superior over application of 75% RDF (90:75:75KgNPK /ha).In case of combine effect of fertilizer and mulch, highest yield (38.9t/ha) was recorded in treatment F<sub>2</sub>M<sub>1</sub> (application of 100% RDF with maize straw Mulch)while lowest yield (26.9 t/ha) was recorded in treatment F<sub>1</sub>M<sub>0</sub> (75% RDF + without mulch).

### **PHYSICAL PROPERTIES OF LITCHI (*LITCHI CHINENSIS* SON N.)**

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#### **ABSTRACT**

Litchi is one of India's most popular fruits, with a high concentration of bioactive substances such as flavonoids, Vitamin B complex, and ascorbic acid. Litchi is a highly popular fruit in most of parts India, but there is still a lot of work to be done in the near future to commercialise litchi and litchi-based products. Litchi production scenario all over India has been outlined. Bihar is the country's biggest litchi producer, followed by Assam, Orissa, Punjab, Tripura, Uttarakhand, and West Bengal. In India, Litchi varieties such as Shahi, China, Early Bedana, Late Bedana, and Bombai were extensively employed. During the experiment, parameters were studied weight 17.18±1.52 g, length 36.6±2.17 mm, width 31.37±1.68 mm, thickness 29.84±1.55 mm, sphericity 86.62±2.33 %, Flakiness ratio 0.95±0.02, Elongation ratio 1.15±0.05, Aspect ratio 0.87±0.04, Critical projected area 800.33±80.28 mm<sup>2</sup>, geometric mean diameter 31.21±1.57mm, Arithmetic mean diameter 32.42±1.66mm, Equivalent mean diameter 31.21±1.57mm, surface area 3065.24±299.70mm<sup>2</sup>, porosity 88.94±3.55%, bulk density 53.22±1.64 g/cm<sup>3</sup>, true density 90.65± 3.61g/cm<sup>3</sup> recorded with the help of vernier caliper and weighing balance. The average pulp, peel and seeds were recorded 68.08±9.52%, 10.93±3.42% and 19.98±4.76% by manual extraction. The physical properties play very important role in the designing of harvesting, separating, sizing and grading machines. Because of the therapeutic, sensory, and nutritional properties of litchi fruit, more innovative products can be produced that keep the fruit's features and have a longer shelf life, making them more appealing to the Indian market.

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### **BIOREMEDIATION : A NOVEL APPROACH TO FRUIT AND VEGETABLE WASTE MANAGEMENT**

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#### **ABSTRACT**

Bioremediation is a general concept that includes all those processes and actions that take place in order to biotransform an environment, already altered by contaminants, to its original status. In the past few years, there has been a tremendous increase in food waste generation due to rapid urbanization and industrialization. Fruit and vegetable wastes (FVW) are produced in large quantities in markets and constitute a source of nuisance in municipal landfills because of their high biodegradability. These food wastages have put an emphasis to employ novel techniques for management of waste generated so that waste generation could be reduced to a minimum or these wastes could be converted into some valuable products. Food waste consists of high levels of sodium and moisture and is usually mixed with other types of waste during its collection. The easily biodegradable organic matter content of FVW (75%) with high moisture facilitates their biological treatment and shows the



trend of these wastes for anaerobic digestion. Novel methods (bioremediation, biogas production, distillation, ozonation and electrolysis) appear to be promising and attractive alternatives, handicaps like high cost, requirements for trained personnel and high capital investment are still holding them back from widespread application in the vegetable waste industry. Use of microorganism for remediation of pollutants is environment-friendly, cheap, less hazardous and less laborious. This process of remediation of toxic organic compounds by exploiting effective microbial strains in contaminated sites is known as bioremediation. Bioremediating methods transform the contaminants into substances that can be absorbed and used by the autotrophic organisms with no toxic effect on them.

## **GENOME EDITING TECHNOLOGIES FOR CROP IMPROVEMENT**

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### **ABSTRACT**

Genome-editing systems enable the scientists to modify the genomes very rapidly and precisely and making possible to introduce targeted traits. The availability of natural allelic variability in the existing gene pool is the limiting factor to introduce the target traits into elite varieties hence, limiting the crop improvement through the conventional breeding techniques. Random mutagenesis technique can be used to induce the variability in the existing germplasm but, it is an imprecise and unpredictable method. Huge number of population must be screened in order to identify the target traits. Now a days a number of genome editing tools have been identified which allows the plant breeder to rapidly modify plant genome in a precise and predictable way. These genome-editing systems generate targeted DNA double-strand breaks (DSBs) in the genome which are primarily repaired by either the non-homologous end-joining (NHEJ) pathway or the homology-directed repair (HDR) pathway. These genome-editing technologies mainly includes, zinc finger nucleases (ZFNs), transcription activator-like effector nucleases (TALENs) and type II clustered regularly interspaced short palindromic repeat (CRISPR)/CRISPR-associated protein (Cas). Among all the genome editing techniques CRISPR/Cas9 became one of the powerful tools to modify plant genomes in a precise, rapid and predictable way. CRISPR/Cas9-based genome editing has been utilized so far in cases of biotic and abiotic stresses like disease, drought and salinity. The most frequent application is gene knockouts achieved by the introduction of indels which is resulted in frame-shift mutations or by introducing premature stop codons. This technology has been utilized in many crops such as rice, maize, wheat, soybean, barley, sorghum, potato, tomato, flax, rapeseed, *Camelina*, cotton, cucumber, lettuce, grapes, grapefruit, apple, oranges, and watermelon.

## **INFLUENCE OF UREA AND NANO N FERTILIZER ON GROWTH AND YIELD OF FINGER MILLET VAR. GPU 28 UNDER DRYLAND CONDITION**

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### **ABSTRACT**

Nitrogen fertilizers play an important role in the cultivation of Fingermillet. Excessive and improper usage of Nitrogen fertilizer causes problems on human and environment. It is essential for a suitable alternative source of Nitrogen with reduced harm on environment. Nano nitrogen fertilizers are alternative to conventional fertilizers with slow and control release of nitrogen. An experiment was conducted at the AICRP during Kharif 2020 involving the use of NPK fertilizers and Nano-Nitrogen fertilizer to test the growth attributes and yield of fingermillet Var. GPU 28. The experiment was laid out in the Randomized Complete Block Design with nine treatments and three replications. The results revealed that there were significant ( $p < 0.05$ ) differences between treatments in the tested parameters. The application of 75 percent recommended urea + 0.8% nano nitrogen fertilizer along with 7.5 t/ha of FYM has given the highest growth and yield performance with regard to plant height at 90 DAS (97.40cm), number of tillers per hill at 90 DAS (5.21), length of ear head at 90 DAS (7.93 cm) dry weight per plant (27.27g), grain yield (3088kg/ha) and straw yield (3459 kg/ha). Based on the present findings it could be concluded that replacing 25 percent urea with nano nitrogen fertilizer increases the growth and yield of finger millet. The application of Nano-N fertilizer can reduce harmful effects of nitrogen to the environment by reducing harmful nitrogen inputs.



## RELATIVE SUSCEPTIBILITY OF DIFFERENT WHEAT GENOTYPES TO THE INFESTATION OF LESSER GRAIN BORER, (*RHYZOPERTHA DOMINICA*)

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### ABSTRACT

The susceptibility of five wheat genotypes of two different species namely *Triticum aestivum* (namely, HD 2967, WB 2, HD 3086, HPBW 1) and *T. durum* (WHD 948) to the lesser grain borer (*Rhyzopertha dominica*, F) was studied against the lesser grain borer (*Rhyzopertha dominica*, F) by No Choice Test Method under laboratory condition ( $28 \pm 2^\circ$  and  $65 \pm 5\%$  RH). The present investigations were conducted at Storage Entomology Laboratory, Department of Entomology, Chaudhary Charan Singh Haryana Agricultural University, Hisar during 2018-20. The susceptibility was assessed based on median development period, number of F1 progeny emerged, the weight loss of infested samples and also the Dobie's Index of susceptibility. The results revealed that the highest index of susceptibility was found in genotype HD 2967 followed by WHD 948, HD 3086, WB 2 and HPBW 1. The number of F1 progeny emerged and weight loss of infested samples were significantly high whereas median development period of insects was low in HD 2967 genotype followed by WHD 948 that were regarded as highly susceptible. In genotype HD 3086, WB 2 and HPBW 1 median developmental period was high and F1 adult emergence was low therefore the susceptibility was low and genotypes were categorized as susceptible. These results imply that the wheat genotypes with low moisture content and high hardness potential had lower susceptibility to the *R. dominica* infestation.

## ROLE OF GENOME EDITING FOR CROP IMPROVEMENT

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### ABSTRACT

To achieve global food security, rising agricultural productivity through modern breeding strategies is of prime interest. A variety of biotic and abiotic stresses influences both productivity and crop quality, and it is essential for growing crops with improved adaptability, high productivity and resistance to these biotic/abiotic stresses. Availability of genome sequences helps to improve crop production by using different biotechnological tools. It is a genome editing method that can be accomplished for successful and efficient selective modification of an organism by using modern biotechnology techniques. Plant scientists to manipulate targeted genes in crop plants by utilizing genome editing tools, like transcription activator-like effector nucleases (TALENs), zinc finger nucleases (ZFNs), and CRISPR/Cas9. Genome-editing methods have been used to classify gene functions and boost agricultural characteristics in a wide range of plant species. Reflecting its broad importance, genome editing with engineered nucleases was named "Method of the Year" for 2011 by Nature Methods. So, the use of genome-edited tools is fast and precise in crop improvement thus provides a new direction to the advanced breeding program.

## PHYSIOLOGICAL AND BIOCHEMICAL CHANGES DURING HIGH TEMPERATURE STRESS IN PLANTS

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### ABSTRACT

Abiotic stress cause changes in soil-plant-atmosphere continuum which is responsible for reduced yield in several of the major crops in different parts of the world. Global warming is predicted to have a general negative effect on plant growth due to the damaging effect of high temperatures on plant development. The increasing threat of climatological extremes including very high temperatures might lead to catastrophic loss of crop productivity and result in widespread famine. High temperature stress has a wide range of effects on plants in terms of physiology, biochemistry and gene regulation pathways. Heat stress affects plant growth throughout its ontogeny, though heat-threshold level varies considerably at different developmental stages. For instance, during seed germination, high temperature may slow down or totally inhibit germination, depending on plant species and the intensity of the stress. At later stages, high temperature may adversely affect photosynthesis, respiration,





water relations and membrane stability, and also modulate levels of hormones and primary and secondary metabolites. Plants possess a number of adaptive, avoidance, or acclimation mechanisms to cope with high temperature situations. In addition, major tolerance mechanisms that employ proteins, osmo-protectants, antioxidants, and other factors involved in signaling cascades and transcriptional control are activated to offset stress-induced biochemical and physiological alterations. The adverse effects of heat stress can be mitigated by developing crop plants with improved thermo-tolerance using various genetic approaches. For this purpose, however, a thorough understanding of physiological responses of plants to high temperature, mechanisms of heat tolerance and possible strategies for improving crop thermo-tolerance is imperative.

### **INDUCED MUTAGENESIS IN TAG-24 CULTIVAR OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)**

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#### **ABSTRACT**

Groundnut or peanut is one among the five extensively grown oil crops of India. where it is grown and utilized for extracting cooking oil, and also for confectionary under rain fed condition. Which has been exposed extensively to mutagenic treatments for induction of variability. The present research was aimed towards yield improvement in TAG-24 groundnut cultivars through induced mutagenesis using EMS and gamma rays to study their effects on various morphological traits when compared with control. The seeds of groundnut were pre-soaked in distilled water for 6 hours for ems and 24 hrs for EMS. The EMS solution was prepared in distilled water. These soaked seeds treated with different concentration of EMS such as 0.05%, 0.1%, 0.2 % and irradiated by Gamma Rays with 20kR, 30kR and 40Kr. The observations were made on seed germination, plant height, number of branches, number of leaves per plant and plant survival (%) after treating seeds with different mutagens. Observed findings showed significant results in seed germination, plant height, number of branches and number of leaves per plant and plant survival (%) after treating seeds with different mutagens.

### **INDUCED MUTATION IN TAG-24 CULTIVAR OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR OLIGOGENIC TRAITS**

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#### **ABSTRACT**

Groundnut or peanut is one among the five extensively grown oil crops of India, where it is grown and utilized for extracting cooking oil, and also for confectionary under rain fed condition. Induced qualitative mutation in TAG-24 groundnut cultivar consisted of chlorophyll and viable mutants. The combination treatments exhibit wide spectrum and frequency on both M1 family and M2 Plant basis for both. Increased in doses and concentrations of mutagens showed increased in spectrum and frequency. Chlorophyll mutants viz. albino, albo-viridis, xantha, xantha- viridis and viridis and viable mutants viz; plant type, leaf, growth habit, flowering, pod, kernel and economic mutation were observed. Desirable mutants like bold poded, early maturing, high yielding were also isolated.

### **EFFECT OF SALICYLIC ACID AND NUTRIENTS ON CROSSLAND GROWTH AND YIELD OF INDIAN MUSTARD (*BRASSICA JUNCEA* L.)**

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#### **ABSTRACT**

A field experiment was conducted on loamy sand soil at CCS Haryana Agricultural University, Hisar over a period of two consecutive years during Rabi season (2018-19 and 2019-20). Results showed that salicylic acid applied as 200 ppm foliar spray at flower initiation and full bloom stage (F<sub>3</sub>) recorded the maximum values of plant height 60 DAS, dry matter accumulation 30 DAS, number of branches, seed, stover and biological yield proved significantly superior over all other treatments. However, the treatment application of 200 ppm salicylic acid at flower initiation remained equally effective with regard to above parameters. Further, Results showed that application of treatment 1/3 each through FYM, vermicompost and



biogas slurry (N<sub>5</sub>) proved significantly superior over all other treatments with respect to Plant height 60 DAS, dry matter accumulation 30 DAS, dry matter partitioning 30 DAS, number of branches, seed, stover and biological yields.

## **SEED TREATMENT: A SEED VACCINATING PROGRAMME FOR MANAGING CROPS**

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### **ABSTRACT**

Human ballooning population has put tremendous pressure on food production. Diseases and pests affecting crops can have devastating consequences in crop production if not properly managed. Breeding is an excellent tool to build resistances against pests and diseases in pulse crops. However, breeding alone does not address all of the agronomic challenges; therefore crop protection products are often needed and used for good crop management. Applying the products directly to the seed is substantially more efficient and effective than broadcast crop protection methods. Seed treatments, in broad terms, are the application of biological, physical and chemical agents and techniques to seed that provide protection to seeds and plants and improve crop safety which in turn leads to good establishment of healthy and vigorous plants which results in better yields. It is estimated that 80% of the seeds sown in our country is untreated as against 100% seed treatment practice in developed countries. Seeds saved by farmers may be infected with microbes that can induce diseases on the seedling and the crop. This can affect seed germination and may be transmitted from seed to seedling to plant. Seed treatment prevents and controls seed-, soil-, and air-borne diseases. It improves germination, substantially vigor, and productivity. Seed treatment is probably the cheapest and often the safest method of direct plant disease control.

## **THE MATHEMATICS BEHIND NATURE'S PATTERNS**

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### **ABSTRACT**

Many Patterns and occurrence exist in nature in our world. In our life mathematics helps make sense of their patterns and occurrences. Patterns in nature are visible regularities of form found in the natural world and can also be seen in the universe. Nature patterns are not just be admired; they are vital clues to the rules that govern natural processes. Pattern can be seen in fish, patterns like spotted trunkfish, spotted pufferfish, blue spotted string ray, spotted moray eel angel fish and yellow box fish. These animals and fish stripes and spots attest to mathematical regularities in biological growth and form. Zebras, tigers, cats and snakes are covered in pattern of spots and giraffes are covered in blotches. Natural patterns like the intricate waves across the oceans; sand dunes on deserts; formation of typhoon; water drop with ripples and others. These serve as clues to the rules that govern the flow of water, sand and air. The natural world and creating a routine looks for math's in every day places, thus to find patterns in nature.

## **GENETIC IMPROVEMENT OF BANANA USING CONVENTIONAL AND BIOTECHNOLOGICAL APPROACH**

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### **ABSTRACT**

Banana (*Musa* spp.) is an important nutrient-rich fruit crop cultivated in the tropics and sub-tropics for local consumption and export. It is the second most important fruit crop in India next to mango. Its year-round availability, affordability, varietal range, taste, nutritive and medicinal value makes it the favourite fruit among all classes of people. It has also good export



potential. Targets for genetic improvement of banana range from improved fruit quality, yield, disease resistance, tolerance to biotic and abiotic stresses, and the biosynthesis of pharmaceutical compounds. Among banana improvement programs objectives are achieving cultivars resistant to abiotic stressors, such as salinity and drought. Another major challenge for the global production of Musaceae species is the development of cultivars resistant to biotic stressors, represented by their primary pests, the banana root borer and the nematodes *Meloidogyne* spp. and disease-causing pathogens, including banana bunchy top virus (BBTV). In vitro techniques have been applied to banana, including embryo rescue, with shoot regeneration from cultured tissues by organogenesis and somatic embryogenesis as a basis for micropropagation, exposure of somaclonal variation, and gene transfer by somatic hybridization and transformation. Radiation induced mutations in combination with tissue culture can improve the yield, quality and disease resistance of established cultivars, and would result in an increased and sustainable production. The technology for multiplication of banana plantlets through micropropagation and other related in vitro culture techniques including in vitro selection for disease resistance is well developed. In addition, molecular techniques can be used to obtain precise information on the genes involved in the traits under selection. Molecular characterization of germplasm will facilitate the selection of material most relevant for incorporation into sexual and somatic genetic-improvement programs. New innovative breeding approaches combined with advances in plant biotechnology offer really new dimensions to banana improvement.

## **CRISPR/CAS9 : TOOL TO REWRITE PLANT'S VIRAL RESISTANCE**

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### **ABSTRACT**

The global population is exploding at an alarming rate that is expected to reach 10 billion in the coming 30 years. Alongside, in this era of climate change, rising sea levels due to rising global temperatures exacerbating the scarcity of arable land. Besides, biotic stresses became an imperative threat causing 20–50 % yield losses. Among those, phytopathogenic viruses alone are estimated to cause a 10–15 % reduction in global crop yields each year. Notable is, along with direct losses, indirect losses stemming from increased susceptibility of virus-infected plants to other pathogens as well as abiotic stress factors are also very substantial. But, this farmer's foe cannot be directly controlled by a chemical application having no antiviral compounds available. The entire above mentioned are menacing to global food security. In this urge, resistance breeding provides a durable and cheaper solution through CRISPR/Cas9 system which is a new weapon in the arsenal of genome editing tools to develop virus-resistant plants with the advantage of ease over other genome editing tools. CRISPR is a naturally occurring defense system in prokaryotic organisms that provides resistance to foreign genetic elements such as bacteriophages. While in plants, this system favours targeted DNA mutagenesis in a precise manner using Cas9 nucleases and guide RNA which is a pre-designed sequence according to our gene of interest in which we want to make a change. By that, the introduced trait is stably heritable mediating the expression of sgRNAs and providing disease resistance. Thus, this system could be a feasible option to introduce multiple traits into crops with a low risk of segregation, which is difficult to achieve by classical breeding or even conventional genetic engineering.

## **IMPACT OF GOOGLE MEET TECHNOLOGY ADOPTION DURING CORONA VIRUS PANDEMIC -COVID-19**

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### **ABSTRACT**

This study seeks to explore the effect of fear emotion on students' and teachers' technology adoption during COVID-19 pandemic. The study has made use of Google Meet as an educational social platform in private higher education institutes. The data obtained from the study were analyzed by using the partial least squares structural equation modeling (PLS-SEM) and machine learning algorithms. The main hypotheses of this study are related to the effect of COVID-19 on the adoption of Google Meet as COVID-19 rise s various types of fear. During the Corona virus pandemic, fear due to family lockdown situation, fear of education failure and fear of losing social relationships are the most common types of threat that may face



students and teachers/educators. These types of fears are connected with two important factors within TAM theory, which are perceived ease of use and perceived usefulness with another external factor of TAM, which is subjective norm (SN). The results revealed that both data analysis techniques have successfully provided support to all the hypothesized relationships of the research model. More interesting, the J48 classifier has performed better than the other classifiers in predicting the dependent variable in most cases.

## IMPACT OF MOISTURE CONSERVATION PRACTICES AND PREPARATORY TILLAGE ON BARLEY PRODUCTION UNDER WATER STRESS CONDITION

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### ABSTRACT

A field experiment was conducted during two consecutive year (*rabi season*) 2017-18 & 2018-19 at Soil Conservation and Water Management Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur to adjudge “Impact of moisture conservation practices and preparatory tillage on barley production under water stress condition” on gangatic alluvial soil having 7.6 Ph, light textured soil with medium soil fertility. Treatments comprises of Viz: Preparatory tillage 1)  $T_1$  - One cross ploughing with cultivator, 2)  $T_2$  - One ploughing with disc harrow + one cross ploughing with cultivator and 3)  $T_3$  - One ploughing with disc harrow + one pass with rotavator, three nutrient management practices i.e.  $N_1$  100% RDF (60 Kg N  $ha^{-1}$  + 30 Kg  $P_2O_5$   $ha^{-1}$  + 30 Kg  $K_2O$   $ha^{-1}$ ) through chemical fertilizer,  $N_2$  75% RDF (through chemical fertilizer) + 25% FYM (Farm yard manure) and  $N_3$  50% RDF (through chemical fertilizer) + 50% FYM (Farm yard manure) and three moisture conservation practices Viz: 1)  $M_1$  Control, 2)  $M_2$  Dust mulch and 3)  $M_3$  Pinoxaden 5.1 EC @ 50 g a.i  $ha^{-1}$  + VAM @ 15 Kg  $ha^{-1}$ . It is clear from the results of two-year experimentation that sowing of barley crop in plots where one ploughing was done with disc harrow + one pass with rotavator, application of 50% RDF through chemical fertilizer + 50% FYM and moisture conservation practices of Pinoxaden 5EC @ 50 g/ha. + VAM @ 15 Kg/ha brought out the maximum values of growth parameters, yields q/ha (grain, straw and biological) harvest index as well as gross return, net return and b:c ratio of barley in both the years respectively followed by One cross ploughing with cultivator, 100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha) and moisture conservation practices of dust mulch.

## EFFECT OF GYPSUM AND ORGANIC AMENDMENTS FOR RECLAMATION OF SODIC SOIL AND PERFORMANCE OF RICE CROP (*ORYZA SATIVA* L.)

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### ABSTRACT

The experiment was conducted at MES Farm of Narendra Deva University of Agriculture and Technology, Faizabad (UP) during *kharif* 2012 and 2013. The experiments were laid out in randomized block design with twelve treatments ( $T_1$  - control;  $T_2$  - Control + Dhaincha;  $T_3$  - Control + FYM @ 15 t. $ha^{-1}$ ;  $T_4$  - Control + Pressmud @ 10 t. $ha^{-1}$ ;  $T_5$  - 75 % GR Value;  $T_6$  - 75 % GR Value + Dhaincha;  $T_7$  - 75 % GR Value + FYM @ 15 t. $ha^{-1}$ ;  $T_8$  - 75 % GR Value + Pressmud @ 10 t. $ha^{-1}$ ;  $T_9$  - 100 % GR Value;  $T_{10}$  - 100 % GR Value + Dhaincha;  $T_{11}$  - 100 % GR Value + FYM @ 15 t. $ha^{-1}$ ;  $T_{12}$  - 100 % GR Value + Press mud @ 10 t. $ha^{-1}$  and three replications. Combined application of gypsum (100% and 75% GR value) along with organic amendments (FYM, press mud and Dhaincha) were playing a maximum improvement of soil properties. During study, the maximum periodic changes in chemical properties of soil from surface to 90 cm soil depths and the decreasing trend with increasing soil depths (surface to 90 cm) and time (starting to 135 days) in all the treatments there was no change in soil properties at any soil depth from 135 to 180 days after gypsum application a sharp decreased was found in pH (from 10.94 to 10.40), EC (from 3.78 to 2.30  $dSm^{-1}$ ), CEC (from 23.46 to 17.46 me/100 g), exchangeable sodium (from 15.40 to 11.92 me/100 g), sodium adsorption ratio (from 78.41 to 67.58), soluble sulphate (from 108.46 to 40.16 me/l), soluble chloride (from 29.16 to 18.76 me/l), soluble carbonate (from 8.32 to 6.22 me/l) and soluble bicarbonate (from 6.82 to 4.72 me/l) hence, while exchangeable sodium percentage (from 65.64 to 68.27) increased with increasing soil depth. However, In rice crop the maximum grain (495.75 & 517.19 kg  $ha^{-1}$ ) and straw yield (763.45 & 801.64 kg  $ha^{-1}$ ), respectively were recorded by applying 100 GR value @ FYM 15 t.  $ha^{-1}$  ( $T_{11}$ ) in both the years.





## HARDENING BASED SKILL AND ENTREPRENEURSHIP PROGRAM FOR RURAL YOUTH OF VIDARBHA REGION

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### ABSTRACT

Skill training of rural youth is aimed at imparting skill-based training on areas in Agriculture & allied areas to promote employment of rural areas and for creation of skilled manpower to perform farm operations. In India major population is still living below poverty line especially rural population. It is important to meet the challenges and prepare rural youth with the proper education and skills they need. Plant tissue culture is an emerging field of biotechnology. Tissue culture as a propagation technique provides a robust means to prepare disease-free planting materials that can provide the first line of defense in developing an integrated disease-management program for banana. Vidarbha region of Maharashtra remained backward industrially as well as agriculturally. 65% of the rural population of the region comprising of eleven districts is dependent on agriculture and allied activities. The entire Indian production is mainly contributed through small farming system. Tissue cultured banana plantlets, acquire several pathogenic bacteria during secondary hardening procedures. Thus teaching useful practical procedures for hardening of banana plantlets for successful field establishment is useful to growers and technicians who are involved in the process of handling and hardening of banana plantlets. Banana farmers should establish a banana tissue-culture facility in-farm to ensure availability of disease-free seedlings. In order to feed the burgeoning growth of population the concept of entrepreneurship must be developed in the mindsets of our farmers. Agriculture must be considered as an enterprise and farmers should be developed as an entrepreneur. In order to popularize the concept of entrepreneurship development in the mindset of our farmers/rural youth, implementing training programs is utmost necessary.

## GENETIC ARCHITECTURE AND STABILITY ANALYSIS FOR GRAIN YIELD AND ITS CONTRIBUTING CHARACTERS IN BARLEY [*HORDEUM VULGARE* (L.)]

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### ABSTRACT

The present experiment was undertaken to study the Genetic Architecture and Stability Analysis for Grain Yield and its Contributing Characters in Barley [*Hordeumvulgare* (L.)] in under three environments. Eight genetically different parents namely BH902, RD2904, RD2909, HUB242, UPB1059, DWR143, DWR137 and BH902 were considered diallel fashion excluding reciprocals during 2015-16. All the eight parents and F's were evaluated in a randomized block design with 3 replications under three different environments created by three different dates of sowing (15 November, 30 November and 15 December) during Rabi 2016-17. The observations were recorded for days to 50% flowering, days to maturity, Plant height (cm), No. of effective tillers per plant, Flag leaf area (cm<sup>2</sup>), peduncle length (cm), spike length (cm), number of spikelets per spike, number of grains per spike, 1000-grains weight (g), harvest index (%) and grain yield per plant (g).

Significant differences among the parents on pooled basis as well as individual environment combining ability analysis indicated that GCA variances were significant on pooled as well as individual environmental basis for all the characters GCA X Environment were significant for all the attributes in all the environments.

Based on per se performance and GCA effects the parent RD2909, DWR143 and DWR137 in E1, DWR137, RD2909 and DWR143 in E2 while the parent DWR43, DWR143 and RD2909 in E3 environment presence of sufficient genetic variability. Significance of GCA for all the characters except GCA for number of tillers per plant in F2 (E3) and SCA for number of tillers per plant in F1 (E1 and E2) and spike area in F2 (E1 and E2) indicated the importance of both type of gene action.

Based on heterosis, heterobeltiosis, SCA effects and per se performance the crosses combinations namely RD2904 x DWR143 in E1; BH902 x 2909, BH902 x DWR137, RD2904 x RD2909 and RD2904 x DWR and HUB242 x UPB1059 in E2, BH902 x 2904, BH902 x DWR 137, RD2904 x RD 2909 and RD2904 x DWR143 in E3 were good specific cross combinations for grain yield per plant. These crosses were the results of good x good, poor x poor and good x poor general combiners. These crosses hold great promise in improving the grain yield in future breeding programme of barley.



The stability analysis also exhibited significant differences among the genotypes for all the traits. The mean sum of squares due to genotypes and environments were found to be significant for all the characters, indicating differential effect of environment on the genotypes. The mean sum of squares due to  $G \times E$  interaction was found significant for all the studied characters except spike length and biological yield per plant. The mean sum of squares due to  $E + (G \times E)$  and  $G \times E$  (linear) were also found significantly for all the characters. Mean squares due to  $E$  (linear) were found significant (except number of spikelets per spike and harvest index) for all the characters, revealed that environment differ from each other which satisfied the basic requirement of stability analysis.

Joint consideration of mean performance and stability parameters indicated that genotypes viz., BH902 x DWR143, RD2904 x RD2909 and RD2904 x DWR137 were suitable for variable environmental conditions; while the DWR143 x DWR137 genotypes were suitable for better environments conditions. Above average stability were depicted by BH902 x RD2904, RD2909 x DWR137 and HUB242 x DWR137 which has higher mean yield, hence these were desirable for poor environmental conditions.

Conclusively, it has been suggested that diallel selective mating, bi-parental mating and multiple cross could be use full breeding approached for developing of heat tolerant genotypes and further amelioration of grain yield can be achieved in Barley.

## **ROLE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE FOR IRRIGATION AND PESTICIDES AND HERBICIDES APPLICATION**

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### **ABSTRACT**

Agriculture plays a significant role in the economic sector. The automation in agriculture is the main concern and the emerging subject across the world. The population is increasing tremendously and with this increase the demand of food and employment is also increasing. The traditional methods which were used by the farmers, were not sufficient enough to fulfill these requirements. Thus, new automated methods were introduced. These new methods satisfied the food requirements and also provided employment opportunities to billions of people. Artificial Intelligence in agriculture has brought an agriculture revolution. This technology has protected the crop yield from various factors like the climate changes, population growth, employment issues and the food security problems. This main concern of this paper is to audit the various applications of Artificial intelligence in agriculture such as for irrigation, weeding, spraying with the help of sensors and other means embedded in robots and drones. These technologies saves the excess use of water, pesticides, herbicides, maintains the fertility of the soil, also helps in the efficient use of man power and elevate the productivity and improve the quality. This study surveys the work of many researchers to get a brief overview about the current implementation of automation in agriculture, the weeding systems through the robots and drones. The various soil water sensing methods are discussed along with two automated weeding techniques.

## **MOLECULAR APPROACHES FOR PLANT DISEASE RESISTANCE**

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### **ABSTRACT**

Plant diseases are major potential threat to the cultivation of crops by reducing yield and economy. Application of fungicides against plant pathogens can provide adequate control but their use increases production costs and not ecofriendly to the environment. Development of disease resistant varieties is the primary and most important step in disease control. These varieties protect the plants from disease causing organism based on plant's immune system which, produce preformed toxins by infecting immune cells of pathogens. Study on evolution of pathogen, identification of genetic basis of disease resistance and deployment of genes conferring durable resistance are important strategies in protecting crop plants against pathogens. Studies on pathogen variation and epidemiology are integral in characterizing and manipulating the evolution of different types of resistance genes. Breeding for resistance is considered as the most effective and efficient control strategy, as



it does not add up input costs and is environmentally safe. Molecular approaches have been found to be more result oriented involving less time and efforts in identification, isolation, cloning and transfer of disease resistance genes across genera and species. Various molecular techniques are providing the tools to characterize all stages of the interaction between plants and potential pathogens from the earliest recognition to the changes that occur during resistant and susceptible responses. The mechanism of determining specificity and generating variation at resistance loci is good to generate new specificities by using microbial selection systems. Disease resistance strategies utilizing classical resistance genes will complement the use of novel transgenes. Resistance generated using novel transgenes and Marker-aided selection (MAS) is potentially useful for breeding for disease resistance. The advent of numerous molecular markers throughout the genome provides the opportunity to analyze the Mendelian factors determining quantitative traits (Quantitative Trait Loci, QTL). Molecular geneticists are now focusing more on mapping and tagging of disease resistance genes. Gene tagging is a prerequisite for marker assisted selection and map-based gene cloning. Also, cloned resistance genes will be used for novel transgenic approaches. In the long term, we can anticipate generating new resistance specificities *in vitro* or in microorganisms to increase the efficiency of selecting rare recombinant sequences.

## EFFECTIVENESS OF QIIME TOOL FOR DETECTION OF GENETIC VARIATION AMONG FRESHWATER MICROBIOME POPULATION

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### ABSTRACT

The present investigation entitled “Comparative meta genomic analysis of freshwater microbiome using Bioinformatics Quantitative Insights into Microbial Ecology (QIIME) Pipeline tools” was carried out with the objective to assess genetic variations of microbial population in contaminating water of River Ganga. This study was conducted during the year 2019-20 using next generation sequencing (NGS) plat forms of Bioinformatics tools. The material consists of raw sequences which were already available through SRA database was used in the study. River Ganges experiences an array of anthropogenic pressure due to sewage and industrial discharge, mass bathing etc. It presents the impact of spatial divergence on the bacterial community structure and composition. Viral and bacterial communities are important for ecosystem function as they are involved in critical biogeochemical cycles and controlling host abundance. This study investigates riverine communities around a rural town that influences local water inputs. River confluences are interesting ecosystems to investigate for their microbial community structure and functional potentials. River Ganges is one of the most important and holy rivers of India with great mythological history and religious significance. The Yamuna River meets Ganges at the Prayagraj (formerly known as Allahabad), India to form a unique confluence. The influence of Yamuna River on taxonomic and functional aspects of microbiome at this confluence and its downstream remains unexplored. Results revealed differences in the relative abundance of bacterial and archaeal communities across the confluence. Grouped by the confluence, a higher abundance of Proteobacteria and lower abundance of Bacteroidetes and Firmicutes was observed. This study shows the microbial community variations found in river water effectively by using QIIME bioinformatical tool.

## MUTAGENIC EFFECTIVENESS AND EFFICIENCY OF GAMMA RAYS WITH PHENOTYPING OF INDUCED MUTATIONS IN LATHYRUS (*LATHYRUS SATIVUS* L.)

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### ABSTRACT

An experiment on induction of mutation in lathyrus by gamma rays was conducted by using treated seeds of lathyrus cv. NLK-73 with 150, 200, 250, 300 and 350 Gy doses of gamma rays in non-replicated trial along with control. The treated material along with untreated control were sown in M1 generation and the seeds collected from individual plant of M1 generation were used to raise M2 generation during *rabi* 2017 and 2018 respectively. Fifteen different types of morphological mutants *viz.*, chlorophyll, early flowering, tall, broad leaves, profuse branches, more pods, flower colour, purple colour leaf, narrow leaves, more pods and tall, broad leaves and tall, broad leaves and profuse branches, profuse branches and tall, profuse branches and more pods, high yield and more pods were identified and isolated. Mutation frequency and mutagenic efficiency increased with increase in dose upto 250 Gy and 200 Gy respectively, later on both decreased with increase in dose of gamma



rays. Mutagenic effectiveness decreased with the increase in doses of gamma rays. Significant variation among the treatments for all the mutants were recorded in M2 generation of Lathyrus and hence, offers scope for identifying mutants.

## **IMPACT OF AEROBIC RICE – FILED BEAN CROPPING SEQUENCE ON NITROGEN BALANCE IN THE SOIL AS INFLUENCED BY FARMYARD MANURE AND BIO-DIGESTER LIQUID MANURE**

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### **ABSTRACT**

Field experiments were conducted for two years consecutively at Zonal Agricultural Research Station, Mandya to study the effect of farmyard manure and bio-digester liquid manure on the performance of aerobic rice – field bean cropping sequence. Soil of the experimental site was red sandy loam in texture, low in organic carbon (0.38 %) and available nitrogen (215 kg ha<sup>-1</sup>), medium in available P<sub>2</sub>O<sub>5</sub> (26 kg ha<sup>-1</sup>) and K<sub>2</sub>O (162 kg ha<sup>-1</sup>). Nutrient balance in soil is an indicator of sustainable soil fertility management. After the harvest of second season aerobic rice, there was a positive balance of nitrogen in the soil. However, maximum net gain of available nitrogen (71 kg ha<sup>-1</sup>) was found with University recommended practice (FYM 10 t + 100:50:50 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg ha<sup>-1</sup>). Whereas, least variation (0.8 kg ha<sup>-1</sup>) between expected and actual balance was noticed with FYM 7.5 t + bio-digester liquid manure equivalent (BDLME) to 125 kg N ha<sup>-1</sup>. Further, after second season field bean grown in sequence with aerobic rice, the experimental soil resulted in net gain of available nitrogen. However, maximum net gain of available nitrogen (38 kg ha<sup>-1</sup>) was found with FYM 7.5 t + BDLME to 30 kg N ha<sup>-1</sup> closely followed by FYM 5 t + BDLME to 30 kg N ha<sup>-1</sup> (36 kg ha<sup>-1</sup>). The positive balance of nitrogen after field bean harvest might be due to legume effect, as legumes are known to add significant amount of organic matter to soil through leaf drop and root biomass besides, symbiotically fixed nitrogen.

## **EFFECT OF FARMYARD MANURE AND BIO-DIGESTER LIQUID MANURE ON SOIL POTASSIUM BALANCE UNDER AEROBIC RICE – FILED BEAN CROPPING SEQUENCE**

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### **ABSTRACT**

Field experiments were conducted for two years at Zonal Agricultural Research Station, Mandya to study the effect of various levels of farmyard manure and bio-digester liquid manure on soil potassium balance under aerobic rice – field bean cropping sequence. Soil was red sandy loam in texture, low in organic carbon (0.38 %) and available nitrogen (215 kg ha<sup>-1</sup>), medium in available P<sub>2</sub>O<sub>5</sub> (26 kg ha<sup>-1</sup>) and K<sub>2</sub>O (162 kg ha<sup>-1</sup>). The maximum net gain of K<sub>2</sub>O (27 kg ha<sup>-1</sup>) was noticed with University recommended practice (FYM 10 t + 100:50:50 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg ha<sup>-1</sup>) and maximum net loss (20 kg ha<sup>-1</sup>) with FYM 10 t + bio-digester liquid manure equivalent (BDLME) to 150 kg N ha<sup>-1</sup>. Further, least difference between expected and actual balance (0.1 kg ha<sup>-1</sup>) was with FYM 7.5 t + BDLME to 75 kg N ha<sup>-1</sup> after harvest of second season aerobic rice. The positive balance in soil might be ascribed as the fixed potassium might have been made available by legume crop in the sequence and enriched the soil. Similarly, after harvest of second season field bean maximum net gain of available potassium (60 kg ha<sup>-1</sup>) was observed with 7.5 t FYM + BDLME to 30 kg N ha<sup>-1</sup> and 10 t FYM + BDLME to 30 kg N ha<sup>-1</sup> treatments. Further, least variation (10 kg ha<sup>-1</sup>) between expected and actual balance was found with absolute control.

## **INDIGENOUS PRACTICES WITH SCIENTIFIC KNOWLEDGE FOR PROFITABLE AGRICULTURE**

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### **ABSTRACT**

India is one of the fastest growing economies in the world. India has great diversity in terms of geography, economy and culture. Agriculture is the backbone of Indian economy. Agriculture and allied sector contributed 19.9 percent to Indian GDP





in 2019-20 and around 58 per cent population livelihood depends on agriculture. In this era of pandemic, growth of every sector touched negative but only agriculture sector had positive growth rate in 2020-21 *i.e.* 3.4 per cent. Indian farmers have immense potential but there is lacuna in scientific knowledge. Combining indigenous and traditional technical practices with scientific comprehension and problem-solving policies grip led to economical and profitable agriculture. Profitable agriculture needs very low investment. It was exhibited from the results of a research in Punjab that indigenous knowledge of cropping system with modern practices increased productivity of land and economic status of farmers significantly. It was found in a study conducted at Meghalaya that farmers have better knowledge of nutrients uptake and soil classification due to continuous field experience and native awareness. Farmers' technical know-how and researcher scientific understanding brought innovation and profitability in agriculture to another level revealed in an investigation done by ICAR research complex for North-Eastern Hill region. Better agricultural policies to farmers boosted the agriculture production economically. Nevertheless, efficient marketing and farmers supporting policies like minimum support price, climate smart agri-technologies and stable farm export policies are must required in present scenario as reported by Rani Lakshmi Bai Central Agricultural University, Jhansi. A study conducted in USA reported that production policies had significant effect on profitable agriculture. Farmers' inclusion into the agricultural research programmes helped in harnessing true indigenous technical perspective for a transformation in agriculture.

## **PHOSPHORUS BALANCE IN SOIL UNDER AEROBIC RICE – FIELD BEAN CROPPING SEQUENCE AS INFLUENCED BY LEVELS OF FARMYARD MANURE AND BIO-DIGESTER LIQUID MANURE**

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### **ABSTRACT**

Field experiments were conducted to know the effect of farmyard manure and bio-digester liquid manure on soil phosphorus balance under aerobic rice – field bean cropping sequence for two years at Zonal Agricultural Research Station, Mandya. The soil was red sandy loam in texture, low in organic carbon (0.38 %) and available nitrogen (215 kg ha<sup>-1</sup>), medium in available P<sub>2</sub>O<sub>5</sub> (26 kg ha<sup>-1</sup>) and K<sub>2</sub>O (162 kg ha<sup>-1</sup>). Actual balance of phosphorus in soil was negative after the harvest of aerobic rice as compared to the expected balance. Maximum net loss of P<sub>2</sub>O<sub>5</sub> (56 kg ha<sup>-1</sup>) was observed with 12.5 t FYM + bio-digester liquid manure equivalent (BDLME) to 150 kg N ha<sup>-1</sup> followed by 10 t FYM + BDLME to 150 kg N ha<sup>-1</sup> (53 kg ha<sup>-1</sup>) at the end of second season aerobic rice. The negative balance might be attributed to addition of more phosphorus into the soil as compared to crop uptake and all the added P might have not been mineralized during the crop growth period and some might have got fixed in the soil. Further, there was a net negative balance with available phosphorus in soil after the harvest of second season field bean. However, maximum net loss of P<sub>2</sub>O<sub>5</sub> (24 kg ha<sup>-1</sup>) was recorded with the University recommended practice (FYM 7.5 t + 25:50:25 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg ha<sup>-1</sup>) whereas, least difference (0.2 to 0.3 kg ha<sup>-1</sup>) was found with FYM 7.5 t + BDLME to 20 kg N ha<sup>-1</sup> and FYM 5 t + BDLME to 25 kg N ha<sup>-1</sup> treatments. It might be attributed to portion of added P<sub>2</sub>O<sub>5</sub> might not been mineralized during the crop growth period and some might have got fixed in the soil.

## **STUDIES ON GROWTH PERFORMANCE OF VARIOUS AGES IN UTTARA WITH WHITE CORNISH CROSSES**

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### **Abstract**

A study was conducted to evaluate the growth pattern of 275 birds of two crosses viz., cross 1 (Uttara × White Cornish) and cross 2 (White Cornish × Uttara) which were obtained in eight hatches at Instructional Poultry Farm of G.B.P.U.A. & T., Pantnagar, Uttarakhand. There was no significant difference of day old and two-week body weight of the chicks between male and female of both crosses in present study. The results revealed that there was significant difference observed in body weight from 4, 6, 8, 10, 12, 14, 16, 18, 20 and 22 weeks of age between male and female of both crosses. The values of body weight at



22<sup>th</sup> week was found in male and female of cross 1 ( $1360.89 \pm 5.59$  and  $1299.14 \pm 3.21$ g) than the cross 2 ( $1292.65 \pm 5.68$  and  $1232.81 \pm 4.58$  g) respectively. As a result, it was concluded that cross 1 (Uttara  $\times$  White Cornish) has a higher body weight in male and female than cross 2 (White Cornish  $\times$  Uttara). Male birds having higher body weight at different ages than the female birds in present study. The growth trends in both sexes showed linear increase in body weights; however, the rate of increase in body weights was higher in male as compared to female, which may be due to sex dimorphism.

## INTEGRATED WEED MANAGEMENT PRACTICES IN ONION UNDER AGRO CLIMATIC CONDITION OF CHHATTISHGARH PLAINS

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### ABSTRACT

The present experiment was conducted at College of Agriculture and Research Station, Janjgir-Champ, IGKV, Raipur (C.G.) during *rabi* season 2016-17 to find out the effect of weed management practices on growth and yield of onion, weed dynamics and economics. The 14 treatments comprised of pendimethalin @  $1.5 \text{ kg ha}^{-1}$  as PE, pendimethalin @  $1.5 \text{ kg ha}^{-1}$  as PE fb one hand weeding at 45 DAT, pendimethalin @  $1.5 \text{ kg ha}^{-1}$  as PE fb fenoxaprop-p-ethyl  $0.080 \text{ kg ha}^{-1}$  as PoE at 45 DAT, oxyfluorfen @  $0.25 \text{ kg ha}^{-1}$  as PE, oxyfluorfen @  $0.25 \text{ kg ha}^{-1}$  as PE fb one hand weeding at 45 DAT, oxyfluorfen @  $0.25 \text{ kg ha}^{-1}$  as PE fb fenoxaprop-p-ethyl  $0.080 \text{ kg ha}^{-1}$  as PoE at 45 DAT, oxadiargyl  $0.080 \text{ kg ha}^{-1}$  as PE, oxadiargyl  $0.080 \text{ kg ha}^{-1}$  as PE fb one hand weeding at 45 DAT, oxadiargyl @  $0.080 \text{ kg ha}^{-1}$  as PE fb fenoxaprop-p-ethyl  $0.080 \text{ kg ha}^{-1}$  as PoE at 45 DAT, propaquizafop 5% + oxyfluorfen 12% @  $0.15 \text{ kg ha}^{-1}$  PE, pendimethalin @  $1.0 \text{ kg ha}^{-1}$  PE fb propaquizafop  $0.05 \text{ kg ha}^{-1}$  PoE, oxydiargyl @  $0.070 \text{ kg ha}^{-1}$  PE fb propaquizafop  $0.05 \text{ kg ha}^{-1}$  PoE 45 DAT, Two hand weeding at 20 and 50 DAT and weedy check. The experiment was laid out in randomized block design with three replications. Onion variety "Agrifound Light Red" was grown as a test crop. Onion was transplanted 1<sup>st</sup> December 2016 with spacing  $15 \times 10 \text{ cm}$ . The crop was fertilized with 75, 60 and 100,  $\text{N}_2$ ,  $\text{P}_2\text{O}_5$  and  $\text{K}_2\text{O}$   $\text{kg ha}^{-1}$ , respectively. In the experimental field weeds, such as *Parthenium hysterophorus*, *Physalis minima*, *Chenopodium album*, *Cyperus rotundus*, *Cynodon dactylon*, *Melilotus indica* and *Alternanthera atriplicata* were the predominant weeds. At initial period of crop growth, broad leaf weeds contributed more as compared to grasses and sedges. The weed density and dry matter of weeds were found minimum under two hand weeding at 20 and 50 DAT. Whereas, weed control efficiency was found maximum under two hand weeding at 20 and 50 DAT. All the herbicides treatments improved, weed control efficiency, weed index economics and reduced weed density and their dry weight as compared to weedy check. Significantly highest bulb yield of onion ( $322.17 \text{ q ha}^{-1}$ ) was noted under hand weeding twice at 20 and 50 DAT, however, it was statistically followed by to bulb yield noted under treatments oxyfluorfen @  $0.25 \text{ kg ha}^{-1}$  as PE fb one hand weeding at 45 DAT ( $291.95 \text{ q ha}^{-1}$ ), pendimethalin @  $1.5 \text{ kg ha}^{-1}$  as PE fb one hand weeding at 45 DAT ( $288.77 \text{ q ha}^{-1}$ ) and oxadiargyl  $0.080 \text{ kg ha}^{-1}$  as PE fb one hand weeding at 45 DAT ( $285.66 \text{ q ha}^{-1}$ ). Hand weeding twice at 20 and 50 DAT gave maximum gross return (Rs. 322670.00  $\text{ha}^{-1}$ ), whereas, net return (Rs. 227222.00  $\text{ha}^{-1}$ ) and benefit cost ratio (3.62) was highest under oxyfluorfen @  $0.25 \text{ kg ha}^{-1}$  as PE fb fenoxaprop-p-ethyl  $0.080 \text{ kg ha}^{-1}$  as PoE at 45 DAT. All these economic parameters were found minimum under weedy check.

## DEVELOPMENT OF GINGER CANDY DURING COVID-19

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### ABSTRACT

Ginger (*Zingiber officinale*) is the underground stem (rhizomes) of a perennial herb. Ginger belongs to the family Zingiberaceae. Ginger contains pleasant aroma and 3% of essential oil. It contains bioactive compound and prevents Nausea, Muscle pain, soreness and also help to prevent Osteoarthritis. Gingerol increase the motility of the gastrointestinal tract and have analgesic, sedative and antibacterial properties. Gingerol is the main bioactive compound in ginger, responsible for powerful medicinal properties, Anti-inflammatory and antioxidant effects. There is a new public health crises threatening, in the world spread of 2019 novel coronavirus (2019-nCoV) or the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) So I have develop a Ginger Candy for the impact of human life. The study was carried out to develop,



preserve and shelf life of the candy from fresh ginger. The candies were made from 1Kg of washed, peeled and sliced ginger and blanched for 30 minutes. Then blanched sliced ginger were placed in 75 % sugar solution for overnight. Candy was prepared without any addition of fat which is good for health. Candy was studied and developed on the basis of overall acceptability and storage. The study showed that the colour, flavour, texture and overall acceptability according to 9-point Hedonic Scale. The 9-point Hedonic scale 1 was used lowest point showed that extremely dislike and the highest point was 9 showed that extremely like. Higher concentration of sugar and slower processing gives higher acceptability of preserved candy. It was analysed and concluded that storage stability of candy have higher organoleptic quality and further storage studied can be done in respect of microbial load etc.

## **DETRITIVORES INSECTS : AS A TOOL FOR COMPOST MAKING**

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### **ABSTRACT**

Insects are the largest group of hexapod invertebrates within the phylum arthropoda. They are the most diverse group of organisms with more than a million known described species. They are omnipresent and have immense potentiality for rapid increase in population. Despite being harmful to the agro ecosystem as pests, they also have many economically beneficial roles viz., pollination, honey production, lac culture, weed killers and detritivores. Among these, their part as detritivores can be witnessed from their active participation in recycling process, feeding on animal and vegetal origin waste, biochemical cycling of the nutrients and biological oxidative decomposition of organic matter (Composting). The important groups of insects that help to establish a balanced compost ecology are black soldier fly, blow fly, flesh fly, water beetle, cockroach, and silphid beetle. These detritivores are helpful to mitigate the problems of compost making like excessive heat generation, offensive smell, long time to break down and unwanted pest development.. Thus by the use of detritivores, it maintains the acidic soil pH, maintains favourable conditions for fungal growth, slow release of major nutrients enough for better plant growth with less losses. So, the adoption of this technology in composting, gives a high-quality end product with minimum contaminants which inturn improves the soil health.

## **EVALUATION OF RESISTANCE AGAINST *NILAPARVATA LUGENS* STAL. IN DIFFERENT RICE GENOTYPES**

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### **ABSTRACT**

Under glasshouse conditions, 19 rice genotypes were evaluated with the different mechanisms of host plant resistance to brown planthopper (BPH) using the standard seed box screening approach, honeydew test, nymphal survival method and days to wilt test. With a damage score ranging from 1.4 to 4.1, five genotypes, IR 36, IR-65482-7-2-216-1-2-B, PTB 33, RP 2068-18-3-5, and T12, were found to be resistant. In comparison to the susceptible genotypes, the resistant genotypes produced significantly less honeydew production and had a lower nymphal survival rate; nevertheless, the resistant genotypes took significantly longer time to wilt. With a damage score of 1.4, RP 2068-18-3-5 was found to be the most resistant cultivar, secreting 22.75 mm<sup>2</sup> of honeydew, 23.4 percent nymphal survival, and 18.6 days to wilt followed by rice cultivars T12 and IR 36 with damage scores 2.5 and 2.9, honey dew extraction of 58.5 and 78.5 mm<sup>2</sup>, 25.8 and 27 percent nymphal survival, 16 and 18.4 days taken to wilt, respectively.

## **SUSTAINING PRODUCTION UNDER CHANGING CLIMATIC CONDITIONS**

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### **ABSTRACT**

Climate change includes both global warming driven by human-induced emissions of greenhouse gases and the resulting



large-scale shifts in weather patterns. Though there have been previous periods of climatic change, since the mid-20th century humans have had an unprecedented impact on Earth's climate system and caused change on a global scale. The largest driver of warming is the emission of gases that create a greenhouse effect, of which more than 90% are carbon dioxide (CO<sub>2</sub>) and methane. Fossil fuel burning (coal, oil, and natural gas) for energy consumption is the main source of these emissions, with additional contributions from agriculture, deforestation, and manufacturing. Observed climate change is already affecting food security through increasing temperatures, changing precipitation patterns, and greater frequency of some extreme events. Studies that separate out climate change from other factors affecting crop yields have shown that yields of some crops (e.g., maize and wheat) in many lower-latitude regions have been affected negatively by observed climate changes, while in many higher-latitude regions, yields of some crops (e.g., maize, wheat, and sugar beets) have been affected positively over recent decades. Based on indigenous and local knowledge (ILK), climate change is affecting food security in drylands, particularly those in Africa, and high mountain regions of Asia and South America. Food security will be increasingly affected by projected future climate change. Many practices can be optimised and scaled up to advance adaptation throughout the food system. Supply-side options include increased soil organic matter and erosion control, improved cropland, livestock, grazing land management, and genetic improvements for tolerance to heat and drought. Diversification in the food system (e.g., implementation of integrated production systems, broad-based genetic resources, and heterogeneous diets) is a key strategy to reduce risks.

## **VARIETAL ADOPTION OF MAIZE CROP IN FLOOD AFFECTED AREAS - A STUDY IN MORIGAON DISTRICT OF ASSAM**

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### **ABSTRACT**

The study was carried out in two different flood situations viz low and high flood intensive area of Morigaon district of Assam. The study reveals that maize based cropping system was dominant in both the situations. Only 17.5% farmers adopted recommended varieties of maize crop and more proportion of adopters was found in case of low flood intensive areas as compare to high intensive flood areas. The maize variety P3401(Pioneer) was adopted by majority of farmers (48.33%) in case of low flood intensive areas while in high flood intensive areas Bumper and DE222 (Delta) were adopted by majority farmers. High yield, recommendation of peer farmers, colour and quality of cob, disease resistance are some important reasons for adoption of maize varieties in flood affected areas. High yielding, quality cob and disease resistance are important reasons for adoption of maize varieties as it compensated the loss of flood. Private extension and farmer to farmer extension approach may be more effective means for transfer of maize varieties in flood affected areas.

## **APPLICATION OF ZINC OXIDE NANOPARTICLES FOR THE DYEING AND MULTIFUNCTIONAL PROPERTIES OF WOOL FABRIC WITH NATURAL DYES**

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### **ABSTRACT**

Dyeing of the textile materials with natural dyes is one of the promising technologies that have the potential to reduce the environmental pollution. The compounds extracted from natural materials have produced sober and elegant shades but these have limitation of low affinity and fastness properties. Therefore, in the present study ZnO nanoparticles were used to enhance the dyeability of the wool with madder and eucalyptus dyes. One percent ZnO nanoparticles were applied on wool fabric by exhaust method at 80°C for 30 minutes by keeping the ML ratio 1:20 and simultaneously dyed with each dye separately. The characterization of the nanoparticles and the dyed fabric was studied using FTIR and phytochemical analysis. The SEM analysis confirmed the presence of ZnO nanoparticles on the wool fabric surface. The results revealed that dye uptake and fastness properties of the fabric improved by treatment with nano ZnO. The mechanical properties of the fabric found intact after treatment and dyeing. Also the treatment provided the UV protection property and antibacterial property to the wool.





fabric. Thus, nano Zn act as a morant to fix the natural dye on the fabric and providing multifunctional properties to the wool fabric.

## QUALITYASSESSMENT OF TANK SILT OF LATUR AND OSMANABAD DISTRICT OF MARATHWADA REGION, MAHARASHTRA

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### ABSTRACT

Latur and Osmanabad districts are the south western part of Marathwada region of Maharashtra state located between 18°05' to 18°25' N latitude and 76°25' to 77°25' longitude and 18°28' to 19°28' North latitude and 76°25' to 77°25' East longitude respectively. The total geographical area of the Latur and Osmanabad districts are 7372 sq. km and 7512.40 sq.km, respectively. The 72 tank of Osmanabad and Latur district were studied for quality of tank silt. The tank silt of the study area was alkaline in nature (7.3 to 8.1), having low to high organic carbon (0.41% to 7.13%) content and are medium to highly calcareous in nature (3.8% -22.5%). The total macro nutrients status i.e. Total N, P, K and S varies from 0.046 to 0.094, 0.027 to 0.073, 0.11 to 1.12 and 0.199 to 0.619 per cent respectively with the mean values 0.065, 0.042, 0.506 and 0.29 per cent respectively. Total micronutrient status in tank silt for Fe, Zn, Mn and Cu range between 4.05 to 7.56, 0.0064 to 0.0124, 0.001 to 0.159 and 0.0014 to 0.0138 per cent respectively with the mean values 5.43, 0.00777, 0.092 and 0.00917 per cent respectively and it was 20 percent more in total nutrient status as compared to soils of adjoining area. The bulk density of tank silt varies from 1.2 to 1.4 Mg m<sup>-3</sup> with an average value of 1.3Mg m<sup>-3</sup> which was found slightly low than soils of adjoining area. The Recycling of Tank silt were found to be a best alternative for the fertilizers. Fertilizers provides one or two nutrients but tank silt provide all essential nutrients in adequate quantity to overcome the nutrient deficiency and also improve physical condition of soil which is much more important for improving health of shallow soils under semi-arid climatic conditions.

## SENSORY PERCEPTION OF VITAMIN C RICH COMMONLY CONSUMED RECIPES USING UNDER EXPLOITED GREENS

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### ABSTRACT

The leafy concentrate (commercial products prepared from various greens) has tremendous potential for overcoming the problem of anemia and vitamin C deficiency as it is rich in iron and Ascorbic acid so its consumption in the daily diet should be encouraged. Processed supplement mix of cereals, pulses, nuts and leafy vegetables being good source of iron could improve iron state of young children of low-income group. The Study was conducted, comparing four vitamin C rich under exploited greens (cauliflower, drumstick, radish, broccoli) commonly consumed food products: Pakora, Poori and Parantha. These products were organoleptically evaluated on 9-point Hedonic scale. Analysis of variance (ANOVA) showed that 30 to 40 per cent incorporation of under exploited greens were more acceptable. The highest score of overall acceptability was found in cauliflower greens Pakora i.e. 8.40, Cauliflower greens poori i.e. 8.60 and broccoli greens parantha i.e. 8.73 respectively.

## ECONOMIC ANALYSIS OF FARMING SYSTEMS IN SATARA DISTRICT OF MAHARASHTRA

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### ABSTRACT

The present study was based on primary data were collected from 108 farmers by personal interview method with the help of



specially design schedule from Satara district of Maharashtra during the agricultural year 2018-2019. In study area three major farming systems were evaluated viz; 1) Crops only 2) Crop + Livestock 3) Crop + Livestock + Horticulture. Resource use pattern in proposed farming system are in varied proportion. Farmers applied their resources in very cogent and excessive manner. Limit the resources use in farming system, farmers go through a very sustainable way of agriculture. In C+ L+ H farming system, farmers used more resources as compared to other two farming system. Next table indicate the how farmers use resources in their farming system. In C + L + H farming system per hectare as well per farm profit was high as compared to Crops only and C + L farming system. Similarly, the per hectare and per farm profit in C + L farming system was higher than Crops only farming system. The per hectare and per farm income of C + L + H farming system over C + L and C + L over Crops only farming system was more. To sum up, it can be noted that as farmer shifts from Crop only to C + L and C + L to C + L + H farming system, the income, expenditure and profit goes on increases. It indicates that the C + L + H farming system was economically most viable in Satara district as compared to other farming systems. Since, C+L+H Farming system is profitable farmers should be motivated to undertake horticultural crops and livestock with cash crops for enhancing their income and employment on farms.

## EFFECT OF FIVE INSECTICIDES ON DEHYDROGENASE ACTIVITY (DHA) IN RICE SOIL

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### ABSTRACT

A laboratory study was conducted at Department of Entomology, Agricultural College, Bapatla during *kharif* 2021 to investigate the influence of five insecticides viz., chlorantraniliprole 18.5 SC, imidacloprid 17.8 SL, dinotefuran 20 SG, pymetrozine 50 WG, cartap hydrochloride 4 G on the dehydrogenase activity (DHA) in black clay and sandy clay loam soils collected from fallow rice fields of Guntur district. The results indicated that the application of imidacloprid 17.8 SL at both recommended dose (RD) and double the recommended dose (DRD) resulted in decline in the DHA of both the soils. Imidacloprid applied at DRD was found to inhibit the DHA to a greater extent compared to other test molecules with mean value of 61.37, 48.79 and 48.18  $\mu$ g TPF/g soil at 24 HAA, 10 and 20 DAA, respectively. At both RD and DRD, the application of chlorantraniliprole 18.5 SC had no inhibitory effect on DHA in both the soils with mean value of 115.69, 136.37 and 163.60  $\mu$ g TPF/g soil at recommended application rate at 24 HAA, 10 and 20 DAA, respectively. Cartap hydrochloride 4G at recommended application rates had no inhibitory effect on the DHA in both the soils even up to 20 DAA. However, at DRD, slight inhibitory effect was noticed only up to 24 HAA with a record of 49.27  $\mu$ g TPF/g in sandy clay loam and 160.90  $\mu$ g TPF/g in black clay soil compared to controls of both soils. On the other hand the application of dinotefuran 20 SG and pymetrozine 50 WG at RD showed inhibitory effect on DHA activity in both the soils up to 24 HAA. Infact, at DRD the application of both these molecules significantly inhibited the DHA activity in both the soils even up to 20 DAA. The descending order of effect of insecticides on DHA of soil was: imidacloprid 17.8 SL > pymetrozine 50 WG > dinotefuran 20 SG > cartap hydrochloride 4 G > chlorantraniliprole 18.5 L.

## NUTRIENT BALANCE AND YIELD OF RAINFED COTTON AS INFLUENCED BY POTASH MANAGEMENT THROUGH GLIRICIDIA GREEN LEAF MANURING IN VERTISOLS

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### ABSTRACT

A field study was conducted during *kharif* 2019-20 at Research field of AICRP for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra to assess the effect of potash management through gliricidia green leaf manuring on soil fertility and yield of rainfed cotton in Vertisols. The soil of the experimental site was Vertisol which was moderately alkaline in reaction, low in available nitrogen, medium in available phosphorus and high in available potassium. The nine treatments replicated three times in randomized block design comprised of control, 100% RDF (60:30:30 NPK kg ha<sup>-1</sup>), 100%, 75% and 50% N and 100% P through chemical fertilizers and the combinations of 15, 20 and 30 kg K ha<sup>-1</sup> through gliricidia green leaf manure at 30 DAS and remaining recommended dose of potassium as basal dose through inorganic fertilizers. The results indicated that application of 100 % NP + 10 kg K (inorganic) + 20 kg K ha<sup>-1</sup> through gliricidia green leaf



manure at 30 DAS recorded significantly higher cotton yield with improvement in soil fertility and it was on par with application of 100 % NP + 15 kg K (inorganic) + 15 kg K ha<sup>-1</sup> through gliricidia green leaf manure. Hence, it is concluded that conjunctive application of 100 % NP + 10 kg K (inorganic) + 20 kg K ha<sup>-1</sup> through gliricidia green leaf manuring at 30 DAS resulted in improvement in soil fertility and yield of cotton grown in Vertisols under rainfed conditions.

## STATUS OF AVAILABLE MAJOR NUTRIENTS IN THE SOILS OF HADONAHALLY PANCHAYAT OF BENGALURU RURAL DISTRICT IN RELATION TO SOIL CHARACTERISTICS

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### ABSTRACT

A study on the macronutrient status of soils of Hadonahally Panchayat of Bengaluru rural district was made comprising of six villages. The objective was to study the status of major nutrient and their relationship with various physicochemical properties. Surface soils (0-15 cm) from different parcels of the village were quantified. Available nitrogen in soil was low (31.36 kg ha<sup>-1</sup>) to high (689.7 kg ha<sup>-1</sup>). Available phosphorus ranged from 5.8 kg ha<sup>-1</sup> to 421.09 kg ha<sup>-1</sup>. Soils were low (13.45 kg ha<sup>-1</sup>) to high (713.9 kg ha<sup>-1</sup>) in potassium status. A significant positive correlation was found between organic carbon and available nitrogen ( $r=0.930^{**}$ ) and available potassium ( $r=0.685$ ). While available phosphorus and clay content was found to be significantly and positively correlated ( $r=0.316^{**}$ ). The soil nutrient index for nitrogen, phosphorus and potassium were 1.70, 2.80 and 2.54 respectively. Thus providing nutrients to crops based on analysis of fertility of each parcel of land, results in enhanced crop productivity and net returns of crops under different cropping system in the panchayat.

## GENETIC VARIABILITY AND STABILITY OF BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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### ABSTRACT

Wheat (*Triticum aestivum* L.) is believed to be cultivated about 10000 years ago when hunting culture transited to agriculture. It is an important human food crop, ranks on top three cereals in the world because of its adaptability, nutritional value and high yield potential. Wheat improvement programmes lay major emphasis on breeding high yielding cultivars with better stability which require the proper evaluation of genotypes for yield and its components traits. It is an authentic fact that greater variability among the genotypes leads to better chance for further improvement in the crop. Genetic diversity is much essential for developing cultivars with wider adaptation, high yield and desirable quality etc. During the time of evolution wheat gained sufficient genetic diversity along the way from einkorn to bread wheat. Today, however its diversity is deteriorating due to repeated cultivation of landraces for specific characters, varietal selection narrow adaptation and the requirement of uniform varieties in industrial seed grain processing the cultivation of high yielding commercial varieties also played an important role in the loss of genetic variation this depletion has now increased the use of diverse genetic resources in breeding programs.

## SEASONAL INCIDENCE OF FEEDING PEST COMPLEX OF ARECANUT IN KARNATAKA

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### ABSTRACT

Areca nut is the most significant plantation crops growing in India in different region of the country. It is having few medicinal



value against disease like cough, fits, worm, anemia, leukoderma and obesity. The study was undertaken to know the better understanding of the seasonal fluctuation of these sternorrhynchan insect pests with different abiotic factors. A field experiment was conducted for two consecutive years as was conducted for two consecutive years on seasonal incidence of sternorrhynchan sucking insect pests i.e., whitefly, *Aleurocanthus arecae*, armoured scale, *Chrysomphalus aonidum* and mealybugs, *Pseudococcus longispinus* were conducted in two different locations viz., UAHS, College of Agriculture, Shivamogga and AHRS, Honnavale in southern transitional zone. Population counts on the number of insects present for four to six years old plants. For this 5cm<sup>2</sup> leaf surface area was selected on 10 randomly selected plants and labelled. Sixteen, 5×1cm<sup>2</sup> long leaf parts were selected from minimum of 10 palms, having insect infestation at fortnightly interval. From each specimen the live individuals were recorded using hand lens (1.5 cm<sup>2</sup>). The study showed that, in both the locations all the three species infesting arecanut was found active throughout the year. Correlation and regression analysis of whiteflies showed that, rainfall was significant positive correlation and maximum temperature and sunshine hours were significant negative correlation. The wax scales showed, non-significant positive correlation with minimum temperature and the mealy bug resulted that the maximum temperature was significantly positively correlated and the relative humidity was significantly negatively correlated.

## DEVELOPMENT OF PROTECTION PACKAGE FOR DIFFERENT RICE CULTIVATION SYSTEMS.

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### ABSTRACT

In recent years the rice cultivation systems were changing due to various reasons like shortage of labour, increased cost of cultivation, availability of stage specific and weed specific weedicides, change in irrigation facilities, rainfall pattern and increased farm mechanization. But due to change in cultivation system, the type of pest, intensity and time of pest incidence are also changing. There is a need to identify these changes for opting better cultivation system and incorporate appropriate pest management practices. Hence, the present study was under taken at Agricultural Research Station, Ragolu, Srikakulam district in Andhra Pradesh under different cultivation systems like Dry direct sowing (DDS), Aerobic cultivation, normal transplanting and Machine transplanting (MSRI) as main treatments and nitrogen levels as sub treatments during *kharif* 2016-17. The results regarding natural enemy activity was non-significant between different rice cultivation systems. The leaf folder incidence was observed at maximum tillering stage, while lowest incidence was observed in machine system of transplanting (1.77% damage leaves) followed by aerobic cultivation (2.3% dl), transplanting (4.9% dl) and DDS with 5.4% leaf folder damaged leaves. Within each system with increase in nitrogen level the intensity of leaf folder damage was also increased. The yellow stem borer damage as white ear was significantly highest in DDS (14.66% WE) followed by Aerobic (13.79% WE) and transplanting (10.69% WE). The stem borer incidence was lowest in MSRI (6.33% WE) at pre-harvest stage. MSRI recorded highest yield (6.66 q/ha) and it was on par with transplanting (6.53 q/ha). In sub-plots the pest load was increased with increased nitrogen levels from 90 kg/ha to 210 kg/ha. Finally, the machine transplanting was recorded as the best system because it is economic in terms of labour saving, pesticide consumption and high grain yield.

## CLIMATE CHANGE AND ITS IMPACT ON FOOD SECURITY

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### ABSTRACT

Climate change is one of the defining concerns of the twenty-first century, with significant implications for global population needs, poverty reduction, natural environment preservation, and food security. Climate change is no longer just a worry for the environment but also a developmental issue that affects both developing and developed countries. Climate change affects agricultural production systems in both direct and indirect ways. Direct effects on certain agricultural production systems are caused by changes in physical factors such as temperature levels and rainfall distribution. Changes in other species, such as pollinators, pests, disease vectors, and invading species, have indirect effects on production. These indirect impacts can have a significant impact. Climate change affects food production, and thus food availability. Climate change will affect the





livelihoods and income of small-scale food producers and through food price increases and volatility, the livelihoods of poor net food buyers, restricting access to food. The common agricultural adaptation strategies used by farmers were the use of drought resistant varieties of crops, crop diversification, changes in cropping pattern and calendar of planting, conserving soil moisture through appropriate tillage methods, improving irrigation efficiency, and afforestation and agro-forestry.

## SUSTAINABLE SOIL FERTILITY MANAGEMENT

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### ABSTRACT

Sustainable Soil Fertility Management focuses primarily on concerns connected to soil management at the field level, which is a major concern for crop productivity and can be improved by implementing a number of sustainable management strategies. Several approaches for improving soil fertility and agricultural yield while minimizing environmental effect have been studied. Cover crops can help improve soil fertility by adding organic matter to the soil, which improves soil structure and promotes a healthy fertile soil; by using green manure or growing legumes to fix nitrogen from the air through the process of biological nitrogen fixation; and by microbes. Fertile soil includes all of the major nutrients required for basic plant nutrition (e.g., nitrogen, phosphorous, and potassium), as well as smaller amounts of other nutrients (e.g., calcium, magnesium, sulfur, iron, zinc, copper, manganese, boron, molybdenum, nickel). There is a need to focus on global strategies with a possible solution for managing the fertility of soil. It is critical to promote Integrated Nutrient Management (INM) by judiciously combining chemical fertilizers with organic manures and biofertilizers to improve soil health and productivity. Strengthening of soil and fertilizer testing facilities to provide soil test-based recommendations to farmers for improving soil fertility ensuring quality control requirements of fertilizers, biofertilizers is need of the hour.

## HYDROLYTIC ENZYME ACTIVITIES OF *PLEUROTUS FLORIDA* DURING VEGETATIVE GROWTH AND FRUIT DEVELOPMENT ON PADDY STRAW RESIDUE

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### ABSTRACT

Macro fungi of oyster mushroom (*Pleurotus florida*) have the capability to produce a high variety of intracellular and extracellular enzymes which can degrade agro-waste materials contain complex organic compounds into simple low molecular weight compounds. Compared with other cultivated mushrooms, very little is known about the nature of the hydrolytic enzymes produced by the edible mushroom *Pleurotus florida*, the parameters affecting their production, and enzyme activity profiles during different stages of the developmental cycle. Hydrolytic enzyme activities of extracts colonized by mycelia during submerged fermentation (SmF) were taken after 7, 14, 21 and 28 days of incubation at 25° C and are also obtained from paddy straw during solid-state fermentation (SSF) by *Pleurotus florida* at mycelial colonization; primordial formation; harvesting and postharvest stages were investigated. The intracellular enzyme activity of *P. florida* mycelium was found to increase with time and the maximum activity was that of endoxylanases (5.6 IU/mg) and cellobiohydrolase (5.46 IU/mg). Endoxylanase had the highest titre value (9.20 IU/mg) during the extracellular *P. florida* mycelial growth stage while the activity of other enzymes was significantly lower. The enzymatic activity was lower during the early mycelial growth and showed higher levels during the formation and development of fruiting bodies. During the pin head stage, there was increase in the activity of endoxylanases,  $\alpha$ -glucosidases, cellobiohydrolase, endoglucanase, total cellulases (FPA) enzymes as 9.60, 1.62, 7.19, 6.96, 2.20 IU/mg respectively. After harvesting, during the first flush, endoxylanases activity was reduced upto 7.88 IU/mg and remained at par during the second, third and fourth flush of harvesting. A similar pattern was observed for  $\alpha$ -glucosidases and cellobiohydrolases. Endoglucanase activity showed a decline upto second flush and remained stable thereafter. Total cellulases activity reduced from pin head stage to first flush and no significant change was observed in the second, third and fourth flush during the reproductive phase of mushroom production. The results showed that the activities of hydrolytic enzymes were regulated in line with the development phase of growth of *P. florida* and also indicates the enormous potential of *P. florida* for industrial production of hydrolytic enzymes on very low cost substrates through SSF.



## AGROFORESTRY—CONSERVATION AND SUSTAINABLE PRACTICES IN THE AGRICULTURAL LANDSCAPE

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### ABSTRACT

Agroforestry is a vibrant technique that cultivates both agricultural crops and forest trees simultaneously on the same unit of land in a sequential pattern. The various components of agroforestry are interacted both ecologically and economically. Agroforestry is reported to be a 6-F programme since it provides Food for man, Feed for livestock, Fibre for cloths, Fuel for village dwellers and city houses, Furniture woods and Funds for the poor and needy forest villagers. It ensures diversified and more sustainable production at a higher level from the available resources; production of fundamental needs of farmers primarily food, fruit, fodder, fuel etc. from their own piece of land; enhancement of land productivity, fertility and sustainability in lands affected by low soil fertility, high erosion and high soil degradation; safeguards the crops from hot or cold winds by acting as windbreaks and creates employment opportunities. As we move further, we come across various dynamics of agroforestry such as Agri-Silviculture which involves growing of agricultural crops along with the forest trees, Sylvo-Pastoral system engages the land for the production of wood as well as for rearing of domesticated animals, Agro-sylvo-pastoral system unifies all three i.e. agricultural crops, forest trees and pasture management, Horti-Silviculture integrates horticultural plants and silviculture system and growing multipurpose trees on crop lands are few epitome of agroforestry. We also acknowledge that the trees planted in agroforestry help the farmers during adverse weather conditions like drought or flood. Mango trees are said to provide multiple benefits including income and food during floods and banana, papaya and mango are listed among the most significant tree species during drought as their roots can penetrate deep down into the soil to fulfill water requirement. Hence, from the foregoing context we can conclude that agroforestry not only improves the quality and fertility of the soil but also gives farmers secure living conditions by raising their net income.

## ORGANIC CARROT SEED PRODUCTION

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### ABSTRACT

Carrot (*Daucus carota* L.) belonging to family *Umbelliferae* with chromosome number  $2n=18$  is popular cool season vegetable is one of the important root vegetable crops. The area under carrot crop in India is reported to be 1.9 lakh ha with an annual production of 18.93 lakh metric tonnes (Anonymous, 2019). In one season (annual), it produces high quality edible root and in two seasons (biennial), produces seeds. The inflorescence, typical of the *Umbelliferae*, is a compound umbel. Seed is the basic and cheapest input but it is one of the most important means of increasing productivity of any crop (Verma and Phogat, 1994). One of the major problems faced by the carrot growers in India is the unavailability of healthy planting material. Chemical fertilizers which are now being employed extensively since the green revolution have depleted soil health by creating the soil ecology non-inhabitable for soil micro-flora and micro-fauna. Organic seed production system is a holistic system includes growing of seed crops by a set of guidelines that prohibit the use of synthetic products/chemicals and it solves many of these problems as this system helps to maintain soil productivity and effectively control pest by enhancing natural processes and cycles in harmony with environment. The need for organic seed production is because seed crops are heavy users of synthetic agricultural chemicals, seed produced organically will yield plants that are more adapted to or more likely to thrive under organic growing conditions. A field experiment was conducted at Seed production area of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during the Rabi season of 2019-20, to know the effect of manure and biofertilizers on seed production of carrot cv. Hisar Gairic. The experiment was laid out in a Randomized Block Design with three replications and different treatment combinations of manure and biofertilizers. Results revealed that maximum no. of primary umbel, secondary umbel, umblets per umbel, seed yield per primary umbel and secondary umbel were found with treatment having FYM 12.5t/ha+ Poultry manure 2t/ha+ vermicompost 4t/ha + *azotobacter* + *phosphobacteria* which was found at par with the treatments having FYM 12.5t/ha+Poultry manure 2t/ha+ vermicompost 4t/ha and FYM 12.5t/ha+ Poultry manure 2t/ha+ *azotobacter* + *phosphobacteria* and these parameters were observed



minimum with the control treatment where neither manure nor biofertilizer was applied. It was concluded that, for enhancing the seed yield of carrot these above-mentioned treatments can be given.

## DEVELOPMENT OF BIOFORTIFIED HYBRIDS BY USING BIOFORTIFIED RESTORERS IN PEARL MILLET

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### ABSTRACT

Biofortification of Pearl millet (*Pennisetum glaucum* (L.) R. Br.) with improved iron (Fe) and zinc (Zn) will have great impact as it is an indispensable component of nutritional security of inhabitants of arid and semi-arid regions. In the present study, seventy-six Pearl millet genotypes comprised of seven biofortified restorers, eight diverse CMS lines, fifty-six hybrids developed from these parents and four checks were screened for blast resistance under field condition at Regional Agricultural Research Station, Vijayapur during *kharif*, 2020. Research on the Pearl millet has shown that a medium genetic variability (41-81 mg kg<sup>-1</sup> Fe and 28-57 mg kg<sup>-1</sup> Zn) available in this crop can be effectively utilized to develop high-yielding cultivars with high iron and zinc densities. The hybrids (ICMA -15666 × Fe & Zn-13, ICMA -96666 × Fe & Zn-5, ICMA -04999 × Fe & Zn-14, ICMA -03999 × Fe & Zn-1, ICMA -06444 × Fe & Zn-13, ICMA -15666 × Fe & Zn-9, ICMA -96666 × Fe & Zn-13) of pearl millet with high levels of iron (69-81 mg kg<sup>-1</sup>) and zinc (47-57 mg kg<sup>-1</sup>) densities. The CMS lines ranging from 41-68 mg kg<sup>-1</sup> and 28-49 mg kg<sup>-1</sup> for Fe and Zn. The biofortified restorers which are ranging from 52-69 mg kg<sup>-1</sup> and 35-56 mg kg<sup>-1</sup> for Fe and Zn respectively, whereas the checks which are ranging from 47-51 mg kg<sup>-1</sup> and 29-41 mg kg<sup>-1</sup> for Fe and Zn respectively. This investigation helped in identification of high yielding heterotic biofortified hybrids for commercial cultivation.

## BAMBOO LEAFHOPPER, *MUKARIA SPLENDIDA* DISTANT (HEMIPTERA: CICADELLIDAE) FROM INDIA

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### ABSTRACT

Bamboo is a poor man's timber, a woody grass belonging to the family Poaceae (Gramineae). A total of approximately 148 species in 29 genera of bamboos both wild and cultivated are known to occur in India. More than 50% of the bamboos are found naturally occurring in India, among which 71 species are endemic to the country. While there is an array of fungal and bacterial diseases known to infect bamboos and their etiology is also well documented, very little is known about the viral diseases and their vectors (mainly leafhoppers) infecting bamboos. Colour polymorphism in bamboo leafhopper, *Mukaria splendida* (Distant, 1908) is noticed based on survey conducted from different locations of India, ten colour morphs are recognized from each sex of *M. splendida* Distant which are identified based on colour pattern on pronotum and forewings. Morphologically all specimens different in the habitus coloration, whereas genitalia of all specimens irrespective of colour are similar. This colour polymorphism may be due to effect of climate change or its association with different bamboo species and varieties. The color polymorphism may be of evolutionary significance and further insight is needed to reveal the same. This study reveals different colour polymorphic forms in the *M. splendida* Distant which indeed help in correct identification.

## A STUDY ON THE EFFECT OF SUGAR INDUSTRY EFFLUENT ON PRODUCTIVITY AND NUTRITIONAL CONSTITUENT OF *LYCOPERSICON ESCULENTUM* MILL. VAR. NAVODAYA.

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### ABSTRACT

A study was made to observe the effect of different dilution of sugar industry effluent on plant productivity and chemical



composition of *Lycopersicon esculentum* Mill. Var. Navodaya. The characters considered for the study were fruit productivity per plant, lycopene content mg per 100 gm, Vitamin-A and Vitamin-B complex such as, Thiamine (vitamin B<sub>1</sub>) Riboflavin (vitamin B<sub>2</sub>) and Niacin (vitamin B<sub>3</sub>), Potassium mg per 100 gm, Sodium mg per 100 gm, Malic acid content mg per litre and Citric acid content mg per litre. Sugar industry effluent was applied as irrigation medium in different concentration i.e. 20 per cent (T<sub>1</sub>), 40 per cent (T<sub>2</sub>), 60 per cent (T<sub>3</sub>), 80 per cent (T<sub>4</sub>), and 100 per cent (T<sub>5</sub>). A control crop was also grown side by side which was irrigated with tap water. Maximum fruit productivity was recorded in T<sub>3</sub> treatment where crop was irrigated with 60 per cent concentration of Sugar industry effluent. The concentration above 60 per cent showed adverse effect on fruit productivity. The nutritional constituent like Lycopene, Vitamins, sodium etc. also increases up to T<sub>3</sub> treatments and treatment T<sub>4</sub> & T<sub>5</sub> have adverse effect on nutritional content of Tomato (*Lycopersicon esculentum* Mill. Var. Navodaya).

## FODDER : A PROMISING CROP FOR FUTURE

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### ABSTRACT

Climate change is a growing concern whose impacts are reflected in almost every sector and it is mainly due to the increase in greenhouse gases. The atmospheric concentration of carbon dioxide has increased globally by 40 per cent from 278 ppm in the pre-industrial era to around 408 ppm in 2018 and is expected to cross 1000 ppm at the end of the century, which is a major threat to food-fodder security and climate change in 21<sup>st</sup> century. Fodder production systems play a major role in mitigating climate change through improving carbon sequestration, reducing methane emission per unit livestock product and reducing nitrous oxide emission. Grasslands, pastures and forage crops contribute greatly in the global carbon cycle which stocks at least 30 per cent of world soil carbon. Many strategies can be adopted to enhance the carbon sequestration in fodder production system like adoption of pasture based agro forestry practices, restoration of degraded lands and inclusion of grasses, grazing management, direct inputs of water, fertilizer or organic matter, sowing of improved forage species and fire management. There are different strategies to reduce methane emissions by supplementing suitable fodder in diet such as providing forage with high digestibility plus high energy and protein concentrations, inclusion of forage legumes in diet, ideal fodder preservation method and use of forages in mixed crop-livestock systems. Certain pastures release biological nitrification inhibitors from their roots, which suppress nitrifier activity and reduce soil nitrification and nitrous oxide. Thus there is a need for strategies that will enable reduced GHG emissions through sustainable intensification of forage production systems to enhance productivity, income generation, climate mitigation and ensuring food-fodder security.

## TRADITIONAL AGRICULTURE : ALTERNATIVE PRACTICES FOR CLIMATE CHANGE MITIGATION

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### ABSTRACT

Traditional knowledge is holistic in nature due to its multitude applications in diverse fields of agriculture. Traditional agriculture can be adopted as an alternative method for sustainable food production in changing climate. Agricultural activities from cropping to harvesting emit GHGs that cause climate change which in turn disturbs agriculture. Climate change influences agriculture through increased temperature, precipitation variability and amplified intensity of weather extremes. Climate change affects agriculture directly through altering the agroecological conditions and indirectly by increasing demand of agricultural production. Integrating traditional knowledge into climate change policies paves the way for cost-effective and sustainable adaptation coupled with mitigation strategies. Intercropping combined with conservation agricultural practices can be used for reducing CO<sub>2</sub> emission and increasing crop productivity. Rice-fish culture is an important farming practice that increases diversification, intensification, productivity, profitability with sustainable food production. Traditional farming systems promote agroecosystem sustainability through conserving soil, harvesting water and cropping varieties of crop under the conditions of water stress, limited resources and low level of technology. Food and Agriculture Organization devised the climate smart agriculture approach in order to manage agriculture for food security in the era of global warming, sustainably enhancing agricultural productivity to support equitable increase in income, food security and development, reducing GHG emissions and increasing carbon sequestration.





## NEW GENERATION BIO-NANO FUNGICIDES IN MANAGEMENT OF SHEATH BLIGHT OF RICE

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### ABSTRACT

Silver nano particles were synthesized by using potential isolates of *Trichoderma* spp and *Pseudomonas fluorescens*. The study revealed that bionano preparations irrespective of the isolate source used, i.e., *Trichoderma* and *P. fluorescens* were found better in decreasing the sheath blight incidence *in vitro* though variation existed in terms of quantum of disease reduction. Bionano preparation from nutrient broth alone was also found effective in decreasing sheath blight severity compared to bioagents used alone or PDB. When the sensitivity of rice leaves from cv. NLR 34449 was assessed by dipping the leaf segments in 100% concentration of bionano silver (prepared using 170ppm silver nitrate), rice leaves turned yellow from the third day of incubation in detached leaf method *in vitro*.

## REVIEW ON GOOGLE EARTH ENGINE PLATFORM FOR BIG DATA APPLICATIONS IN REMOTE SENSING

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### ABSTRACT

In the past two decades, majority of researchers used remote sensing technology for different applications. There was an abundant amount of data collected by different remote sensing systems such as spaceborne and airborne with various characteristics such as spatial, spectral, radiometric and temporal resolutions. In order to analyse the data, common software packages and desktop computing resources are generally utilized. But, managing and analysing of these massive volumes of data with these softwares is a challenging task. Therefore, a cloud computing platform called Google Earth Engine (GEE), developed by Google has effectively overcomes the challenges faced in big data analysis using Google's computational infrastructure in which numerous remote sensed datasets were provided to users with free access. This cloud computing platform has such a potential in storing, accessing and analysing datasets on very powerful servers. The features of automatic parallel processing and fast computing platform involved in GEE effectively deals the challenges involved in big data processing. It also has a capability of processing big geo data over large areas and monitoring the environment for longer periods of time. GEE also aids in developing apps using Artificial and Machine Learning tools. Hence, this platform has been employed for broad range of applications such as Land cover/ Land Use classification, urban planning, climate analysis, Image processing and natural disaster.

## MANAGEMENT OF ROOT ROT AND BACTERIAL LEAF BLIGHT (BLB) DISEASE IN CLUSTERBEAN

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### ABSTRACT

Clusterbean [*Cyamopsistetragonoloba* (L.) Taub.] is popularly known as “Guar” or “Guwar” and belongs to family Fabaceae of kingdom Plantae. It is an important legume crop and mainly grown under rainfed conditions of arid and semi-arid regions of tropical India during *Kharif* and *Zaid* seasons. It is considered as one of the most drought tolerant grain legumes and very valuable within crop rotation cycle as it lives in symbiotic association with nitrogen fixing bacteria. The production of clusterbean crop is mainly hindered by several fungal and bacterial diseases and causes huge losses to farming community. Among these root rot and bacterial leaf blight (BLB) are the important diseases of clusterbean in Haryana and Rajasthan in India. To manage these important diseases, on farm trial on management of root rot and bacterial leaf blight disease in



clusterbean were carried out at 5 locations at farmers' fields to assess the suitability of a technology for a particular situation during *Kharif* season 2021. Effect of seed treatment with streptocycline and carbendazim along with foliar application of streptocycline and copper oxychloride was compared with control (Farmer's practice). Seed treatment by soaking of seed with streptocycline (1g/kg seed) and carbendazim (2 g/kg seed) followed by two foliar sprays of streptocycline (75 g/ ha) and copper oxychloride (500 g / ha) at 55 and 70 DAS provided effective management of both root rot and bacterial leaf blight disease as compared to farmer's practice. Minimum disease incidence was recorded in respect of root rot i.e 5.3% and bacterial leaf blight incidence was 7.1 %, however the disease incidence was in Farmer's practice i.e 24.5% and 54.1%. The results indicate that application of the technology provided 23.9 percent higher yield than control. The B: C ratio was 1.61 percent as compared to Control (Farmer's practice) i.e 1.37.

### SCREENING OF SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH) M<sub>3</sub> MUTANT LINES FOR CHARCOAL ROT RESISTANCE (*MACROPHOMINA PHASEOLINA*).

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#### ABSTRACT

The present investigation conducted to screen sorghum 100 mutants along with 7 checks viz., DJ 6514, IS 2312, M 35-1, GS 23, DSV-4(Resistant), E-36-1(Resistant) and SPV-86(susceptible) of sorghum for resistance against charcoal rot (*Macrophomina phaseolina*) in augmented block design at Agriculture research station Hagari, during *rabi*-2019. Screening study revealed that the mutant line PV-26(0.8) and IS925-22(0.8) showed resistant reaction and recorded reduced levels of other charcoal rot parameters such as per cent lodging due to charcoal rot, mean length of spread (MLS) when compared with resistant check E-36-1(0.2) and DSV-4 (0.4) with respect to mean number of nodes crossed by disease.

### HETEROSIS FOR FRUIT YIELD AND COMPONENT TRAITS IN TOMATO (*SOLANUM LYCOPERSICUM* L.) UNDER ORGANIC CONDITIONS IN MID HILL OF HIMACHAL PRADESH

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#### ABSTRACT

Tomato (*Solanum lycopersicum* L.) cultivation in commercial growing pockets of Himachal Pradesh is severely affected due to bacterial wilt disease (caused by *Ralstonia solanacearum*). Being safe and better in quality, the demand for organic tomatoes is increasing day by day, for which high yielding organic input responsive varieties/hybrids with more pest tolerance/resistance are required. Keeping these points in view, the present investigation was undertaken to estimate the extent of *per se* performance and heterosis, under organic farming system. Eight diverse genotypes viz., CLN 2070, CLN 2123 A-1 red, Hawaii 7998, Palam Pride, 12-1, BWR-5, ArkaAbha and ArkaMeghali and their 28 cross combinations developed in half diallel mating design were evaluated along with standard check Avtar (7711) in bacterial wilt sick plots in RBD with three replications under organic farming system. The analyses of variances indicated significant differences among genotypes (G) for marketable yield and other component traits in all the environments. Also, significant differences for environment (E) and G × E interaction for most of the traits indicated a definite role of environment on the performance of genotypes/crosses. Most of the hybrids and parents showed 100 per cent plant survival. On the basis of *per se* performance, heterosis for marketable fruit yield and component traits, the cross combinations viz., 12-1 × BWR-5, Palam Pride × BWR-5, Palam Pride × 12-1 and Hawaii 7998 × 12-1 were the most promising and surpassed the standard check (Avtar). These hybrids were also resistant to bacterial wilt and can be further exploited.



### VARIANCE STUDIES IN M<sub>3</sub> MUTANT LINES OF SORGHUM (*SORGHUM BICOLOR*, L.).

<sup>1</sup>Navinkumar, M., <sup>2</sup>Girish, G., <sup>3</sup>Ashok, M.B., <sup>4</sup>Ravi Kumar, A., <sup>5</sup>Yogeesh, L. N., and <sup>6</sup>Muniswamy, S.

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#### ABSTRACT

The variance study was conducted with 100 genotypes along with 7 checks viz., DJ 6514, IS 2312, M 35-1, GS 23, DSV-4, E-36-1 and SPV-86. Analysis of variance for characters viz., days to 50 per cent flowering, days to maturity, plant height, panicle length, panicle weight, panicle width and grain yield per plant revealed that significant difference for all the characters studied except for stem girth and 100 seed weight indicating that the traits studied are genetically diverse. This indicated that there was ample scope for selection of promising mutant lines from present gene pool for yield improvement. Genetic variability studies revealed high heritability coupled with high genetic advance as per cent of mean was observed for traits viz., panicle width, grain yield per plant and fodder yield, which denotes that these traits were controlled by additive gene action and hence these traits can be fixed by selection. Moderate GCV and PCV coupled with high heritability and genetic advance was observed for plant height, number of leaves, stem girth and 100 seed weight indicating little improvement in yield can be achieved through selection of these traits.

### CORRELATION STUDIES IN M<sub>3</sub> MUTANT LINES OF SORGHUM (*SORGHUM BICOLOR*, L.)

<sup>1</sup>Navinkumar, M., <sup>2</sup>Girish, G., <sup>3</sup>Ashok, M.B., <sup>4</sup>Yogeesh, L. N., <sup>5</sup>Ravi Kumar, A. and <sup>6</sup>Muniswamy, S.

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#### ABSTRACT

The correlation study was conducted with 100 genotypes along with 7 checks viz., DJ 6514, IS 2312, M 35-1, GS 23, DSV-4, E-36-1 and SPV-86. The characters viz., number of leaves, plant height, stem girth, panicle length, and panicle width had significant positive correlation with grain yield at phenotypic level indicating the role and importance of these traits in development of superior lines with high yield. The traits like, number of leaves, stem girth, 100 seed weight, fodder yield, panicle length, days to maturity, panicle width and plant height shows high magnitude positive direct effects on grain yield indicating that importance should be given for these traits during selection of mutants for yield improvement.

### DIVERSITY STUDIES IN M<sub>3</sub> MUTANT LINES OF SORGHUM (*SORGHUM BICOLOR*, L.)

<sup>1</sup>Navinkumar, M., <sup>2</sup>Girish, G., <sup>3</sup>Ashok, M.B., <sup>4</sup>Yogeesh, L. N., <sup>5</sup>Ravi Kumar, A. and <sup>6</sup>Muniswamy, S.

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#### ABSTRACT

The diversity study was conducted with 100 genotypes along with 7 checks viz., DJ 6514, IS 2312, M 35-1, GS 23, DSV-4, E-36-1 and SPV-86. A wider genetic diversity was observed for the different traits studied among the mutant lines as evidenced by the formation of seven clusters. The grouping of 100 mutant lines into seven clusters showed positively skewed distribution. The analysis of Cluster pattern revealed that, highest number of mutants are present in cluster-I (35), followed by cluster-II (27), cluster-IV (18), cluster-III (8), cluster-VI (6), cluster-V (5) and cluster-VII is a solitary one. The pattern of distribution of genotypes into various clusters was at random suggesting that the genetic diversity was not related to geographic diversity. Out of ten character studied, the trait fodder yield contributes 49.62 per cent, followed by Plant height



contributes 42.92 per cent, seed yield contributes 5.48 per cent, days to maturity contributes 1.38 per cent, panicle length contributes 0.04 per cent and Days to 50% flowering contributes 0.04 per cent towards total divergence. panicle width, 100 seed weight, stem girth and number of leaves have shown zero per cent contribution towards genetic divergence signifying that the divergence is mainly due to fodder yield.

## **1 NUTRIENT LOSSES FROM SOIL : CAUSES AND MITIGATION MEASURES**

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### **ABSTRACT**

Optimum amount of nutrients are required for the healthy development of a crop and the sustainability of healthy soil. Only a small portion of the applied nutrients are used up by the plants and the rest is lost by different means. The common ways by which almost all nutrients are lost are erosion and leaching. The nutrient loss from soil occurs through leaching, volatilization, crop removal, erosion and runoff. Use of controlled release fertilizers, coated fertilizers, urease and nitrification inhibitors and split application of fertilizers are the common measures that are used to reduce these losses. Novel techniques like use of biochar, nano-fertilizers, nanocomposites, zeolite and polymer compounds slow down the release rate of nutrients and increases the use efficiency of fertilizers. Through proper management and judicious application of fertilizers, loss of nutrients can be reduced and can thus maintain healthy soil and pollution free environment.

## **IMPORTANCE OF BIOPESTICIDE IN INTEGRATED PEST MANAGEMENT SPECIALLY IN SUGARCANE**

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Sugarcane is a leading cash crop of India and it is attacked by more than 100 insects pests. Sugarcane insect pest play a very important role in sugarcane farming, quality and same as production. Excessive use of chemical insecticides for control them, especially western U.P sugarcane cultivars have adverse effects on agro eco systems, environmental as well as human health. Conventional insecticides inherent toxicities to the environment, all living organisms and Our food chain also. So now there is a need of modern concept of integrated pest management based upon many tactics such as timing, selection, manual practice as well as biological control and last option is chemical control. Though many several options but biopesticide are very useful technique, that discourages the development of population of damaging organisms. The exploit of helpful organisms or natural enemies remains a useful tool in IPM. The conclusion is use of biopesticide is a very effective tactic in IPM, because it is less toxic than conventional insecticides, it is generally affect only the target insect pest (e.g *Beauveria bassiana* are only target the termite when it is used in soil application of sugarcane crop), effective in very less quantity and decompose quickly, resulting in lower exposure and largely avoiding pollution problems, so in this way biopesticide interact with other IPM. control measures i.e. Natural enemies has been accepted as a ecofriendly, environmentally non degrading, sparing and liberal procedure of insect pest management.

## **BARNYARD MILLET—A POWER HOUSE OF HEALTH BENEFITING NUTRIENTS**

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### **ABSTRACT**

Barnyard millet (*Echinochloa frumentacea*) is a multipurpose crop which is cultivated for food and fodder. It has an excellent rejuvenating capacity compared to other crops. It is one of the hardiest millets, which called by several other names viz., oadalu, sawan, sanwa and sanwank. Nutritionally barnyard millet is an important crop. It is a fair source of protein, which is highly digestible and is an excellent source of dietary fibre with good amounts of soluble and insoluble fractions. Barnyard millet has been found to be most effective in reducing blood glucose and lipid levels. Hence, an investigation was undertaken





with an objective to find the nutritional composition of barnyard millet. Nutrient content was estimated by using standard procedure. The results revealed that protein content in barnyard millet was found to be 6.3 g, fat 2.5 g, total ash 1.9 g, crude fibre 9.9 g, carbohydrates 71.1 g, energy 333Kcal per 100g and total dietary fibre content was 12.43g in that soluble and in soluble dietary fibre was found to be 4.63 g and 7.90 g per 100g respectively. The high fibre content helps in preventing constipation, excess gas, bloating and cramping. Thus for the health conscious consumer of the present world. Minor millet especially barnyard millet is perhaps one more addition to the proliferating list of healthy foods, owing to its nutritional superiority. Hence incorporation of barnyard millet flour in different ratio may enhance the nutritional value of the processed food.

## **NUTRITIONAL QUALITY AND PHYSICAL PROPERTIES OF MINOR MILLETS IN COMPARISON WITH STAPLE CROPS**

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### **ABSTRACT**

High awareness among the public with regard to nutritional content of millets has influenced more people towards consumption of millets regularly in all the daily meals even to an extent of replacing regular or traditional cereals in their daily diet. Hence the present study was undertaken with an objective to find the nutritional and physical property of minor millets in comparison with staple crops. Minor millet such as finger millet, foxtail millet, kodo millet, proso millet, little millet, barnyard millet and staple crops like rice and wheat were selected for the study. The result revealed that ash content of rice and wheat ranged from 0.56 to 1.38g per 100 g which is comparatively lower than that of minor millets ranging from 1.44 to 2.96 g/100g. In rice and wheat fat, fibre, protein and carbohydrates ranged from 0.56 to 2.03, 0.35 to 1.35, 6.55 to 11.5, 74.94 to 83.08 g/100g respectively. Comparatively highest content of proximate values were obtained in millets in which fat, fibre, protein and carbohydrate ranged from 0.85 to 4.20, 2.20 to 9.80, 6.05 to 12, 65.80 to 74.12 g per 100 g respectively. Highest hydration capacity, hydration index, swelling capacity and swelling index were observed in wheat as compared to that of rice and minor millets.

## **SLOW-RELEASE EXOGENOUS MELATONIN ON SEXUAL BEHAVIOUR SCORES AND ANTIOXIDANT AND OXIDATIVE STRESS PROFILES IN INDIGENOUS BUCKS OF ANDAMAN AND NICOBAR ISLANDS**

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### **ABSTRACT**

Teressa and Andaman local goat breeds are indigenous goat germplasm of Andaman and Nicobar Islands. The present study was carried out to assess the effect of slow-release subcutaneous exogenous melatonin (MT) implant on sexual libido/behaviour scores, antioxidant and oxidative stress profiles of bucks in rainy and dry summer seasons. The experimental animals (3-4 years) were divided into two groups, Gr I: Control (n=6) and Gr II: Treatment (n=6; melatonin im plant @ 18mg/50 kg B. Wt). The seasons were grouped into rainy and monsoon based on the meteorological data such as rainfall, temperature humidity index (THI) and sunshine hours. Sex behaviour scores such as sex libido score, mating ability score and sexual behaviour score, antioxidant profiles such as total antioxidant capacity (TAC), catalase (CAT), glutathione (GSH), glutathione reductase (GSHRx) and superoxide dismutase (SOD) and oxidative profile such as malondialdehyde (MDA) were estimated during different seasons for MT treated and untreated control groups. Statistical results revealed that the sex behaviour scores and antioxidant & oxidative profiles differed significantly ( $p < 0.05$ ) between the treatment and control groups within the season and between the seasons in both the experimental groups. Similarly sexual behaviour/libido scores and antioxidant profiles were significantly ( $p < 0.05$ ) higher whereas oxidative profile was significantly ( $p < 0.05$ ) lower in MT treated than in untreated control group. Similarly, antioxidant profiles were significantly ( $p < 0.05$ ) higher and oxidative profile was significantly ( $p < 0.05$ ) lower in rainy than in dry summer season in both the experimental groups. Results on sexual behaviour profiles revealed that these sexual behaviour scores were significantly ( $p < 0.05$ ) higher in rainy than in dry summer season for both experimental groups. It can be concluded from the study that slow-release melatonin implantation and



rainy season has significantly ( $p < 0.05$ ) greater beneficial effects on improvement of the antioxidant profiles, minimization of oxidative stress in goat bucks of Andaman and Nicobar Islands.

## IMPACT ON QUALITY OF AONLA (*EMBLICA OFFICINALIS* GAERTN.) BY PHYSICO-CHEMICAL CHANGES DURING GROWTH AND DEVELOPMENT

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### ABSTRACT

Physiological maturity in aonla is mainly determined on the basis of specific gravity, ground colour, fiber content, seed colour and TSS/ acid ratio. Gradual increase was observed in average fruit weight, stone weight, pulp weight, pulp: stone ratio, total soluble solids and ascorbic acid with the advancement of maturity in aonla under northern Indian conditions. Harvesting of fruits at proper stage of maturity is desirable for maintaining the quality and consumer acceptability. Keeping in view above facts the present investigation entitled “Studies on physico-chemical changes during growth and development of Aonla (*Emblica officinalis* Gaertn.) fruit cv. Narendra Aonla-10” is carried out with objectives to observe the physical and chemical changes during growth & development of fruits and the maturity index for right stage of fruit harvesting during 2019-2020 at Main Experimental Station of Department of Horticulture, A.N.D. University of Agriculture and Technology, Kumarganj - Ayodhya (U.P.). Results showed that all physiochemical parameter of growth and development viz- length, width, weight, pulp / fiber percentage showed significant change from 6<sup>th</sup> August to 6<sup>th</sup> December and then showed non-significant change till 6<sup>th</sup> January. Pulp / seed ratio, Vitamin C and total sugar increased up to maturity. Therefore, fruit of aonla variety NA-10 indicated maturity between 6<sup>th</sup> December to 6<sup>th</sup> January and this stage showed right stage of harvesting.

## GAMMA INDUCED MUTANTS OF TRICHODERMA: THREAT TO SOIL BORNE PATHOGENS

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### ABSTRACT

Excessive use of chemicals for the control of the soil borne pathogens is costly and restricted effects and also hazardous to soil. Therefore, the biocontrol is safe and ecofriendly approach in controlling the disease and pest. Now, Induced mutation by gamma radiation is one of the genetic manipulation strategies to improve the antagonistic ability of biocontrol agents. So by this we get more sporulation, colonization rate leading to enhanced antagonistic ability. The superior mutants could be appropriate biocontrol agents against soil borne fungal diseases. This technique is useful to improve the delivery and efficacy of the mutant biocontrol agents against soil borne plant pathogens which are difficult to control. So the Gamma Induced Mutation will really provide a valuable tool for sustainable disease and pest management.

## SLOW-RELEASE EXOGENOUS MELATONIN MODULATES ENDOCRINOLOGICAL PROFILES AND SCROTAL CIRCUMFERENCE AND TESTICULAR BIOMETRICS IN INDIGENOUS BUCKS OF ANDAMAN AND NICOBAR ISLANDS

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### ABSTRACT

Teressa and Andaman local goat breeds are indigenous goat germplasm of Andaman and Nicobar Islands. The present study was carried out to assess the effect of slow-release subcutaneous exogenous melatonin (MT) implant on endocrinological profiles, scrotal circumference (SC) and testicular biometrics of goat in rainy and dry summer seasons. The experimental animals (3-4 years) were divided into two groups, Gr I: Control (n=6) and Gr II: Treatment (n=6; melatonin implant @



18mg/50 kg B. Wt). Testicular biometrics & SC, endocrinological profiles such as follicle stimulating hormone (FSH), luteinizing hormone/interstitial cell stimulating hormone (LH/ICSH), testosterone, thyroxine (T4) and cortisol were estimated during different seasons for MT treated and untreated control groups. Statistical results revealed that the SC & testicular biometrics, endocrinological profiles differed significantly ( $p < 0.05$ ) between the treatment and control groups within the season and between the seasons in both the experimental groups. FSH, LH/ICSH and testosterone were significantly ( $p < 0.05$ ) higher whereas concentration of T4 and cortisol were significantly ( $p < 0.05$ ) lower in MT treated than in untreated control group. Significantly ( $p < 0.05$ ) greater SC was observed in cool rainy and lowest was in dry summer season and significantly ( $p < 0.05$ ) greater in treated than in untreated control group. The hormone profiles such as FSH, LH/ICSH, testosterone and T4 were significantly ( $p < 0.05$ ) greater and cortisol was significantly ( $p < 0.05$ ) lower in rainy than in dry summer season in both the experimental groups. It can be concluded from the study that slow-release melatonin implantation and rainy season has significantly ( $p < 0.05$ ) greater beneficial effects on improvement of the endocrinological profiles and scrotal & testicular biometrics in goat breeds of Andaman and Nicobar Islands.

## **ROLE OF NANOTECHNOLOGY IN PEST MANAGEMENT**

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### **ABSTRACT**

Nanotechnology is rising in agriculture, and it gives efficient and sustainable food production by improving rapid diagnosis and detection of different diseases and pest incidence in plants using nanoformulations, develop the ability of plants to control diseases and environmentally safe operation of chemicals and increasing the efficacy of pesticides by using only little one doses through nano-based materials. nanoformulations of pesticides, nanosensors, and the formation of nanoparticle-mediated resistant crop varieties are a part of the spectrum of agricultural nanoapplications. the use of nanomaterials has been considered as substitute solution to control plant pests including insects, fungi and weeds. plenty of nanoparticles (Ag, Fe, Cu, Si, Al, Zn, ZnO, TiO<sub>2</sub>, CeO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub> and carbon nanotubes) have been reported to have some disadvantageous effects on plant growth apart from the antimicrobial properties. nano-particles combined with bio-molecules with specific affinity (e.g. antibodies or aptamers) persuade the selectivity and specificity of targets. Those nanoparticles with small size to large surface area (1–100 nm) have several possible functions. nano-particles can add as ‘magic bullets’, containing herbicides, nano-pesticides, fertilizers, or genes, which target specific cellular organelles in the plant to release their content. Nano-particles are highly stable and biodegradable active compounds protected in capsules, they are not degraded by external agents or the crop plant itself, and are not involuntarily spread into the soil, allowing the use of a reduced number of active compounds for plant analysis and therefore causing a lower environmental impact.

## **CHANGES IN CHARACTERISTICS OF REFINED PALM OIL DURING VACUUM FRYING CONDITIONS OF CARROT SLICES**

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### **ABSTRACT**

The aim of this study was to determine frying oil quality with different assessment methods during vacuum frying of carrot slices. The refined palm oil was heated under different processing conditions viz., frying temperature (100°C), pressure (13 kPa) and time (25 min) for 40 batches. Quality evaluation was conducted for the used oil, after completion of every batch of vacuum frying. By using the refined oil repeatedly, the oil undergoes some changes in quality parameters viz., viscosity, total polar compounds (TPC), free fatty acids (FFA), peroxide and colour values. Viscosity, TPC, FFA, Peroxide and Color values was measured by brook field viscometer, Testo270<sup>0</sup>, Rapid analysis equipment (CDR food lab, Italy) and hunter lab colorimeter, respectively. The results revealed that Viscosity, TPC, FFA and peroxide values was increased from 35.4 to 43.12



centi poise, 5.54 to 15.81 %, 0.18 to 0.90 mg KOH/g, 0.21 and 30.4 meq O<sub>2</sub>/kg, respectively. The color value of L\* was decreased from 4.72 to 2.58 and a\* and b\* were increased from, 0.35 to 1.78 and 1.48 to 2.01, respectively. All the oil quality parameters were within the allowable limits even after 40 batches of vacuum frying.

## SCREENING OF RICE CULTURES FOR RESISTANCE TO SHEATH ROT CAUSED BY *SAROCLADIUM ORYZAE*

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### ABSTRACT

Rice (*Oryza sativa*) plays a significant role in achieving global food security. However, it suffers from several biotic and abiotic stresses that affect its production as well as productivity. Sheath rot of rice caused by *Sarocladium oryzae* is now getting momentum and causing considerable yield losses. Varietal resistance is the most cost-effective and eco-friendly management strategy for the small-scale farmers. During 2019-20, *Rabi* in an investigation thirty pre-release rice cultures which were developed at Agricultural Research station, Bapatla, screened against sheath rot under natural disease pressure conditions at Agricultural Research Station, Nellore. Among them BPT3032 was identified as resistant (score 1), twenty-six cultures viz; BPT2858, 2953, 2938, 2863, 2954, 2910, 2824, 2846, 2854, 2850, 2776, 2950, 2766, 3137, 3145, 3142, 3031, 3082, 3143, 3141, 3111, 3136, 2795, 2932, 3164 and 3072 were found moderately resistant (score 3) and BPT 2848, 2841, 3140 were found moderately susceptible. The identified resistant culture, BPT 3032 can be used in further breeding programmes for development of rice varieties having resistance to the disease.

## IDM : SIGNIFICANT APPROACH IN PLANT PATHOLOGY

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### ABSTRACT

Integrated disease management (IDM), which combines biological, cultural, physical, mechanical and chemical control strategies in a holistic way rather than using a single component strategy proved to be more effective and sustainable. So, integrated plant disease management approach is very much useful for controlling the pathogen in plant pathology. Integrated approach integrates preventive and corrective measures to keep pathogen from causing significant problems, with minimum risk or hazard to human and desirable components of their environment. It also reduces the environmental risk associated with management by encouraging the adoption of more ecologically benign control tactics. So, IDM is a valid and innovative concept in many crops with a great potential.

## EFFECT OF POST PARTUMANESTRUS ON HEAMATOLOGICAL, BIOCHEMICAL AND ENDOCRINOLOGICAL PROFILES IN CROSSBRED COWS UNDER HUMID TROPICAL ISLAND ECOSYSTEM

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### ABSTRACT

A study was carried out to assess the effect of post partumanestrus (PPA) on hematological, antioxidant and endocrinological profiles in crossbred cows under tropical island ecosystem of Andaman and Nicobar Islands. Based on the records, the cows that had shown anestrus for more than 120 days were selected in PPA group while cows coming in estrus before 65 days of postpartum for more than three successive lactations involving present lactation were selected in normal cyclic group (control group). Blood samples were collected, analysed for hematological profiles and serum separated, analysed the antioxidant profiles such as catalase (CAT), superoxide dismutase (SOD), glutathione (GSH), total antioxidant capacity (TAC) and free radical such as malondialdehyde (MDA) and hormone profiles such as follicle stimulating hormone (FSH), luteinizing





hormone (LH), estradiol 17 (E2), progesterone (P4), cortisol (CORT) and thyroxin (T4) were estimated. The result revealed that the crossbred cows of ANI with PPA were suffered severe anaemia. PPA affected cows were shown significantly ( $p < 0.05$ ) low level of antioxidant profiles and higher MDA level than the unaffected animals. Similarly, endocrinological profiles revealed the PPA affected cows were have significantly ( $p < 0.05$ ) higher level of CORT and lower level of E2, P4, FSH, LH and T4 than the unaffected crossbred cows. PPA was due to anaemia, lack of antioxidants, over production of free radicals and disturbances of endocrinological profiles. A balanced, limited ration with good quality and quantity of antioxidants, sufficient daily exercise and sufficiently large, clean drinking water can minimize the PPA in crossbred cows.

## **EMBRYO RESCUE TECHNIQUE : A NOVEL TECHNOLOGY FOR CROP IMPROVEMENT**

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### **ABSTRACT**

The term “embryo rescue” refers to in vitro techniques whose purpose is to promote the development of an inherently weak, immature or hybrid embryos into a viable plant. Depending on the organ cultured, embryo rescue is referred to as embryo, ovule, or ovary culture. It is most often used to rescue embryos from interspecific and intergeneric crosses and from embryos that do not fully develop naturally. Wide hybridization involving crossing of two different species of plants from the same genus or different genera often results in failure, due to failure of zygote formation, zygote development and hybrid seedling development. Failure of zygote formation occurs due to the inability of the pollen tube to reach the embryo sac (pre-fertilization barrier) and failure of zygote development (postfertilization barrier) may take place due to lethal genes, genotypic disharmony between genomes of the two parental species, chromosome elimination, incompatible cytoplasm and endosperm abortion. Endosperm abortion occurs due to inability of the young endosperm to continue development and provide nutrition to developing young embryo. The endosperm may abort during early embryo development preventing further development of the embryo or it may abort at a later stage allowing an almost complete development of the embryo. For example, in the cross between Triticum and Secale, endosperm aborts at such a late stage that a small frequency of viable seeds is also obtained. Endosperm abortion can be overcome by embryo rescue technique by culturing young hybrid embryo on a suitable culture medium.

## **BIO-DIVERSITY AND INTELLECTUAL PROPERTY RIGHTS : TODAY’S BLAZINGISSUE**

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### **ABSTRACT**

Existence on earth is bounded by biological diversity and is the backbone of sustainable development. Therefore, there is an invariable threat to the bio-diversity due to the gratuitous interferences and the traditional knowledge is often altered. Through the adoption and implementation of the CBD and TRIPS, the concept of protecting the biodiversity through IPR came into attention. Now a day, globally the traditional knowledge associated with the particular thing is commercially used and this really turns into a major threat to biodiversity. Hence, it is imperative to see the importance of protecting the biodiversity and the extent to which the intellectual property laws help in ensuring the protection of biodiversity. So this is a blazing issue and should be taken into consideration for effective use for the protection of the bio-diversity.

## **NON-DESTRUCTIVE QUALITY EVALUATION TECHNIQUES FOR FRUITS AND VEGETABLES**

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### **ABSTRACT**

Quality is a term which exhibits the degree of excellence, a high standard or value. Fruits and vegetables with superior sensory



and nutritional qualities have high economic value. Now-a-days, measuring the quality without injuries has special position in post-harvesting and processing of agricultural products. In this regard, various non-destructive methods have been developed to detect internal properties of crops. Types of non-destructive techniques are computer vision system, near infrared spectroscopy, magnetic resonance imaging, X-Ray & computed tomography imaging, ultrasonic technique and E-Nose. a) In computer vision system, an image is captured, processed and classified based on quality attributes using classification algorithm. b) Whenever near infrared radiation is applied to food, unique chemical composition of matter causes molecules to absorb NIR radiation and vibrate at unique frequencies and absorbance at different wavelengths relates to different constituent composition. c) Whenever magnetic field applied to food, radio waves transfer to sample, turn off radio waves, receive waves transmitted by food and convert to image. d) X-ray imaging technique, monochromatic X-ray wave passes through a material, change in X-ray intensity after transmission from food is used to detect defects and X-ray CT imaging technique is used to provide both 2-D and 3-D images using multiple projections of an object. e) Whenever ultrasound waves interact with material some of energy scattered and absorbed, change in attenuation and velocity of waves is used to detect internal defects. f) E-nose is used to detect and discriminate among complex odors using a sensor array which is already trained.

## MORPHOLOGICAL AND PHYSIOLOGICAL PEEK THROUGH TO UNRAVEL WEED COMPETITIVE ABILITY IN IRANIAN WHEAT LANDRACES UNDER ORGANIC CONDITIONS

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### ABSTRACT

Weed competitiveness, a prime obstacle hindering productivity of major global food resources including wheat (*Triticum aestivum* L.), becomes more challenging under organic production systems that refrain usage of synthetic agro-chemical. Approximately 95% of organic wheat production is based on crop varieties that were bred originally for the conventional high-input agricultural sector. Difference in the trait requirements under high- and low- input conditions makes it pivotal to undertake breeding for crop competitive ability specifically under organic systems; genetic heterogeneity for which is known to exist among wild varieties, landraces and obsolete cultivars. In the present study, a total of 249 Iranian wheat landraces were evaluated under organic system in 2019-2020 and 2020-2021 for various morphological and physiological traits conferring competitive ability. Experimental site was observed to be infested with a species rich weed community comprising both grass and broad leaf weeds. About 70% of landraces displayed extensive variation for early vigor and canopy cover attributes that allowed either the suppression of the weed growth or either co-existed with the weeds while maintaining their fitness as was reflected in terms of their crop stand and harvest. On the other hand, growth of certain landraces was suppressed due to weed pressure. Weed biomass of few landraces such as IR76 (Early Vigor Index-EVI 3), IR165 (EVI 5), IR 212 (EVI 4) and IR240 (EVI 4) was observed to be the highest i.e., 12.68g, 11.99g, 13.41g and 13.53g, respectively. Few landraces possessing the highest EVI (5) demonstrated the lowest plot weed biomass. SPAD and NDVI values recorded during the flowering stage ranged between 8.50 – 27.2 units and 45 – 90% respectively, impervious to respective early growth vigor indexes. Overall, the immediate applicability of the present study lies in to facilitate identification of potential donors for pyramiding traits in elite cultivars that eventually leads towards varietal development with superior weed competitive ability and maximized yield potential specifically for low input organic management conditions.

## PRODUCTIVITY, PROFITABILITY, ENERGETICS AND NUTRIENT UPTAKE OF POSTKHARIFRICE-COWPEA PRECEDED BY RICE VARIETIES GROWN UNDER DIFFERENT ESTABLISHMENT METHODS

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### ABSTRACT

A field experiment was conducted at Agronomy Main Research Farm, Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar, Odisha during of 2014-15 and 2015-16 to evaluate the productivity, profitability, energetics and nutrient uptake



of post *kharif* rice-cowpea preceded by rice varieties grown in *kharif* under different establishment methods. The treatments comprising three establishment methods (Direct Seeded Rice, Non Puddled Transplanted Rice and Puddled Transplanted rice) and three variety/hybrids of rice ('Arize 6129', 'Arize 6444' and 'Swarna') were tried in split plot design with three replications. The Puddled Transplanted Rice (PTR) recorded the maximum rice equivalent yield ( $8.43 \text{ t ha}^{-1}$ ) for post *kharif* rice-cowpea which was at par with NPTR ( $8.34 \text{ t ha}^{-1}$ ) and the minimum of  $6.85 \text{ t ha}^{-1}$  was recorded under Direct Seeded Rice (DSR). The total cowpea biomass yield was the maximum under NPTR and the minimum under DSR. The maximum gross return of 1,20,380/-, total energy output of 2,25,045 MJ  $\text{ha}^{-1}$  and energy use efficiency of 8.59 was recorded under PTR, NPTR and DSR, respectively. Uptake of nitrogen was higher under NPTR while phosphorus and potassium uptake values were higher under PTR. The rice cultivar/hybrids grown in *kharif* had no significant effect on yield, economics, energetics and uptake of nutrient, but hybrid 'Arize 6129' recorded higher mean values than hybrid 'Arize 6444' and cv. 'Swarna'.

## EMPOWERING RURAL YOUTH FOR A SUSTAINABLE LIVELIHOOD IN AGRO BASED ENTERPRISES UNDER ARYA PROJECT

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### ABSTRACT

Creating interest and building confidence among rural youth in agriculture, is difficult but not impossible, as the available evidences of profitable agriculture have proved under varied situations. Retaining youth in agriculture, is therefore strongly linked to agriculture. There is a noticeable increase in the migration of rural youth to urban areas, in search of better livelihood opportunities due to the apparent differences in basic amenities, communication, health and education facilities between rural and urban areas. Realizing the importance of rural youth in agricultural development, the Indian Council of Agricultural Research has initiated a project on "Attracting and Retaining Youth in Agriculture" (ARYA) through KVKs, one district from each State. It is envisaged in the project that the rural youth can be attracted in agriculture by providing them gainful employment in rural areas by engaging them in different enterprises which could regularly provide income to them in a sustainable manner. A total of 200 rural, unemployed, educated youths between 18 and 35 years of age were selected for the project by KVK Mahendergarh. Different vocational training programmes for four enterprises, viz. bee keeping, processing and value addition, vermicomposting and mushroom production were imparted and equipment assistance for establishment for enterprise was also provided to promising youths under the project. The output and outcome of the study over the last two years (2019– 2021) revealed that a total of 79 rural youths from 18 villages have been running the various enterprises successfully and generating a handsome income of Rs 48,000–3,60,000, and providing the employment opportunity of 213–1150 man-days in the villages. The results of the study revealed that skill development training programmes were very useful to the rural youth to earn their livelihood through agro-based enterprises and improve agriculture income with the supplementation of this income.

## SOIL HEALTH MANAGEMENT AND PRACTICES : KEY FACTOR FOR CROP PRODUCTIVITY

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### ABSTRACT

Globally, food systems face many challenges, including optimum yield, and maintaining and/or increasing crop nutritional quality, adapting to a changing climate, minimizing environmental impacts. A basic assessment of soil health is necessary to evaluate the degradation status and changing trends following different land uses and management interventions. It is crucial to distinguish soil quality & soil health, soil quality is related to soil function, whereas soil health presents the soil as a finite, non-renewable, and dynamic living resource. Soil quality indices are decision tools that effectively combine a variety of information for decision-making. Use of integrated approaches in the management of soil nutrients, water, pest and disease, crop productivity, etc., has been widely discussed in soil health management. Soil health frameworks are comparatively recent initiatives, there are thousands of published conservation agriculture studies that examine yield outcomes with cover crops, no-till, and rotation. This literature indicates that Soil health practices can also have neutral or negative yield impacts only in select systems have consistent yield increases been realized, highlighting the need for language clarification and



improvements in mechanistic understanding of regional scale yield impacts. Management techniques that focus on soil health are promising solutions to mitigate some environmental impacts and may increase economic returns. The key sustainability factors for high productivity systems in the long run mainly depend on soil health, which is the function of soil structural stability, hydrological properties, nutrient build up and retention, efficient nutrient cycling and mobilization to the crop plants.

## **BIOFORTIFICATION : A NUTRITIONAL SECUREITY AND APPROACH TO FIGHT AGAINST MALNUTRITION**

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### **ABSTRACT**

So far, our agricultural system has not been designed to promote human health; instead, it only focuses on increasing grain yield and crop productivity. Biofortification is the idea of breeding crops to increase their nutritional value. This can be done either through conventional selective breeding, or through genetic engineering. It is an upcoming, promising, cost-effective, and sustainable technique of delivering micronutrients to a population that has limited access to diverse diets and other micronutrient interventions. Unfortunately, major food crops are poor sources of micronutrients required for normal human growth. The manuscript deals in all aspects of crop biofortification which includes—breeding, agronomy, and genetic modification. It tries to summarize all the biofortification research that has been conducted on different crops. Success stories of biofortification include lysine and tryptophan rich quality protein maize, Vitamin A, rich orange sweet potato, generated by crop breeding, oleic acid, and stearidonic acid soybean enrichment, through genetic transformation and selenium, iodine, and zinc supplementation. The biofortified food crops, especially cereals, legumes, vegetables, and fruits, are providing sufficient levels of micronutrients to targeted populations. Although a greater emphasis is being laid on transgenic research, the success rate and acceptability of breeding is much higher. Besides the challenges biofortified crops hold a bright future to address the malnutrition challenge.

## **ATTITUDE OF FARMERS TOWARDS KISAN CALL CENTRE**

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### **ABSTRACT**

Kisan Call Centre plays crucial role in transfer of technology for the development of agriculture. The current pandemic situation highlights the importance of Kisan Call Centers (KCC) as the services are provided on phone calls i.e. without physical proximity. The present study was undertaken in Baramati and Rajgurunagar tehsils of Pune district with a sample size of 120 respondent farmers. The statement wise attitude of respondent farmers revealed that most of the respondent farmers (95.83 per cent) had highly favourable attitude regarding the KCC that they thought other farmers should also get benefited. 93.33 per cent caller farmers had highly favourable attitude with regards to Kisan Call Centre saves farmers labour, time, money, etc. of farmers. It was further observed that majority of the respondent farmers (65.00 per cent) had moderately favourable attitude towards Kisan Call Centre.

## **SCREENING OF UNIFORM DISEASE NURSERY TRIALS UNDER NATURAL (UDN) AND ARTIFICIAL CONDITIONS (UDNA)**

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### **ABSTRACT**

A field experiment was conducted during rabi 2020-2021 to study the source of resistance on disease control in linseed. Among the different entries of Under uniform disease nursery trial (UDN) natural condition out of 65 genotypes tested,





Whereas, 11 genotypes were found Resistant i.e. 1 grade infection, while 21 genotypes showed moderately resistant and 26 and 7 genotypes showed moderately susceptible and susceptible reaction respectively. Under uniform disease nursery trial (UDNA) artificial condition, the inoculums were sprayed twice and the disease reaction was recorded. Out of 46 test entries, 1 entries shown resistant i.e. I grade infection. Others 28 entries shown moderately resistant and 14 entries were moderately susceptible reaction and 3 entries were found susceptible reaction.

## POTENTIAL APPLICATION OF FRUITS AND VEGETABLE BY PRODUCTS

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### ABSTRACT

Fruits and vegetables are mostly used for making food products and food processing industries after use of pulp removed the inedible portions. A research found large amount of peel, pomace, and seed are waste through the industries and kitchens. According to FAO 40 percent waste of fruits and vegetable in India. These wastages have contained higher amount in phytochemicals, bioactive compounds, enzymes, pigments, flavouring agent and antioxidant properties. The present review focused on byproducts of fruits and vegetables wastage. It applies on pharmaceutical, cosmetic, food industries as a microbial media, fortified probiotics, edible product coating, Biochar and bio sorbent etc. Utilization of indigestible part and create to form a byproducts have good impact on environment and helps to increase economic productivity.

## STUDIES ON ECONOMIC RETURN TO THE FARMER WITH VARYING LEVELS OF NITROGEN AND PLANT GROWTH REGULATORS IN MAIZE (ZEA MAYS L.) CROP IN SANDY LOAM SOIL.

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### ABSTRACT

Cost of cultivation for each treatment was worked out separately taking into consideration all the cultural practices followed and cost of inputs used in the cultivation in rupees. The experiment was carried out at department of Agronomy, SHUATS, Naini, Prayagraj in sandy loam soil during Rabi season of 2019-20 taking high yielding variety of maize i.e. K-27 recommended for U.P. The experiment was planned in RBD having 12 treatments with three replications. Three levels of nitrogen and three PGRs were used at various stages of maize growth. Perusal of table -1 revealed that gross return was maximum i.e. Rs. 96930.40/ha in treatment 10 (120 kg nitrogen /ha+NAA@40PPM), closely followed by treatment 12 (120kg nitrogen/ha +Putrescine@50ppm) i.e. Rs95849.91. Similar pattern was discernible from treatment 6 (100 kg nitrogen /ha+NAA @40ppm) with Rs.92311.71 and treatment 8 (100g nitrogen/ha+Putrescine@50ppm) i.e. Rs.91043.43. Net return (Rs/ha) of Rs 52172.80 was also maximum in treatment 10 which followed similar pattern as in gross return in treatment 12 and closely followed in treatment 6 and 8 i.e. Rs 50232.31, 47836.21 and 45707.93, respectively. Benefit to cost ration when calculated, it also recorded maximum i.e. 2.17 in treatment 10 and followed the same pattern as in net return in treatment 12 and treatments 6 and 8 i.e. 2.10, 2.08 and 2.01, respectively. Thus it could be concluded that benefit to cost ratio to the farmer in terms of rupees/ha was maximum when nitrogen was used @120 kg/ha with PGR, NAA @40ppm in sandy loam soil in K-27 variety of maize compared to other doses of nitrogen with Putrescine and Mepiquat Chloride plant growth regulators.

## BEHAVIOUR OF *CHRYSOPELRA CARNEA* (STEPHENS) TOWARDS SATURATED HYDROCARBONS

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### ABSTRACT

*Chrysoperla carnea* (Stephens) is an effective predator of sucking insect pests. Saturated hydrocarbons in form of volatile cues play a vital role in the communication between and within the species in an agro-ecosystem. These cues serve as



attractants or repellents and modify insect behavior patterns at inappropriate times. In the present study, three saturated hydrocarbons were selected viz., Nonadecane(C<sub>19</sub>), Tetracosane(C<sub>24</sub>) and Pentacosane (C<sub>25</sub>) and for each hydrocarbon, 1000 mg/L and 100 mg/L concentrations were prepared. The impact of these selected hydrocarbons was assessed by insect activity meter using Y-tube bioassay technique at 25±2°C and 65±5% RH. 5µl of selected hydrocarbons were applied on Whatman filter paper (2.0 cm X 0.4 cm), which served as a source while filter paper applied with 5 µl hexane served as a control. Source paper-card was inserted in one arm and a control paper-card was inserted in the other arm of the Y-tube olfactometer. The third/lower arm of the Y-tube olfactometer served as the entry point for predator *C. carnea*. A constant flow of air was maintained in the Y-tube olfactometer. Five replications were maintained, each for 20 mins duration. Data was recorded and tabulated. Results indicated that 1000 mg/L and 100 mg/L concentrations of Nonadecane (8.2 and 5.4, respectively) elicited highest positive response towards *C. carnea*, followed by Pentacosane (1.8 and 2.2, respectively). Tetracosane elicited negative response. Thus, the study conducted proclaimed that favorable hydrocarbon viz., Nonadecane(C<sub>19</sub>) and Pentacosane (C<sub>25</sub>), which elicited the positive response at optimal concentrations, can be exploited to enhance the foraging behaviour of *C. carnea*.

## DISORDERS OF THE SKIN AND BLOOD BIOCHEMISTRY IN DOGS

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### ABSTRACT

Dogs often suffer from dermatological conditions. In the present study, we examined the prevalence of different dermatological disorders in dogs, the haemato-biochemical changes, and the therapeutic efficacy of moxidectin and ivermectin in canine demodicosis. The prevalence study was conducted from January 2020 to December 2020. Out of 2156 cases, 537 (24.91%) were found to have severe dermatological symptoms. Among dermatological affections, sarcoptic mange infestations were the most common (34.64%), followed by ticks, lice, mite infestations, pyoderma and allergic dermatitis. The majority of skin disorders were recorded during the rainy season (38.92%), followed by the summer season (23.47%). There were more dermatological affections in males (56.93%) compared to females (43.07%). A high rate (37.81%) of dermatological affections was found in dogs aged between 1-3 years and a low rate (14.69%) was found in dogs older than 5 years. Compared to healthy dogs, dogs with demodicosis had significantly lower Hb, PCV, TEC, and albumin levels, while they had significantly higher neutrophils, eosinophils, total protein, albumin, ALT, and AST levels. Moxidectin and ivermectin were both equally effective against canine demodicosis and complete recovery was observed 14 days after treatment.

## MOBILE APPS FOR AGRICULTURE AND ALLIED SECTORS

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### ABSTRACT

In India the need for timely access to information for decision making in agriculture and allied sectors needs no emphasis. Keeping this in view various mobile apps have been developed by different organizations which enable the farmers to access market information, weather information, monitoring plant health, other services etc. Kisan Suvidha app, Pusa Krishi and Soil Health Card (SHC) mobile apps were developed by Ministry of Agriculture and Farmers Welfare, Govt. of India. *Kisan Suvidha app* provides information to farmers on weather, market prices, dealers, plant protection, IPM practices, seeds, expert advisory, soil health card, go downs and cold storage. Whereas, *Pusa Krishi app* provides information related to new varieties of crops developed by the ICAR, resource conserving cultivation practices, farm machinery and its implementation and production technologies, to the farmers. *SHC app* gives soil nutrient status to each farmer for his dosage and soil amendments needed to maintain soil health in the long run. *Crop insurance app* developed by Department of Agriculture & Farmers Welfare (DAC&FW) provides details of crop insurance. For plant pest and disease management *Krishi Video Advice mobile app* developed by MANAGE with NIC, Hyderabad. Any farmer/extension officer can use this mobile app to capture three images of the crop live from the farmers field itself and upload the same. The Kisan Call Centre expert will provide advise



based on the crop images. *Plantix* developed by PEAT, Germany used for plant disease diagnostics and monitoring. It offers the possibility to send pictures of affected plants directly via smartphone and guides through an identification process to determine the plant disease in a very simple manner.

*IFFCO Kisan agriculture* developed by IFFCO Kisan, a subsidiary of Indian Farmers Fertilizer Cooperative Ltd. This app enables access to various modules including agricultural advisory, weather, market prices and agriculture information library in the form of text, images, audio and videos in the selected language. *APEDA farmer connect* developed by Agricultural and Processed Food Products Export Development Authority (APEDA). This mobile app allows a farmer to apply online for farm registration and approval by state government and lab sampling by authorized laboratories. *Havaamana Krishi* developed by AICRP on Agro meteorology, Vijayapura Centre, University of Agricultural Sciences, Dharwad. Havaamaana-Krishi is an Agro meteorological application that provides information on weather, short range weather forecast for the jurisdiction of UAS Dharwad in north Karnataka, India. *eNAM Mobile App and Agri Market* developed by SFAC, Ministry of Agriculture and Farmers Welfare, Govt. of India. *eNAM app* is use to facilitate remote bidding by traders and access to arrivals and price related information to farmers and other stake holders on their smartphones. *Agri Market* has developed with an aim to keep farmers Abreast of crop prices.

Some of the crop specific apps are: *Rice Xpert* developed by ICAR-NRRI, Cuttack. This helps to reach the latest rice technologies to the rice farmers in real time basis. *Solapur Anar* developed by ICAR-NRCP, Solapur. This app aims to educate pomegranate growers about scientific pomegranate production practices. *Cane Adviser* developed by ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu, India. This is a mobile app for cane growers and millers. It gives details from planting to harvest.

Other apps providing Agro Advisory are *RML Farmer* developed by RML AgTech. Farmer can access information related to weather forecast, market price, crop advisory, farm related news as per their location in their preferred language. *MyAgri Guru* developed by Mahindra Agri Solutions, Mahindra and Mahindra. My Agri Guru connects farmers and agri-experts across the country. The farmer agri-expert interactions cover over 90 diverse crops. *Rythu Nestham* developed by Rythu Nestham Foundation. It is a mobile app which helps farmers in organic farming. *Damini app* developed by ESSO-IITM. This app gives exact location of current lightning strikes, probable locations of impending lightning around the area of 40sq km and movement and direction of thunderstorm. *Meghdoot app* launched by Mo Earth science and technology. This app will provide forecast to farmers relating to temperature, rainfall, humidity and wind speed and direction which play critical role in Agricultural operations. Ministry of Earth sciences has launched the mobile app *Mausam* for IMD. Users can access observed weather, forecast, radar images and be proactively warned of impending weather events. Union ministry for Agriculture and farmers welfare Narendra Singh Tomar launched *CHC farm machinery mobile app* in New Delhi. The multi-lingual mobile app CHC farm machinery is for farmers to hire tractors and other farm machineries.

Apps developed for allied sector are: *Pashu Poshan* developed by NDDB. With the help of this app, balanced ration can be formulated while optimizing the cost considering animal profile, i.e., cattle or buffalo, age, milk production, milk fat and feeding regime etc. and milk producers are advised to adjust the quantity of locally available feed ingredients offered to their animals along with mineral mixture. *Cattle Expert System* developed by TNAU, Coimbatore and C-DAC, Hyderabad. It is a mobile app that covers feeding management for cattle and buffalo, breeding management, disease and control management, production technology, calf management, general care and management, practices etc. for cattle and buffalo. Mobile technology is transforming access to information. Number new apps are emerging in response to new requirements and challenges of the farming community.

## EVALUATION OF FRONTLINE DEMONSTRATION OF GREEN GRAM (*VIGNA RADIATA* L.) IN HAVERI REGION OF NORTHERN KARNATAKA

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### ABSTRACT

Green gram or Mungdal (*Vigna radiata* L.) is an important pulse crop in India, plays a major role in augmenting the income of



small and marginal farmers of Northern Karnataka. The low production of traditional varieties of green gram was a cause of concern for the farmers at large. To overcome this problem of low yield, Krishi Vigyan Kendra in Haveri has conducted frontline demonstration in field of adopted villages. The present study was conducted by KVK, Haveri during 2016-17 and 2017-18 during *kharif* season with twenty frontline demonstrations in Itagi, Balambeeda and Lakumapura villages of Haveri district. The results of demonstrations showed that cultivation of high yielding variety DGGV-2 of green gram has given yield increase of 28.73 and 20.25 percent during 2016-17 and 2017-18, respectively over local check. The technology gap ranges from 8.49 q ha<sup>-1</sup> and 1.50 q ha<sup>-1</sup> during 2016-17 and 2017-18, respectively. The highest extension gap of 1.60 q ha<sup>-1</sup> was recorded during 2017-18. This high extension gap in all these varieties requires urgent attention from planners, scientists, extension personnel and development departments. The technology index varies from 60.64 per cent and 10.71 per cent during 2016-17 and 2017-18, respectively. The changes will accelerate the adoption of newer technologies to increase the productivity of green gram in this area. There is a need to adopt multi-pronged strategy which involves enhancing green gram production through horizontal and vertical expansion and productivity improvements through better adoption of improved technology.

## EFFECT OF DIFFERENT TILLAGE SYSTEM AND RESIDUE MANAGEMENT ON SOIL MICROBIAL CHARACTERISTICS

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### ABSTRACT

Conservation agriculture production system (CAPS) with the components of minimum tillage, finger millet based intercrops and cover crop was established at AICRP for Dryland Agriculture UAS, GKVK, Bengaluru in triplicated split plot design and the impact of Conservation Agriculture Production System (CAPS) on soil microbial characteristics were assessed at the end of the finger millet + pigeon pea cropping cycle. Dehydrogenase enzyme activity and microbial biomass carbon and nitrogen was estimated. statistically higher dehydrogenase activity was measured among different tillage practices and cover crops. The highest dehydrogenase activity (15.067 µg TPFg<sup>-1</sup> soil 24 h<sup>-1</sup>) was under zero tillage, while it was 47.56 µg TPFg<sup>-1</sup> soil 24 h<sup>-1</sup> with horsegram cover crop. The Highest values were recorded in zero tillage + horsegram cover crop plots. Microbial biomass carbon was highest with the zero tillage (223.57 µg g<sup>-1</sup>) and with Horsegram as cover crop (227.73 µg g<sup>-1</sup>). However, interaction was found non-significant. Statistically significant biomass nitrogen was measured during zero tillage (40.88 µg g<sup>-1</sup>) with horsegram cover crop (41.23 µg g<sup>-1</sup>) and its combination (zero tillage + horse gram cover crop) 43.37 µg g<sup>-1</sup>. Thus, the results show a positive influence of protection soil tillage on the reviving of upper layer of top soil especially in the variants where soil was supplied with cover crop.

## INVESTIGATION OF SOIL FERTILITY STATUS OF THE CHILLI GROWING AREA OF NORTHERN PART OF KARNATAKA

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### ABSTRACT

A survey was conducted for assessment of soil fertility status of byadgi chilli (*Capsicum annuum* L.) growing areas of Dharwad, Gadag and Haveri districts of northern part of Karnataka state. Totally 175 locations spread over in the study area were chosen where crop was extensively grown. Physico-chemical properties of soils were analysed for getting nutritional





status of chilli growing areas. The soil reaction ranged from 6.85-8.36 with a mean value of 7.51, total soluble salts content (EC) ranged from 0.13 to 0.79 dS m<sup>-1</sup> with a mean value of 0.32 dS m<sup>-1</sup> and soil organic carbon content ranged from 1.5 to 12.60 g kg<sup>-1</sup> with a mean value of 7.13 g kg<sup>-1</sup>. Available nitrogen, phosphorus (P<sub>2</sub>O<sub>5</sub>) and potassium (K<sub>2</sub>O) contents ranged from 112 to 616, 12.63 to 85.88 and 107.52 to 645.12 with mean values of 276.97, 47.79 and 325.71 kg ha<sup>-1</sup>, respectively. Similarly, for secondary nutrients the values of exchangeable calcium, magnesium 9.9 to 32.3, 3.6 to 16.89, with mean values of 20.80, 8.82 cmol (p+) kg<sup>-1</sup>, respectively and available sulphur ranged from 5.81 to 35.69 kg ha<sup>-1</sup> with mean value of 15.18 kg ha<sup>-1</sup>. Lastly DTPA extractable iron and zinc ranged from 2.56 to 8.28 and 0.26 to 0.98 mg kg<sup>-1</sup> with mean values of 4.85 and 0.59 mg kg<sup>-1</sup>. It is apparent from the data that, out of 175 samples, 17 per cent samples were low in organic carbon, while 43 and 39 per cent of samples were in medium and high category, respectively. For available nitrogen, 66 per cent samples were under low category while 33 and one per cent samples were in medium and high categories, respectively. For available Phosphorus 66 per cent and 29 percent samples were medium and high category, only 5 per cent low category. In case of available potassium, three and 39 per cent samples were in low and high categories, respectively and 58 per cent samples were in medium category. For available sulphur, 6, 82 and 21 per cent samples were in low, medium and high categories, respectively. Among the micronutrients, for iron 35 and 65 per cent of samples were in low and medium categories, respectively but for zinc, 60, 39 and 1 per cent of samples were in low, medium and high categories, respectively. Nutrient index values of organic carbon, N, P, K, S, Fe and Zn were 2.22 (Medium), 1.40 (Low), 2.23 (Medium), 2.37 (High) 2.06 (Medium) 1.65 and 1.47 (Low) respectively. Based on the calculated values of nutrient indices, soils of the study area were low in N, medium in organic carbon as well as phosphorus and sulphur, but high in potassium content. In case of micronutrients iron and zinc were low in chilli grown areas.

#### **SLOW RELEASE MULTINUTRIENT TABLETS FOR ENHANCING SOIL FERTILITY, NUTRIENT USE EFFICIENCY AND CROP PRODUCTIVITY**

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#### **ABSTRACT**

Slow-release fertilizers have been in common use for decades. They are effective compared to conventional fertilizers due to their gradual pattern of nutrient release which better meets plant needs, minimizes losses and therefore increases nutrient availability. Multinutrient tablets containing major, secondary and micronutrients were prepared using compatible fertilizer materials, binding agents and filler materials. An experiment carried out to evaluate the effect of these multinutrient tablets in tomato revealed that multinutrient tablet prepared with fertilizer materials neem coated urea, factamphos, muriate of potash, magnesium oxide, phosphogypsum, zinc sulphate, borax and binding agent methyl cellulose and clay (filler) applied at 75 per cent of recommended dose of fertilizers (6 tablets per plant) increased the nutrient availability in soil, nutrient use efficiency and yield of tomato. The fruit yield of tomato was increased by 46.22 % over control. . The highest NUE of nitrogen (58.77 g g<sup>-1</sup>), phosphorus (55.10 g g<sup>-1</sup>) and potassium (79.35 g g<sup>-1</sup>) was observed. The highest apparent recovery percentage of nitrogen 96.87 %, phosphorus 90.53 % and potassium 94.95 % and partial factor productivity of 27.71 g g<sup>-1</sup> were recorded due to the application of multi nutrient tablets.

#### **GENOME EDITING IN PLANTS: NOVEL TECHNOLOGY FOR CROP IMPROVEMENT**

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#### **ABSTRACT**

In today's world, almost one billion people suffer from chronic malnourishment, while at the same time our agricultural systems are degrading, exacerbated by the loss of biodiversity and the increasing uncertainties of climate change. With the global population projected to exceed 9 billion by 2050, contemporary agriculture will face enormous challenges, requiring crops with higher yields and of improved quality, and needing fewer inputs. Although conventional breeding is currently the



most widely used approach in crop improvement, it is labour intensive and it usually takes several years to progress from the early stages of screening phenotypes and genotypes to the first crosses into commercial varieties. Genome-editing tools provide advanced biotechnological techniques that enable the precise and efficient targeted modification of an organism's genome. The clustered regularly interspaced short palindromic repeat (CRISPR)-associated protein 9 (Cas9) genome editing system is a powerful tool for targeted gene modifications in a wide range of species, including plants. Over the last few years, this system has revolutionized the way scientists perform genetic studies and crop breeding, due to its simplicity, flexibility, consistency and high efficiency. Considerable progress has been made in optimizing CRISPR/Cas9 systems in plants, particularly for targeted gene mutagenesis. However, there are still a number of important challenges ahead, including methods for the efficient delivery of CRISPR and other editing tools to most plants, and more effective strategies for sequence knock-ins and replacements.

## IN VITRO PROPAGATION STUDIES IN PDKV-WAIGAON NEWLY DEVELOPED CULTIVAR OF TURMERIC (*CURCUMA LONGA* L.)

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### ABSTRACT

Turmeric (*Curcuma longa* Linn.) plant possess diploid chromosome number  $2n=63$  and belongs to monocot family Zingiberaceae. It is one of the major spice crops of India and naturally cultivate on large scale even though it is originated from neighboring country Bangladesh. It has numerous medicinal application and homemade Ayurvedic drugs in ancient India. It is generally propagated through asexual method using underground rhizomes, however due to high rate of heterogeneity, genetic uniformity of the cultivar not maintained for long period. Therefore, tissue culture is one of the best approach to maintain varietal identity. Being vegetative natured crop, it is also an ideal crop for micro-propagation studies. In the present study, newly released turmeric cultivar of Vidarbha region 'PDKV Waigaon' is micropropagated through tissue culture using bud rhizome as explant source. Surface sterilized rhizome explants of turmeric were grown on MS media supplemented with different concentrations of BAP along with combination of different concentrations level of NAA. It results into production of varying degree of multiple shoots. MS media supplemented with  $2 \text{ mg L}^{-1}$  BAP +  $1 \text{ mg L}^{-1}$  NAA gives best result. In this case, 95% of the inoculated explants induced multiple shoots within a span of 10-12 days of explant inoculation. The mean number of shoots per explant was found 7.80 shoots. Rooting was spontaneous in almost all the treatments, supplement with normal NAA concentration. Most of the regenerated shoots were successfully transferred to the primary hardening under green-house conditions. The SOPs developed under the study will be useful for rapid multiplication of newly released turmeric cultivar PDKV Waigaon for its large-scale cultivation.

## LONG TERM EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON SOIL FERTILITY, POTASSIUM FRACTIONS AND YIELD OF COTTON + GREENGRAM (1:1) INTERCROPPING SYSTEM IN VERTISOLS

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### ABSTRACT

A field study entitled, "Long term effect of integrated nutrient management on soil fertility, potassium fractions and yield of cotton+greengram (1:1) intercropping system in Vertisols" was conducted during *kharif* 2019-20 at Research field of AICRP for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. The soil of the experimental site was Vertisol which was moderately alkaline in reaction, low in available nitrogen, medium in available phosphorus and high in available potassium.

The eight treatments replicated three times in randomized block design comprised of control, 50% and 100% RDF, 50% N  $\text{ha}^{-1}$  through gliricidia / FYM, 50% N through fertilizers + 50% N  $\text{ha}^{-1}$  through gliricidia / FYM + 100%  $\text{P}_2\text{O}_5$  + 100%  $\text{K}_2\text{O}$   $\text{ha}^{-1}$  fertilizers, 100% N  $\text{ha}^{-1}$  through gliricidia + 100%  $\text{P}_2\text{O}_5$  + 100%  $\text{K}_2\text{O}$   $\text{ha}^{-1}$  through fertilizers. The results after 33<sup>rd</sup> cycle indicated that application of 50% RDN through FYM in combination with 50% N + 100%  $\text{P}_2\text{O}_5$  + 100%  $\text{K}_2\text{O}$   $\text{ha}^{-1}$  through



fertilizers recorded higher cotton + greengram yield and was on par with the application of 50% N through gliricidia + 50% N + 100% P<sub>2</sub>O<sub>5</sub> + 100% K<sub>2</sub>O ha<sup>-1</sup> through fertilizers and application of 100% RDF. However, the significant improvement in soil fertility and potassium fractions was recorded with application of 50% N through gliricidia + 50% N + 100% P<sub>2</sub>O<sub>5</sub> + 100% K<sub>2</sub>O ha<sup>-1</sup> through fertilizers and was on par with 50% RDN through FYM in combination with 50% N + 100% P<sub>2</sub>O<sub>5</sub> + 100% K<sub>2</sub>O ha<sup>-1</sup> through fertilizers. Among the various potassium fractions, the exchangeable and lattice K was highly correlated with yield of crops. Hence, it is concluded that the integrated application of 50% N through gliricidia / FYM + 50% N + 100% P<sub>2</sub>O<sub>5</sub> + 100% K<sub>2</sub>O ha<sup>-1</sup> through fertilizers resulted in improvement in soil fertility, potassium fractions and yield of cotton + greengram (1:1) intercropping system in Vertisols under rainfed conditions.

## DISEASE RESISTANT BREEDING FOR MAJOR SOIL BORNE PATHOGENS IN CHILLI

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### ABSTRACT

Chilli (*capsicum annum*) plays an important role in human diet and the economy of nations. Major soil borne pathogens viz., *Phytophthora capsacin*, bacterial wilt (*Ralstonia solanacearum*) and root-knot nematodes (*Meloidogyne spp.*) creates a lot problem in the chilli growing states in the country. Controlling of these diseases is very difficult or impossible because chemical management leads to pesticide residue in fruits which leads to food safety issue and affect export potential and another one is grafting technology where resistant rootstock will be used to cultivate highly economical bell peppers but availability of rootstock is problem. Resistance breeding is the best method to incorporate genes into the variety without deteriorating the quality of crop. Marker assisted backcross breeding is the most advanced method which can identify resistance at gene level and transfer genes /QTLs to a desirable variety by gaining the knowledge about molecular markers available for future selection. Conventional breeding or molecular breeding are best methods for controlling soil borne pathogens.

## APPROACHES FOR SITE-SPECIFIC NUTRIENT MANAGEMENT (SSNM)

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### ABSTRACT

World-wide use of various fertilizers has made a tremendous contribution in enhancing food production. It has been estimated that nutrient inputs are responsible for 30–50% of crop yield. However, the issues such as low NUE and associated environmental pollution and global warming have raised serious concerns about the existing nutrient management practices. The recovery efficiency of fertilizer nutrients is about 20–40%, 15–20% and 40–50% for N, P and K, respectively while for secondary and micronutrients, it is substantially low ranging between 5–12%. The important reasons for low and declining crop responses to fertilizer nutrients include continuous nutrient mining from the soil due to imbalanced nutrient use (7:2.8:1 NPK) leading to depletion of some of the major, secondary and micro nutrients like N, K, S, Zn, Mn, Fe, B etc., decreasing use of organic nutrient sources such as FYM, compost and integration of green manures/grain legumes in the cropping systems and mismanagement of irrigation systems leading to serious soil degradation qualitatively. Based on the past 50-year intensive research, nutrient management recommendations have been developed for almost all cultivated crops. The recommendations developed tell about the amounts of different nutrients required on hectare basis and their time of application. Such blanket recommendations which largely did not take into account the variability in the inherent soil fertility and other edaphic characteristics resulted into over-application of nutrients in some pockets and under-application in others. This resulted in wastage of fertilizers and low NUE. However, recognizing the flaws of the blanket recommendations of nutrients, the concept of SSNM of nutrients was developed. The use of fertilizers is therefore, essential to fill the above gap between the crop needs for nutrients and the supply of nutrient from soil and available organic inputs. The SSNM helps in improving NUE as it provides an approach for feeding crops like rice, maize, wheat, etc. with nutrients as and when needed. The major benefit for farmers from improved nutrient management strategy is an increase in the profitability. The SSNM eliminates the wastage of fertilizers by preventing excessive rates of fertilization and by avoiding fertilizer application when the crop does not require nutrient inputs. It also ensures that N, P, and K are applied in the ratio required by the intended crop.



## DIVERSITY ASSESSMENT AND SELECTION OF SUPERIOR PERSIAN WALNUT (*JUGLANS REGIA* L.) TREES OF SEEDLING ORIGIN FROM NORTH-WESTERN HIMALAYAN REGION

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### ABSTRACT

North-Western Himalayan region of Jammu and Kashmir has significant Persian walnut (*Juglans regia* L.) trees, most of which are of seedling origin. The regions have rich morphological, phenological, and carpological walnut diversity because of the large variability of native walnut, resulting from cross-pollination and seedling propagation. We studied 84 walnut accessions from this region to assess this diversity and identified trees with superior fruit traits. Studying the growth, leaf, phenological, inflorescence, and fruit characteristics show high variability. Nut weight (NW) ranged from 10.04 to 22.66 g, whereas kernel weight (KW) varied from 4.75 to 14.00 g. In this study, we recorded kernel percentage in a broader range from 30.64% to 61.78%,

and shell thickness (ST) from 0.98 to 2.83 mm. The principal component analysis revealed that traits related to KW, kernel percentage, ST, NW, nut length (NL), kernel length (KL), and kernel width (KW) accounted for a large proportion of phenotypic variability. Cluster analysis divided accessions into four cluster groups. We identified three promising genotypes, such as JWSP-06, JWSG-43, and JWSD-59, after considering the important traits in a selection index. These promising genotypes will be used to the benefit of conservation research, cultivation, and breeding. Based on the observed differentiation of variation, it is concluded that the magnitude of phenotypic variation in the population under study is high, and the implication of the results will play a vital role in future walnut breeding programmes.

## INFLUENCE OF BIO FERTILIZERS ON SUSTAINABLE PRODUCTION OF CHILLI (*CAPSICUM ANNUUM* L.)

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### ABSTRACT

Chilli (*Capsicum annum* L.) is one of the important vegetables –cum-spice crops of India. It is a good source of proteins; vitamins particularly ascorbic acid and it is reported in many therapeutic uses. Chilli crop is very important for agricultural economy and is used in processing industries. India is the largest producer, consumer and exporter of chilli, which contributes to 25% of the world's production. In India the most important chilli growing states are Andhra Pradesh, Karnataka, Tamil Nadu, Orissa, Maharashtra, Rajasthan and West Bengal. Andhra Pradesh is the largest producer of chilli in India and contributes about 30% to the total area under chilli followed by Telangana and Karnataka. Chilli is input responsive and application of organic manures as well as inorganic fertilizers has been reported to influence yield and quality. Since application of chemical fertilizers alone may not sustain the productivity as reported by many workers and integrated use of all potential sources of plant nutrients seems to be the option to maintain soil fertility and crop productivity. Among the several agronomic/management practices, as a component of INM, use of bio-fertilizers and bio-control agents is gaining importance because of their low cost, capacity to enrich soil fertility and no residual toxicity. There is greater demand in the international market for organically produced chilli.

An investigation was carried out at Horticultural Research Station, Lam, Andhra Pradesh during 2015-16 to 2017-18 with an objective of studying the effect of biofertilizers and biocontrol agents on yield of chilli cv. LCA-620. The treatments included biofertilizers (*Azospirillum*, PSB and K<sup>+</sup> solubilizing bacteria @ 2kg/acre as basal application) and bio control agents (*Trichoderma viride* @ 2kg/acre and VAM @ 5kg/acre as basal application) along with 50%, 75%, 100% RDF in different combinations. The treatment receiving 75% RDF along with bio fertilizers and bio agents recorded the highest no. of fruits per plant, dry chilli yield per ha<sup>-1</sup>, seed yield per ha<sup>-1</sup>, seedling vigour index-I and seedling vigour Index-II proving the favorable influence of bio fertilizers on yield and seed quality parameters.





## PREPARATION OF VALUE-ADDED PRODUCTS USING GREEN BANANA FLOUR

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### ABSTRACT

India shares about 12 % of the world's vegetables production, but the per capita vegetables consumption is only 135 g/day as against the ICMR recommendation of 250 g/day. To improve consumption and nutritional value, the value-added products can be developed to use in different products using locally available fruits and vegetables. Banana fruit has a very short post-harvest shelf life because of its highly perishable nature. Short shelf life and increased production necessitates development of value-added conventional products from green banana. To prevent the losses of banana, drying method was applied to convert raw banana into banana flour by drying the raw banana by sun drying and hot air oven at 50°C for 5hrs. Dried banana slices were powdered to prepare green banana flour (GBF) and its value-added products. Present study was carried out to "Preparation of value-added products using Green Banana Flour" and determine the effect of substituting different level of gram flour, semolina and rice flour with different levels of unripe banana flour in order to make namkeen Sev, Papad and Noodles. Chemical analysis was carried out for GBF and its value-added products. 10 g of GBF contains 1.17 % of moisture, 1.084 % ash, 3.22% of protein, 0.73% of fat, 0.0046 % tannins. Control sample (100%-gram flour) of namkeen Sev was highest in protein, fat, ash and type3 (30 % GBF) of Papad and Noodles were highest in protein and fat. Tannins found lowest score in all types of products. Whenever according to sensory analysis control sample of namkeen Sev, type1(70% GBF) of Papad and type2 (50% GBF) of Noodles were best.

## PER SE PERFORMANCE OF ELITE ACCESSIONS OF INDIAN PENNYWORT (*CENTELLA ASIATICA* L.) FOR GROWTH, HERBAGE YIELD AND TRITERPENOID COMPOUNDS

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### ABSTRACT

The nine selected accessions along with check variety Vallabh Medha were evaluated for quantitative (stolon length, internodal length, number of nodes per stolon, number of stolons per rosette, leaf length, leaf width, rosette length, rosette diameter, petiole length, chlorophyll content, fresh and dry herbage yield per square meter and per hectare) and qualitative (madecassoside, asiaticoside, madecassic, asiatic and total triterpenoid content and their yield) parameters differed significantly except for chlorophyll content. Among elite accessions, Acc. 07 and Vallabh Medha performed better for most of the growth parameters, while for the yield attributes Acc. 12, Vallabh Medha, Acc. 6 and Acc.18 were found better. Regarding total triterpenoid yield per hectare, the accessions Acc. 12 (180.16 kg ha<sup>-1</sup>), Acc.3 (141.01 kg ha<sup>-1</sup>) and Acc.7 (137.98 kg ha<sup>-1</sup>) seemed to be promising accessions.

## STABILIZATION OF HEAVY METALS IN SEWAGE SLUDGE COMPOSTING PROCESS

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### ABSTRACT

The major limiting factor for the soil application of sewage sludge is the presence of heavy metals. This study was conducted to evaluate the effect of composting on nutrient content, heavy metal (Cd, Cr, Ni and Pb) concentration and heavy metal



fractions in the sewage composts with different bulking agents (sawdust and coirpith), heavy metal adsorbent (zeolite) and liming materials (lime and fly ash). Experimental results revealed that sewage sludge composts were rich in organic carbon and plant nutrients. Total nutrients and heavy metal concentration showed an increasing trend towards the maturity of composts. Heavy metal fractionation studies pointed out that mobile fractions of heavy metals such as exchangeable and carbonate fractions decreased at the end of composting whereas the residual fractions increased which indicates that composting of sewage sludge with heavy metal adsorbent and different bulking agents decreased the mobility and bioavailability of heavy metals. The compost C8 (Sewage sludge + sawdust + zeolite (50:30:20) + flyash) was superior with respect to stabilization of heavy metals studied. The concentration of Cd, Cr and Pb were within the permissible limit as per Fertilizer Control Order (FCO). The addition of coal fly ash and zeolite enhanced the stabilization of heavy metals due to the higher alkalinity and ion exchange capacity of fly ash and zeolite respectively. Polyphenolic group and organic compounds present in sawdust also have the ability to bind heavy metal. The study revealed that composting is an effective technology for reducing the heavy metal bioavailability and the heavy metal speciation studies of the matured composts revealed that considerable portion of the heavy metals were associated with immobile fractions indicating less bioavailability and ecotoxicity.

## DEVELOPMENT OF HYBRIDS AND THEIR STABILITY IN OKRA [*ABELMOSCHUS ESCULENTUS* (L.) MOENCH.]

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### ABSTRACT

Three experiments were conducted during Kharif, 2017, Kharif, 2018 HRS, Lam and Rabi, 2019 at HRS, Lam, KVK, Venkatramannagudem and KVK, Vonipenta with an objective of studying genetic parameters, characters association in okra genotypes, combining ability of the parents and crosses, to estimate the magnitude of heterosis and to assess the stability of resulting hybrids for yield and yield components. The investigation was undertaken with an aim to develop heterotic hybrids with wider adaptability. Among the eighteen characters studied for stability, the G x E interactions were highly significant for nine characters viz., plant height, days to first flowering, internodal length, days to first picking, number of fruits per plant, fruit length, fruit weight, yield per plant and yield per hectare implying differential behaviour of genotypes under three locations for these characters. Based on the present study, it can be concluded that five hybrids viz., 440-10-1 x HRB-9-2, VRO-6 x HRB-9-2, TCR-1674 x HRB-9-2, VRO-6 x JPM-20-16-39 and VRO-3 x HRB-9-2 are stable with desirable *sca* effects, heterosis and *per se* performance for fruit yield and other important traits. These hybrids may be further tested over locations and years, and recommended for commercial release. The knowledge and material generated in the investigation could be utilized for future okra breeding programmes.

## ECONOMIC EVALUATION OF DIFFERENT INTEGRATED FARMING SYSTEMS IN NORTH EASTERN HILL REGION

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### ABSTRACT

Data have been collected from the farmers' field of Nongthymmai village, Ri Bhoi district, Meghalaya. Economic performance evaluation of two farming system models i.e Livestock based integrated farming system and pond based integrated farming system models were carried out. For the estimation of economic viability, net present value (NPV), pay-back period, internal rate of return (IRR) and benefit-cost ratio (BCR) were worked out. In livestock-based farming system, farmers kept the pig and poultry. Manures were recycled to field after composting at site. The area of the farmer was around 0.5 hectare and NPV of the System was found Rs. 1.72 lakhs. The benefit Cost ratio was found out to be 1.96 and cost of cultivation includes construction of poultry and pig shed. The internal rate of return was worked out to be 19.25% and



pay-back period was 4 years. Fish culture forms an integral part of the people in the Ri-Bhoi district of Meghalaya and is one of the important sources of income for the farmers. Most of the farmers are having small size pond (500 to 600 m<sup>2</sup>) where fish is reared by conventional method. Constructed low-cost pig/goat houses near the pond dykes and duck sheds over the water bodies using locally available materials like bamboo, wooden logs, thatch grass, GI sheet etc. Vegetables like bottle gourd, lablab bean, lai patta were cultivated in the pond dyke, whereas crops like tomato and cole crops were cultivated in nearby areas. The NPV of the Pond or aquaculture-based farming system was found Rs. 144000. Internal rate of return was also found very high i.e. 22.5%. Benefit–cost ratio (BCR) of the system was worked out to be 2.7 and pay-back period was found 3.5 years. It was found that integration of aquaculture with crops, vegetables, fruits and livestock would efficiently utilize natural resources, reduce farmers risk and generate year-round employment and income.

## EVALUATION OF GERMPLASM ACCESSIONS OF SESAME (*SESAMUM INDICUM* L.) FOR OIL AND YIELD

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### ABSTRACT

Sesame (*Sesamum indicum* L.) is an ancient oil seed crop known for its importance in food, confectionaries, edible oil, pharmaceutical, cosmetics and industries? In India, sesame is grown in 19.47 lakh hectares with a productivity of 413 kg/ha growing in West Bengal, Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Telangana and Andhra Pradesh. Sesame grows well in warm climate with temperature of 16- 40°C. In sesame, oil percentage ranges from 35- 50 %. Sesame is known as queen of oil seed crops. There is very high demand of edible oil in India. It is important to have self-sufficiency and food security in edible oil sector by adopting the improved varieties. Germplasm plays a major role in crop improvement of any crop. The present investigation was carried out to evaluate the sesame germplasm accessions for seed yield and oil at Acharya N.G. Ranga, Agricultural Research Station, Yellamanchili, Visakhapatnam District, Andhra Pradesh. The main objective of the present study is to identify the germplasm accessions with high oil and seed yield, which may be further utilized in the breeding programme for development of varieties with high oil and high yield to have food security for the increasing population. Sixty five sesame germplasm accessions are evaluated during Kharif 2018 in Randomized block design with two replications and plot size of two rows each of 4.5 m row length and with a spacing of 30 X 15 cm. Five parameters are recorded viz., days to 50 % flowering, days to maturity, number of capsules per plant, oil percentage and seed yield per plant (g). All the agronomic and plant protection measures are adopted as per the recommendations. The study revealed that the seed yield ranged between 0.65 g to 5.2 g per plant, oil percentage ranged between-33.01 % to 47.49 %, number of capsules per plant ranged between 22 to 61, days to 50% flowering ranged between 45 to 55 days and days to maturity with 84 to 95 day. The details are given in Table-1. The genotypes VZM-10 and SKL-19 recorded highest seed yield per plant with 5.2g and for oil percentage, the genotypes VSP-9 47.49 % and VSP-8 with 47.35 % highest oil percentage. The germplasm accessions with highest values for the oil percentage and seed yield are given in Table-2. Hence the genotypes VZM-9, SKL-19, VSP-9, VSP-8 may be utilized in the further crop improvement programme.

## TRYPANOSOMOSIS IN A GERMAN SHEPHERD DOG—A CASE REPORT

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### ABSTRACT

An eight-year-old male German Shepherd dog presented to the Veterinary Clinical Complex, Bihar Veterinary College, Patna with history of inappetence, persistent fever, ocular discharge, respiratory distress standing for prolong periods and head pressing. Physical examination revealed corneal opacity, absence of menace reflex and partial blindness. Chest X ray, ECG and Ultrasonography of dogs were done immediately and blood samples collected for haematology and smear examination. The microscopic blood smear examination revealed the large number of *Trypanosoma* species. Haemato-biochemical



examination showed Haemoglobin (5.4 gm/dl), SGPT (210 U/L), SGOT (440 U/L), BUN (132.90 mg/dl), creatinine (3.65 mg/dl) and a decrease in concentration of blood glucose level. The dog was treated with Quinapyramine sulphate at 0.025 ml/kg body weight by subcutaneously along with supportive therapy. Marked recovery in clinical signs as well as restoration of normal haematobiochemical profile was observed after two weeks of treatment. This disease is commonly reported in equines.

## RURAL CHANGE IN INDIA: WITH SOCIAL SCIENCE PERSPECTIVES

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### ABSTRACT

Indian society consist with rural society though urbanization is growing but still there is 67 percent pf the Indian people's lives in rural areas. Peoples who live in rural areas make their living from agriculture or related occupations. Rural development traditionally focused on the utilization of land intensive natural resources such as agriculture and forestry. Nevertheless, changes in global production networks and increased urbanization have changed the character of rural areas. Changes in rural areas can be caused by internal factors like assets of a given rural region and external factors like national politics or their combination. Different theoretical approaches (unidimensional and multidimensional) have been applied to the study of Rural change and these approaches have involved different measures to examine the nature and magnitude rural transformation. According to different studies which criticized that rural development approach to the rural transformation does not always involve development. However, different findings related to the rural change gives such a positive outcome that more than half of the value added in manufacturing sector in India is contributed by rural areas. However, the magnificent growth of nonagricultural sector in rural India has not brought significant employment gains or reduction in disparity in worker productivity. This gives the need for a new approach to direct the transition of rural economy.

## STUDY THE EFFECT OF NITROGEN ON GROWTH, YIELD AND SHELF LIFE OF POTATO (*SOLANUM TUBEROSUM* L.)

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### ABSTRACT

The experiment was conducted at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during *rabi* season of 2019-20. The treatments comprising of three potato varieties (Kufri Pukhraj, Kufri Gaurav and AICRP-P-39) and four levels of nitrogen (0, 80, 160 and 240 kg/ha) were laid out in a randomized block design (factorial) with three replications keeping net plot size 3.0x3.0 m and plant spacing 60x20 cm. The five competitive plants were selected randomly from each treatment to record data on various field parameters, which were influenced significantly by potato varieties and different levels of nitrogen. Similarly, 3 kg potatoes from each treatment were stored for 3 months in the post-harvest laboratory of the research farm under ambient storage conditions for studying the shelf life of potatoes using completely randomized design (factorial).

The results revealed that among the various nitrogen levels, the nitrogen dose of 240 kg/ha gave superior results for various field parameters, viz., plant height at 60, 75 and 90 DAP, number of stems per hill at harvest, number of leaves per hill at harvest, leaf and stem weight per hill at harvest, number and yield of tubers in different grades (up to 25, >25-50, >50-75 and >75g) per square meter, total number of tubers per square meter, total tuber yield (q/ha), biological yield (q/ha), dry matter content in foliage and tubers (%), except plant emergence, which were statistically at par with the nitrogen dose of 160 kg/ha. However, marketable tuber yield was found highest with the nitrogen dose of 160 kg/ha, while maximum harvest index was noticed under control treatment and minimum with N dose of 240 kg/ha. So far the variety is concerned, Kufri Pukhraj was significantly better for all the recorded parameters than the variety Kufri Gaurav and AICRP-P-39.

The highest values for nitrogen, phosphorus and potassium uptake by the leaves and tubers were registered with the nitrogen dose of 240 kg/ha, closely followed by 160 kg/ha. Significantly higher NPK uptake by the leaves and tubers was observed for the variety Kufri Pukhraj. The interaction effect between nitrogen levels and varieties was observed significant only for





potassium uptake by the tubers, being highest for the nitrogen dose 240 kg/ha and variety Kufri Pukhraj closely followed by nitrogen dose 160 kg/ha in association of same variety. The highest available nitrogen status in soil after harvesting was recorded for the nitrogen rate 240 kg/ha, available phosphorus and potassium for the treatment where no nitrogen was applied closely followed by the nitrogen level 80 kg/ha. For the variety Kufri Pukhraj, the leftover nitrogen and potassium in soil after harvesting of crop was observed significantly higher than other varieties.

The highest net income (Rs. 1,07,238/ha) and benefit to cost ratio (2.00) was achieved from Kufri Pukhraj variety supplied with nitrogen 160 kg/ha followed by the same variety supplied with nitrogen 240 kg/ha.

The loss in weight of tubers due to physiological activities, decay and sprouting increased with the increase in storage period and the loss has direct positive correlation with the nitrogen levels. There was a marked reduction in ascorbic acid of potato tubers during storage up to the end of the experiment and had the positive correlation with the nitrogen levels. Reducing and total sugars decreased up to 45th day of storage, but thereafter, both increased up to the end of storage and were positively correlated with the nitrogen levels, however, non-reducing sugar showed the reverse trend.

## ASSESSING THE INFLUENCE OF ALTITUDE ON PERFORMANCE OF PGPR PERTAINING TO YIELD AND OTHER AGRONOMICAL PARAMETERS OF WHEAT

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### ABSTRACT

Rising demand of food to meet the requirements of constantly growing population requires expansion of agriculture. However, agriculture is experiencing assorted difficulties in increasing crop production and enhancing its quality. The major reason behind these problems is the unavailability of soil nutrients, poor soil health, and poor agronomic practices. Therefore, current research focuses on the isolation, characterization, and assessment of potential plant growth promoting rhizo-bacteria and their consortia for enhancing growth and yield of wheat at different altitudes. Being an inexpensive and effective approach, it can be used as an alternative to chemical fertilizers for increasing yield of crops. Current study was therefore executed to assess different bacterial isolates for their ability to promote plant growth and yield of wheat in order to develop potential probiotic trait bearing bio-inoculants. Study was initiated through soil sampling from different regions of Uttarakhand and eighty-four bacterial isolates were purified and screened through *In vitro* plant growth promoting traits. On the basis of quantitative expression of PGP traits bioinoculants were further characterized. Potential bioinoculants were selected and further compatibility was evaluated with each other and compatible bioinoculants were developed as consortium. All bacterial bioinoculants and consortium were found to possess multiple plant growth promoting traits i.e. siderophore production, zinc solubilization, phosphate solubilization, potassium solubilization, indole acetic acid and exo-polysaccharide production. Furthermore, potential bacterial bioinoculants and their consortium were assessed for their plant growth and yield promoting potential on wheat. The outcomes of trials confirmed the efficiency of bacterial bioinoculants through enhanced yield and other agronomical parameters that showed positive results. Therefore, it is concluded that after some other field demonstrations these potential bioinoculants and consortium can be utilized as bio-protective agents to enhance plant productivity and quality in an eco-friendlier manner to improve sustainable agriculture.

## MEASUREMENT OF $Na^+$ IONS IN THE ROOT OF RICE (*ORYZA SATIVA* L.) UNDER OSMOTIC STRESS CONDITION AT SEEDLING STAGE.

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### ABSTRACT

Salinity is a major abiotic stress severely threatening the cereal crop production all over worlds. Considering the issue an experiment was conducted to examine the effect of the osmotic component of salt stress on rice cultivar IR64, Sahbhagi dhan and Pokkali. Seeds of selected high yielding three rice genotypes (IR64, Sahbhagi Dhan, Pokkali) were germinated in the dark



for 3-4 days under normal temperature and pressure. These seedlings were transferred to hydroponic media (Yoshida media) for the culture. The seedlings were allowed to grow for 15 days (days after germination) with continuous media aeration at 25°C illuminated at 400-500  $\mu\text{mol m}^{-2}\text{s}^{-1}$  using fluorescent lighting (Philips, Kolkata, India) in a day and night cycle of 48 hours each. The nutrient solution was replaced at 5 days interval and study biochemical effect. Biochemical studies provided the evidence that Pokkali improved their tolerance by strengthening their antioxidant defensive mechanism. Further studies are required with longer stress duration to achieve a higher  $\text{Na}^+$  concentration in plant tissue in several varieties with contrasting tolerance to salt stress.

## MICROBIAL ENCAPSULATION : A TECHNIQUE TO ENHANCE THE POLLUTANT DEGRADING EFFICIENCY OF BACTERIA

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### ABSTRACT

Rapid urbanization and industrialization have resulted in entry of a large number of pollutants in the ecological systems. These pollutants have proved to be harmful for human beings as well as other soil dwelling and aquatic organisms. Benzo a pyrene (BaP) is an example of High Molecular Weight Poly Aromatic Hydrocarbon that is produced by incomplete burning of organic substances due to several anthropogenic and natural causes. BaP has proved to be carcinogenic in nature, which makes its removal from environment quite important. To resolve this problem, microbial degradation has gained much attention due to presence of high level of microbial diversity enabling great potential to degrade the substance without impairing environmental sustainability. However, free microorganisms that are introduced directly into soils sometimes find it hard to adapt to the environment and cannot successfully compete with the indigenous ones. In the current study, microorganisms having the potential to degrade BaP were tested for their shelf life when encapsulated in sodium alginate beads and in talc based bioformulation. Bioformulations and beads having bacteria were kept for storage at room temperature (25°C) and at 4°C in a refrigerator for a period of 60 days. The bacteria were revived in an interval of 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup>, 30<sup>th</sup>, 45<sup>th</sup> and 60<sup>th</sup> day. The shelf life of bacteria was found to be increased greatly in stored form than in the free form. The study suggested that introducing bacteria in bioformulated form or in immobilized form rather than free form can assist their survival in soil for a long period, thereby making the practice of microbial degradation more effective.

## RESPONSE OF NUTRIENTS TO BROWN TOP MILLET [*BRACHIARIA RAMOSE*] FOR MANAGEMENT ON GROWTH AND YIELD ATTRIBUTES

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### ABSTRACT

Millets refers to small seeded grasses that are cultivated as grain crops grown on dry regions of temperate, tropical and subtropical situations. Small millets grown in Asia and Africa. Brown top millet is hardy and heat tolerant crop, and tolerant to drought but can also grow low areas of flooded. The crop grows well even shaded condition also and can grow under tamarind trees. The crop survives under arid conditions and has the potential to spread widely because of its rich nutritional value as well as its ability to adapt to climate change. The study was conducted during Rabi 2019-20 at ICAR- Krishi Vigyan Kendra, Haveri to Nutrient Management on growth and yield of Brown top millet. The experiment was laid out in RCBD comprising of eight treatments replicated thrice. Studies revealed that the growth parameters, yield attributes and grain yield of Brown top millet differed significantly due to foliar application of NPK along with RDF and soil application of micronutrients along with RDF. The results indicated that the application of RDF + FYM 6t/ha + foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS recorded significantly higher plant height (69.75cm), number of tillers per plant and number of grains per plant (436) at harvest over the other nutrient levels. And also, on par with Foliar nutrition of 19:19:19 @ 2 % at 30 and 45 DAS + FYM 6 t/ha In grain yield (7.65 q /ha) and straw yield (14.52 q/ha) recorded significant higher with application of T5 and also on par with RDF of crop + FYM 6 t/ha) over the other treatments levels. The gross returns, net returns and BC ratio



were also higher with the same treatments (Rs37865, Rs.21365 and 2.39 respectively) as compared to all other treatments and absolute control.

## MORPHOLOGICAL AND BIOCHEMICAL STUDIES OF ROOT CELLS OF RICE (*ORYZA SATIVA* L.) UNDER DROUGHT STRESS CONDITION AT SEEDLING STAGE THROUGH PEG

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### ABSTRACT

Rice (*Oryza sativa* L.) is one of the major staple food crops for about 65 % of the world's population and it requires large amount of water to grow as compared to other plants. It is one of the important sources of dietary energy, proteins and minerals. High yielding seed were selected of three different genotypes of rice (IR64, Sahbhagi Dhan, Sarnashreya) and germinated in the dark for 3-4 days under normal temperature and pressure. These seedlings were transferred to hydroponic media (Yoshida media) for the culture and treated with PEG for 48 hours. Present study aimed to identify the potential drought tolerant rice genotype for eastern region of India. This study morphological, biochemical and yield attributes of rice has been used to identify the most tolerated rice variety. The study included the comparative analyses of morpho-physiological and biochemical alterations with special emphasis on ROS generation and detoxification through antioxidant enzyme activity. In future, studies are needed with longer stress duration to achieve severe drought in plant tissue in several varieties with contrasting tolerance to drought stress.

## INTEGRATED MANAGEMENT OF POWDERY MILDEW OF BHENDI CAUSED BY *ERYSIPHECICHORACEARUM*

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### ABSTRACT

Bhendi powdery mildew caused by *Erysipheicichoracearum* DC. affects all the stages of the plant growth by causing premature defoliation and resulting 17.0 to 86.6 per cent yield loss in bhendi. A field experiment was conducted during rabi 2019-20 and rabi 2020-21 to find out the suitable fungicides, bio agents for managing the bhendi powdery mildew. Three sprays were given at an interval of fifteen days, results revealed that the treatment involving tebuconazole 50 % + trifloxystrobin 25 % recorded minimum disease severity of 6.16, 7.28 per cent after the third spray followed by hexaconazole 5 % + captan 70 % which recorded the disease severity of 9.76, 10.22 per cent while the treatment involving *B. subtilis*, *P. flourescens* have shown least disease control with the maximum disease severity of 34.18, 30.44 per cent and 35.06, 31.10 per cent respectively, while the control plot had recorded highest disease severity of 75.28, 72.20 per cent during rabi 2019-20 and rabi 2020-21. With respect to yield, among different treatments imposed, tebuconazole 50 % + trifloxystrobin 25 % has recorded highest yield of 110.54, 108.18 q/ha which was significantly superior compared to other treatments followed by hexaconazole 5 % + captan 70 % with a yield of 104.31, 103.23 q/ha. While, least yield of 56.56, 57.64 q/ha was obtained with *B. subtilis* compared to unsprayed control 49.18, 48.32 q/ha during rabi 2019-20 and rabi 2020-21, respectively. Therefore, it can be concluded that the three sprays of tebuconazole 50 % + trifloxystrobin 25 % (nativo) and three sprays of hexaconazole 5 % + captan 70 % were found to be effective in managing the disease with maximum per cent disease control and highest yield.

## THE INFLUENCE OF CLIMATE CHANGE VARIABLES ON SPORE GERMINATION OF *ERYSIPHECICHORACEARUM* DC. CAUSING POWDERY MILDEW OF BHENDI

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### ABSTRACT

Bhendi (*Abelmoschus esculentus* (L.) Moench) is globally important annual vegetable belongs to family malvaceae, it is most



broadly distributed vegetable all over the world. Plant diseases are one of the major constraints in crop production with drastic losses in the quality and quantity of the produce. Powdery mildew of bhendi caused by *Erysiphe cichoracearum* DC. has become a major limiting factor affecting the economic production in North Karnataka. The disease is wide spread and most destructive to the crop under favourable conditions causing considerable yield loss. The study on response of powdery mildew disease to changing climate variables ( $\text{CO}_2$  and temperature) scenario would help us to predict the outbreak of disease under changing climate conditions well before so that effective control measures can be taken. Hence, a lab experiment was conducted at Centre for Agroclimatic studies, University of Agriculture Science, in order to study the influence of elevated  $\text{CO}_2$  and temperature on conidial germination of *E. cichoracearum* under *in vitro* various plant growth chambers by applying different temperatures and  $\text{CO}_2$  levels. The results obtained revealed that among the five different treatments, maximum spore germination of 50.21 per cent was recorded in treatment  $T_2$  (elevated  $\text{CO}_2$  at  $550 \pm 25$  ppm with  $2^\circ\text{C}$  rise in temperature) as the accumulation of more amount of  $\text{CO}_2$  coupled with increased temperature ( $T_2$ ) that might have triggered the spores to undergo for more germination it was further followed by treatment  $T_1$  (elevated  $\text{CO}_2$  at  $550 \pm 25$  ppm with normal temperature) with spore germination of 46.82 per cent, treatment  $T_3$  (Ambient  $\text{CO}_2$  @  $410 \pm 25$  PPM with  $2^\circ\text{C}$  rise in temperature) with spore germination of 44.23 per cent and least spore germination was observed in lab condition (35.90 %).

## IMPACT OF FRONTLINE DEMONSTRATION ON YIELD ENHANCEMENT OF WHEAT

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### ABSTRACT

The present study was conducted in Morena District of Madhya Pradesh Front Line Demonstration on wheat crop conducted under NICRA project by Krishi Vigyan Kendra Morena during the last five years (2016-17) to (2020-21). The Results revealed that the average yield recorded in the FLDs field and farmer's field was 51.38 q/ha and 45.42q/ha during 2020-21, respectively and FLDs field and farmer's field lowest yield was 51.50 q/ha and 44.80q/ha during 2016-17, respectively. The result showed 13.12 to 14.93 percent yield increase in FLDs over farmers during 2016-17 to 2020-21 practice. therefore, front line demonstration programme was an effective tool for increasing the productivity of wheat and changing knowledge, attitude and skill of farmers.

## ECOLOGICAL IMPACT OF FUSARIUM WILT CAUSED BY *FUSARIUM OXYSPORUM* F. SP. UDUMON PIGEONPEA

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### ABSTRACT

Uncertainty in the models of plant disease development under the climate change calls for a diversity of management strategies, from more participatory approach to interdisciplinary sciences. One such approach is to study the impact of ecology on the Fusarium wilt of pigeonpea. The fusarium wilt of pigeonpea is a soilborne disease which is influenced by the weather and other climatic factors. So, a detailed study was conducted on the ecology of Fusarium wilt during the year 2017-18 and 2018-19 at ARS, Kalaburagi. Ecological factors like temperature, RH, soil temperature, soil moisture, pH, rainfall was studied against the Fusarium wilt. Fusarium wilt on pigeonpea was first appeared on 15.9.17 when the corresponding maximum temperature, minimum temperature, R.H at A.M, at P.M, soil temperature, soil moisture, rainfall and rainy day were  $34.5^\circ\text{C}$ ,  $17.5^\circ\text{C}$ , 85.2 %, 72.3 %,  $28.7^\circ\text{C}$ , 26.5 %, 32.8cm and 2 days respectively. When the correlation coefficient (r) values were assessed, there was a non-significant positive correlation between PDI, Maximum temperature (0.37), Minimum temperature (0.20) and soil temperature (0.44). Whereas, morning relative humidity (-0.72), evening relative humidity (-0.87), soil moisture (-0.82), rainfall (-0.72) and rainy day (-0.79) were significant and negatively correlating with PDI. All the selected weather parameters for investigation were correlated with PDI. The data on per cent disease index was subjected to multiple linear regression (MLR) and correlation with weather variables. Regression analysis of the cumulative wilt incidence indicated that amongst the multiple regression equations, a goodness of fit was best fitted for the equation.  $Y = 74.11 + 1.08 \text{ Temp (Max)} + 0.64 \text{ Temp (Min)} + 0.37 \text{ R.H (A.M)} - 0.73 \text{ R.H (P.M)} - 1.50 \text{ (Soil temperature)} - 0.38 \text{ (Soil moisture)} - 0.10 \text{ (Rainfall)} - 17.48 \text{ (Rainy day) 2017-18}$ .





When the correlation coefficient (r) values were assessed, there was a non-significant positive correlation between PDI, Maximum temperature (0.40), Minimum temperature (0.23) and soil temperature (0.47). Whereas, morning relative humidity (-0.74), evening relative humidity (-0.89), soil moisture (-0.84), rainfall (-0.68) and rainy day (-0.75) were significant and negatively correlating with PDI. All the selected weather parameters for investigation were correlated with PDI (2018-19). The data on per cent disease index was subjected to multiple linear regression (MLR) and correlation with weather variables. Regression analysis of the cumulative wilt incidence indicated that amongst the multiple regression equations, a goodness of fit was best fitted for the equation for crop season 2018-19.  $Y = 69.20 + 1.00 \text{ Temp (Max)} + 0.42 \text{ Temp (Min)} + 0.35 \text{ R.H (A.M)} - 0.72 \text{ R.H (P.M)} - 1.19 \text{ (Soil temperature)} - 0.42 \text{ (Soil moisture)} - 0.01 \text{ (Rainfall)} - 15.22 \text{ (Rainy day)}$ . From these studies it is said that optimum moisture content, relative humidity, rainfall and temperature are essential for the growth of the pathogen. High rainfall with optimum RH, temperature yields to severe incidence of Fusarium when compared to low rainfall. From these studies it is evident that climatic factors do play a major role in disease development.

## **GENETIC VARIABILITY AND TRAITS ASSOCIATION STUDIES FOR YIELD AND RELATED TRAITS IN MARKER-ASSISTED MULTI-DROUGHT TRAITS PYRAMIDED GENOTYPES UNDER REPRODUCTIVE STAGE DROUGHT STRESS IN RICE (*ORYZA SATIVA* L.)**

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### **ABSTRACT**

Drought is a major production constraint possessing adverse effects on grain yield. Grain yield is a complex trait dependent on many component traits and it responds poorly to direct selection. Improvement of grain yield under drought is a challenging task and requires knowledge on genetics and association between grain yield and its component traits. Current study was undertaken using 21 marker-assisted multi-drought-traits pyramided genotypes to study the genetic variability, frequency distribution, association of component traits with grain yield under aerobic as control and reproductive stage stress (RMS) as test environment. Field evaluation was carried-out in two seasons and data was collected on various parameters. Path coefficient analysis was used as a selection criterion to select yield contributing traits for further analysis. Days to 50% flowering, days to maturity, productive tillers, panicle exertion, spikelet fertility, 1000-grain weight, biomass yield and harvest index had positive direct effect on grain yield during both and/or atleast one season under both moisture regimes. Levene's test has been employed and acceptance of test gave an idea of having equal variances and data from summer and kharif seasons have been pooled within their respective moisture regimes. BLUP values were estimated using pooled data. ANOVA revealed significant differences for moisture conditions and genotypes indicating scope for selection of genotypes for desired conditions. Box plots have been drawn and depicted the mean phenotypic differences under two moisture regimes and the performance of genotypes varied significantly. Frequency distribution via histogram for all the target traits were found to be normal. Early flowering and maturity have been observed in pyramided genotypes as compared to parents and checks infers to existence of transgressive segregants. Majority of the traits possessed medium to high PCV and GCV with high heritability and GAM indicating the effectiveness of selection in drought/moisture stress condition. Grain yield possessed positive correlation with all the component traits under consideration during both moisture regimes. Selection of genotypes based on these component traits were rewarding. We can robust selection criteria and end up with superior genotypes suitable for intermittent drought conditions.

## **IMPORTANCE OF ACHIEVING UNIVERSAL PRIMARY EDUCATION TO REDUCE GLOBAL POVERTY**

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### **ABSTRACT**

Primary education, often known as elementary education, is the first level of education. After preschool/kindergarten and



before secondary school, primary education is usually the first step of formal education. Every child's first and most basic right is to get a primary education. It is not just the responsibility of the government, but also of parents, to guarantee that all children have access to education. It is the initial stage in developing a child's personality. Primary education's goal is to provide a wide foundation for a child's learning. The major goal of primary education is to raise children's consciousness, open doors to possibilities for self-development, and minimize intergenerational poverty. Primary education is a fundamental requirement for ongoing growth. This encompasses social, cognitive, cultural, emotional, and physical skills development. Education is a key component in eradicating global poverty. Employment possibilities expand, income levels rise, and maternal and child health improves as a result of education. There has been a slowing of the spread of HIV/AIDS and an increase in the healthiness of the population in general in regions where access, attendance, and education quality have improved. In fact, children with educated mothers had a 50% higher chance of living past the age of five. Education benefits not just individual and familial health, but also the health of a community. Crime rates are lower, economic development is higher, and social services are better in countries with strong educational institutions. Universal primary education is second goal in the "United Nations Millennium Development Goal" is to achieve universal primary education. Universal primary education in developing nations including in India, can be achieved through eliminating school fees, by offering school health programs, by employing new teachers and by getting more funds to developing and poor countries.

## **SUSTAINABLE CONTROL OF TICKS IN CATTLE**

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### **ABSTRACT**

Ticks infestation is an important constraint in livestock production especially in tropical regions. Ticks and tick born diseases create a significant adverse effect on economy of livestock rearing as well as nation economy of developing country. Use of acaricides is not sustainable in long run because the ticks become resistant day by day to the drug. The unsatisfactory performance increases the dose of acaricides and frequency of its application. The resistance has given rise to analysis of approaches for sustainable control of ticks. So rational use of acaricides, good management strategy, resistant breed, biological control, herbal acaricides and integrated tick management need to be focus. Rotational use of acaricides reduces the incidence of resistance to any one acaricide group. In tropical country like India the cow shed and feed lot are having more possibilities to increase tick infestation due to high availability of the larvae. Therefore, animal shed should be tick proof, no crack and crevices in building and acaricides spray cover the entire building. Heaps of ashes, pile of dung cakes and bricks provide breeding places to the ticks in animal sheds. Zebu/Indigenous cattle has been seen to be resistant to ticks after initial exposure. Introduction of indigenous breeds is an important means of sustainable tick control. Ticks predators including birds, rodents, shrews, ants and spiders also play roll in control of ticks. Backyard poultry farming in cattle barn has reduces tick load infestation in cattle by picking ticks from barns as well as ticks moving around barn. Some plants extract act as herbal acaricide and safely use for animal. Rhizome extract, leaves of tobacco, extract of neem leaves, bark and seed etc. are important phyto-acaricides effectively used by livestock keeper against tick infestation. The natural product has huge possibility to intercept the existing and future tick management problem. The new concept of integrated tick management programme will maximize the effectiveness of tick control actions. It includes correct pest identification along with accurate and timely tick monitoring activities and applying combination of natural, biological and chemical control practices to keep ticks population below economical injurious level besides minimum possible risk to human being, livestock health and our environment.

## **ASSESSMENT AND PREVALENCE OF DRY ROOT ROT CAUSED BY *RHIZOCTONIA BATATICOLA* IN PIGEONPEA**

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### **ABSTRACT**

Dry root rot is an emerging and one of the most destructive constraint for pigeonpea production. as the disease is more prevalent with hot climate at 30 to 35°C temperature and low soil moisture conditions in Northern Karnataka. To, calibrate the



incidence and spread of the disease, a roving survey was taken up during the cropping season of 2017, 2018 & 2019. Four major pigeonpea growing districts such as Raichur, Kalaburagi, Yadgir and Bidar were chosen to evaluate the status of incidence and severity. From each taluk three to five villages were selected randomly for survey. Results indicated that, During 2017-18 & 2018-19 maximum incidence of dry root rot was observed in Sultanpura village of Raichur district with the incidence of 17.2% & 28% respectively. Followed by Shirasagi village of Kalaburagi district with the record of 16.5% & 27.3%. Least dry root rot incidence of was observed in Mirjapur & Hippagar villages of Bidar district with the incidence of 8.6% & 11.00% respectively. During the *Kharif* 2019-20 recorded highest incidence of 17.5 % was recorded in Hirapur village of Kalaburagi district followed by raichur district with the incidence of 13.00% in Yermarus village and the least incidence of 5.00% was observed in Tadola village of Basavakalyantaluk. From the survey, it is clear that Pigeonpea crop in Raichur district was most affected due to dry root rot incidence.

## ESTIMATION OF PHYTO SIDEROPHORES IN WHEAT-AEGILOPS ADDITION/ SUBSTITUTION LINES UNDER FE DEFICIENCY

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### ABSTRACT

Wheat (*Triticum aestivum* L.,  $2n = 6x = 42$ ) is a grass that belongs to the Poaceae family. It is a major cereal crop grown all over the world, second only to maize in terms of production.

Therefore, the composition and nutritional quality of the wheat grain have a significant impact on human health and well-being, especially in developing countries. However, most of the elite wheat cultivars have low grain Fe and Zn contents.

Micronutrients are necessary for plant development and play a key role in crop and human nutrition. In most Indian soils, total micronutrient content is adequate, but micronutrient concentrations in the soil solution are essentially poor to fulfil the demand of growing crops. Crops grown in the majority of Indian soils are deficient in multiple micronutrients. Fe is a significant micronutrient that limits plant growth and grain production. It is essential for life-sustaining processes such as respiration and photosynthesis, where it participates in electron transport via reversible redox reactions, cycling between  $Fe^{2+}$  and  $Fe^{3+}$ .

However, plants have evolved different ways to deal with Fe deficiency by making the  $Fe^{3+}$  form of Fe easier to absorb. In the context of low Fe supplies, plants activate Fe acquisition mechanisms. Dicots can make the unsolubilized form of Fe available with the release of proton, inducing Fe(III) chelate reductase, and then transferring  $Fe^{2+}$  ions through the root plasma membrane (Strategy I). Grasses release the metal chelating non-proteinaceous amino acids termed phyto siderophores (PS), which are the natural chelating agents produced particularly under iron deficiency (Takagi, 1976) and PS coordinate Fe with their amino and carboxyl group. Phyto siderophores not only form complexes with Fe, but they can bind several other metals, particularly Zn, and Cu. Phyto siderophores can increase the bioavailability of Cu and Ni and to a lesser extent Zn. With the help of biotechnological tools and techniques, we can insert the phyto siderophores secretion responsible gene into field crops. It will increase the crop uptake in nutrient-deficient conditions and indirectly crop yield.

## SURVEY ON MAJOR DISEASES OF FIELD AND HORTICULTURAL CROPS IN NORTH REGION OF BIHAR, INDIA

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### ABSTRACT

A survey was conducted to determine the status of major targeted diseases of field and horticultural crops grown in agro climatic conditions of Saharsa, Supoul, Madhepura and Khagaria districts of northern Bihar, India. Three blocks in each district and three villages in each block were surveyed through random field survey method. Percent disease incidence was recorded on randomly selected plants in a particular field of that location. The incidence of diseases was observed on the basis of typical field symptoms and later the association was confirmed through microscopic examinations under lab condition. In view of maximum diseases incidence; foliar blight of wheat, sheath blight of rice, turicum leaf blight of maize, mungbean yellow mosaic virus, Alternaria blight of mustard were recorded with >50% incidence in these districts. However, dry root rot



and wilt of chickpea, wilt of pigeonpea & lentil, powdery mildew of peas, Alternaria leaf spot of linseed, Fusarium wilt & red rot of sugarcane and root rot of jute were occurred with 10 to 50% incidence. In fruit crops; sigatoka disease of banana noticed with >50% incidence, while, anthracnose/ die back and floral malformation of mango, wilt of banana, foot rot of papaya and anthracnose of guava and citrus canker were observed with 10-50% incidence. Diseases viz., late blight, bacterial wilt, black leaf spot/ rot, leaf curl, yellow vein mosaic virus, die back and late blight were recorded with >50% incidence in tomato, brinjal, cauliflower, cucurbits, okra, chilli and potato, respectively. Purple blotch of onion, black leaf rot of cabbage and collar rot of elephant foot yam were observed with 10-50% incidences.

## **LIVESTOCK AND POULTRY IN INDIA: PRESENT SCENARIO AND THEIR ROLE IN NATIONAL ECONOMY**

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### **ABSTRACT**

Livestock production is the backbone of Indian agriculture contributing 5.1 % (an amount of Rs. 8, 71,884 Crore) to national gross value added at current prices during 2018-19 (NAS-2019, CSO, GoI). Livestock sector plays a significant role in the welfare of India's rural population as it employs a major section of the country's labour force and also provides a large share of draft power being used to cultivate crop land. India's livestock sector is one of the largest in the world with a holding of 11.6% of world livestock population. Contribution of livestock and fisheries sectors to the national economy in terms of Gross Domestic Product (GDP) is 4.6 and 0.91%, respectively. Agriculture and allied sector contributed about 15.87% to the total GDP. Out of the total agricultural GDP, livestock sector contributed about 28.63% during 2018-19. The livestock sector is an important source of foreign exchange too and is performing well in the manner of production, value addition and export of dairy, fishery, wool, poultry and other products. Poultry sector in India is valued at about Rs. 1988 Billion (2020) broadly divided into two sub-sectors – one with a highly organized commercial sector with about 80% of the total market share (say, Rs. 1,59,040 crore) and the other being unorganized with about 20% of the total market share of Rs. 39,760 Crore.

## **IMPACT OF TRACE MINERALS SUPPLEMENT ON REPRODUCTIVE PERFORMANCE OF CROSSBRED CATTLE**

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### **ABSTRACT**

In lactating animals, the majority of factors like nutrient intake, physiological health, housing management and atmospheric conditions affect reproductive performance of the animal. In dairy animals the main factor affecting reproduction is nutrition status that too trace minerals. So to have a good return from the livestock trace minerals with balanced feeding of the animals must be done. Optimum feeding of minerals with respect to the various stages of reproductive life cycle must be done to increase the reproductive performance.

## **PHYTOCHEMICAL ANALYSIS OF BITTER GOURD FRUITS AND ITS COMPONENTS IN DIFFERENT ACCESSIONS**

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### **ABSTRACT**

*Momordica charantia*, commonly known as bitter melon, is one of the economically important medicinal plant belonging to family Cucurbitaceae, is used as an antidiabetic and antihyperglycemic agent in India as well as in other Asian countries. Bitter





gourd is very low in calories but dense in precious nutrients and contains an array of biologically active compounds such as ascorbic acid, tocopherols, flavonoids, phenols etc. The present study was designed to compare the phytochemicals in immature fruits and its components viz. green peel, outer skin, flesh and seeds of five accessions of *Momordica* spp. The data revealed that all the accessions possessed variable amounts of ascorbic acid, tocopherols, phenolic etc. Ascorbic acid and tocopherols ranged from 11.31-80.25 mg/100g FW and 2.54-15.51 mg/100g FW, respectively with maximum content in flesh followed by whole fruit. Similarly, total phenols, flavonoids and o-dihydroxy phenols varied from 43.80-267.40, 36.21-221.91 and 2.59-15.83 mg/100g FW, respectively with maximum content in flesh part. Variety PAUBG-232 was found to be the desirable cultivar with high amount of ascorbic acid, tocopherols, phenols, flavonoids and o-dihydroxy phenols with the values of 80.25, 15.51, 267.40, 221.91 and 15.83 mg/100g FW, respectively in flesh portion followed by green peel and whole fruit. On the whole, flesh part of PAUBG-232 predominated in phytochemical profile while least amount was observed in the seeds of variety PAUBG-108. It can be concluded that antioxidants like vitamins and phenolics are present abundantly in bitter gourd, which can provide protection against many ailments.

## **EFFECT OF TIME OF SOWING ON YIELD OF MINOR MILLETS DURING KHARIF IN YSR DISTRICT OF ANDHRA PRADESH**

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### **ABSTRACT**

Today millets rank as the sixth most important grain in the world, sustains one third of the world's population and is a significant part of diet in Africa, India, Northern China, Japan, Manchuria and various areas of the former Soviet Union and Egypt (Sahu, 2010). Recently farmers are showing a lot of interest on growing of small millets because of the increasing demand in the market and also of health concerns. As there is no information on time of sowing of small millets in YSR Kadapa, a field experiment was conducted from 2020-2021 at Agricultural Research Station, Utukur, Kadapa during kharif season under rainfed conditions. The experiment was laid out in split plot design with three dates of sowings as main plots viz., July I F.N, July II F.N and August I F.N and six different minor millets namely foxtail millet, proso millet, little millet, brown top millet, barnyard millet and kodo millet as sub plots. The experimental soil was medium in nitrogen, high in phosphorus and potassium. All the crops were sown in the plots of size 4.5 m x 3.6 m with spacing of 30 cm x 10 cm. Among the different millets, proso millet was earliest having duration of 65 days and kodo millet was of 120 days duration crop. The results indicated that, July I F.N and II F.N sown crops recorded on par yield for all millets whereas delay sowings in august reduced the yields drastically in YSR Kadapa district of Andhra Pradesh.

## **ECONOMIC ANALYSIS OF DRIP IRRIGATION**

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### **ABSTRACT**

Drip irrigation is form of most water efficient method of irrigation and nutrient delivery system which transport water and nutrients directly to root zone of plants in adequate and accurate amount and at accurate time. It improves yield and save most precious resource (water) and energy in the era of resource crisis. It works on the principle of pressure. Positive pressure is used to pump water while negative pressure creates suction to pump-up water-soluble fertilizer for fertigation process. Drip irrigation also helps in combating salinity issues by transferring salt to periphery of root zone of plants. Other minor benefits include- no wetting of foliage which can result in fungal diseases, avoid soil salinity by reducing use of fertilizer, good soil aeration as there is no saturation of soil. By 2050, there'll be 10 billion people living on our planet, and 20% less arable land per person to grow enough calories. Include increasing water scarcity, and it's clear why we need a way to increase agricultural productivity and resource efficiency. That's where drip irrigation fits in, changing the economics of global agriculture by allowing farmers to produce more calories per hectare and cubic meter of water. Drip irrigation is known to be the most efficient irrigation methods with 95-100% water use efficiency. This is compared to sprinkler systems that have 80-85% water use efficiency or flood and furrow that are 60-70% efficient. Efficiency is related to the effectiveness of the system on crop performance and eventually on yield and profitability of the farmer. Farmers looking to invest in a drip irrigation system should calculate ROI versus alternative irrigation methods. Because drip irrigation delivers significant increases in crop yields



while saving on inputs (water, fertilizer, energy and labor), it can pay for itself in a relatively short period of time and give farmers more profit in their pocket. Luhachet *et al.* (2004) conducted a study and found that the NPV of drip irrigated grapes, ber and citrus (kinnow) orchard was Rs 98040, Rs 60910 and Rs 133840 respectively and IRR values for same crops under furrow method were 17, 28.5, and 29 per cent, respectively while the values of BCR for drip-irrigated orchards of same crops were 1:1.76, 1:3.73 and 1:3.70, respectively. This shows drip irrigation is comparatively more profitable and efficient as compared to other conventional methods of irrigation. To promote the micro irrigation per drop more crop scheme is launched under the PMKVY scheme by department of horticulture which provides financial assistance (70% for normal blocks and 85% for over exploited blocks) to farmers in setting up drip system on their farms. So, keeping in view potential benefits of drip irrigation it should be promoted and adopted on wider scale so as to mitigate water crisis problem.

## SOIL AVAILABLE PHOSPHORUS AS INFLUENCED BY MANURES AND LEVELS OF PHOSPHORUS IN CALCAREOUS SOIL

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### ABSTRACT

Incubation study was carried out to study the effect of manures and levels of phosphorus on availability of phosphorus in calcareous soil at Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, during *kharif* 2019. The experiment consists of eleven treatments as control, RDF and combination of three organic manures (FYM, Vermicompost and PMC) and three levels of phosphorus (25, 50 and 75 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) through DAP replicated thrice in Factorial Completely Randomized Design. In incubation study the soil samples were collected at 15 days interval i.e. 0, 15, 30, 45 and 55 days after incubation and analyzed for available phosphorus in soil. The soil available phosphorus was significantly increased due to different treatments up to 30 days incubation except in control and recommended dose of fertilizer treatments. Among the organic manures, the application of vermicompost @ 2.5 t ha<sup>-1</sup> to soil significantly increased soil available phosphorus over rest of organic manures. As regard phosphorus levels, the application of 75 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> significantly increased the soil available phosphorus than that of 25 and 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. The application of vermicompost along with 75 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> significantly increased maximum available phosphorus (20.94 kg ha<sup>-1</sup>) at 30 days incubation and there after it was declined.

## COMPARATIVE STUDY OF FUNGICIDE AND DIFFERENT *RHIZOBIUM* INOCULANTS ON GROWTH AND YIELD OF SOYBEAN (*GLYCINE MAX* (L.) MERRILL)

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### ABSTRACT

An experiment was carried out at in *Kharif* season at student research field, College of Agriculture, Indore (M.P.) for Comparative study of fungicide and different *Rhizobium* inoculants on growth and yield of soybean (*Glycine max* (L.) Merrill). The soil of the experimental field was medium black in texture, neutral in reaction (pH 7.70) with normal EC (0.23 dS/m) and medium organic carbon contents (0.56 %) and analysing low in available N (225 kg/ha), medium in available P (9.60 kg/ha) and high in available K (508 kg/ha) contents. A field experiment was consisted of 15 treatments replicated four times in randomized block design (RBD). As per treatment, the seed of soybean cv. JS 335 treated or not treated with fungicides and inoculated with *Rhizobium* culture before 15, 10, 05, 01 days of planting and on the day of sowing. Among the treatments, seed treatment with Thiram + Carbendazim 50 WP – inoculation with Premax+ Rizo-liq (ODS)] (T<sub>10</sub>) recorded the maximum plant height (66.75 cm) at harvest, branches per plant (4.02), fresh weight (35.83 g) per plant at 75 DAS, dry matter per plant (23.14g) at 75 DAS, leaf area index (12.87) at 60 DAS, number of pods (39.18) per plant, number of seeds (2.84) per pod while minimum was recorded in T<sub>15</sub> absolute control (No fungicide, No culture). The maximum yield (2.15 t/ha) was



recorded under [Thiram + Carbendazim 50 WP - Premax+ Rizo-liq (ODS)] ( $T_{10}$ ) treatment and the minimum (1.51 t/ha) was recorded in absolute control ( $T_{15}$ ) treatment. The application of *Rhizobium* with or without fungicides showed a synergic effect in increasing the seed yield of soybean per hectare.

## PROFILING OF BIOCHEMICAL PARAMETERS IN MATURE SEEDS OF PUNJAB CELERY 1 (*APIUM GRAVEOLENS* L.)

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### ABSTRACT

Celery (*Apium graveolens*), a herb of Apiaceae (Umbelliferae) family, has its origin in the Mediterranean and the Middle East part of the world. In around 1930s, the crop was introduced to Punjab, India. In India, celery is mainly grown for seed export to USA, Canada, UK, Netherlands, Kuwait, South Africa, Japan, Singapore, and Germany, thus meeting 62% of the world demand. All parts of celery plants are edible: leaves, petioles, roots and seeds, either fresh or canned, or dry as spices or seasoning. Celery seed (*Apium graveolens* L.) is commercially an important seed spice and its seed oil is used for flavoring food and in the perfumery and pharmaceutical industries. The aim of the present study was profiling of biochemical parameters in mature seeds of Punjab Celery 1. The various biochemical parameters evaluated were: moisture (10.66%), total carbohydrates (94.57 mg/g DW), total soluble sugars (17.03 mg/g DW), reducing (10.11 mg/g DW) and non-reducing sugars (6.91 mg/g DW), starch (0.77 mg/g DW), crude fibre (3.73 %), ash (4.40 %), minerals (P-5843.73 ppm, K-2229.53 ppm, Ca-1519.50 ppm and Fe-181.57 ppm), antioxidants (vitamin C-0.57 mg/g DW, tocopherols-0.58 mg/g DW, tannins-2.18 mg/g DW, total phenols-0.28 mg/g DW), crude protein (6.10%) and total soluble proteins (38.42 mg/g DW). Celery seeds contained about 2% essential oil and 23% fixed oil. The essential oil had limonene (terpene) as the major constituent with 40.75% followed by senkyunolide (20.08%), naphthalene (16.21%), butyl phthalide (8.48%), alpha-selinene (3.67%), pentyl-benzene (3.22%) and many other minor constituents like alpha-pinene, beta-pinene etc. The fatty acid profile of fixed oil was dominated by fatty acids; petroselinic acid (68.29%) followed by linoleic acid (20.70%), Myristic acid (1.44% area), palmitic acid (6.01% area) and linoleic acid (1.43%). In conclusion, celery seed is endowed with good biochemical composition and thus may be included in our daily diets as a nutritional delicacy.

## INDUCING EFFECT OF PRE-SOWING TREATMENTS WITH CERTAIN GROWTH HORMONES ON SEED GERMINATION OF GINGER LILY (*HEDYCHSIUM SPICATUM*)

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### ABSTRACT

An utmost attempt to augment the germinability of Ginger lily seeds using gradual sensible doses of certain plant growth hormones was made at College of Horticulture, Veer Chandra Singh Garhwali Uttarakhand University of Horticulture and Forestry, Bharsar (30° 05' N latitude and 78° 99' E longitude) during 2020. The experiment entails of two parts viz., laboratory experiment and polyhouse condition experiment comprising of gradual concentrations of GA<sub>3</sub>, IAA and NAA and an untreated check treatment tallying a total of 10 treatments. Various germination as well as growth parameters were studied critically and results witnessed superiority of the treatment GA<sub>3</sub> @ 750 ppm over rest of the treatments in all the traits under study and analyzed statistically significant observations. The treatment incidentally resulted in minimum time taken for first germination appearance under both laboratory (12.00 days) and polyhouse (26.33 days) condition. The laboratory condition ensured lesser time consumption on germination. Maximum germination was also noticed in GA<sub>3</sub> @ 750 ppm under both laboratory (93.30 %) and polyhouse (47.92 %) condition, indicating preferability of laboratory condition over polyhouse condition for germination. Also, the highest germination energy per cent [22.67 % (lab.) and 16.67 % (polyhouse)], maximum mean daily germination (MDG) [0.77 % seeds /day (lab.) and 0.11 % seeds /day (polyhouse)], fastest speed of germination [1.000 seeds/day (lab.) and polyhouse (0.20 seeds/day)]. germinator maintaining a constant temperature of 25 ± 2° C and 75-80 % relative humidity. Seed germination in lab condition using seed germinator creating consistent favorable conditions



by regulating temperature, humidity and light appeared to have resulted in better germination potential of seeds over the seeds germinated in polyhouse condition. The poorer seed germination in polyhouse condition could possibly be due the fluctuation in the environmental conditions which directly influences imbibition and other important biochemical processes responsible for seed germination. Thus, the seed germination *Hedyhcium spicatum* could effectively be improved judiciously by simply using seed germinator and growth hormones like GA3 @ 750 ppm.

## CHARACTERIZATION OF SOIL, WATER AND NUTRIENT STATUS OF THE LEAF UNDER BANANA LEAF MARGIN AFFECTED GARDENS IN HIRIYUR TALUK OF CHITRADURGA DISTRICT, KARNATAKA

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### ABSTRACT

The experiment on ‘Characterization of soil, water and nutrient status of the leaf under banana leaf margin affected gardens in Hiriurtaluk of Chitradurga district, Karnataka’ was carried out in the University of Agricultural and Horticultural Sciences, Shivamogga during 2019-2020 to know the problem arising in banana gardens of Hiriurtaluk. Soil samples were collected from two different depths (0 to 30 cm and 30 to 60 cm) in leaf margin affected and healthy banana gardens and analyzed for physical and chemical properties. From the same gardens index leaf samples were collected and subjected to analysis for nutrient composition. Similarly, water samples were collected and analyzed to know the quality irrigation water in the study area. The results of the investigation revealed that soils of banana leaf margin affected gardens showed the high mean clay content than healthy banana gardens, higher soil pH (7.82 – 9.2 in surface and 8.20-9.40 in subsurface soil) was found in affected gardens and significantly higher electrical conductivity was recorded in affected gardens compared to healthy banana gardens, i.e., (1.09-4.17dS m<sup>-1</sup>) in surface and (1.22-4.20dS m<sup>-1</sup>) subsurface soils. From the investigation, it was observed that the availability of nutrients was diverse in healthy and affected gardens. Soluble chloride was significantly increased in banana leaf margin affected gardens compared to healthy banana gardens. In water samples, EC (1.28dS m<sup>-1</sup>) and chloride (14.01 Me L<sup>-1</sup>) concentration exceeded the safer limit for the irrigation, out of all the nutrients in banana leaf, the concentration of chloride was found to be high (856.96 ppm) in leaf margin affected gardens in comparison to healthy banana gardens.

## ECO-FRIENDLY MANAGEMENT OF MAJOR INSECT PESTS OF OKRA, *ABELMOSCHUS ESCULENTUS* (L.) MOENCH” USING INTERCROPPING AND NEWER PESTICIDE MOLECULES

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### ABSTRACT

Okra, *Abelmoschus esculentus* (L.) Moench is one of the major economically important malvaceous vegetable crops commercially cultivated in many parts of the world and throughout India. However, major limiting factor in productivity of okra is its susceptibility to a large number of insect pests during various stages of growth. The studies on monitoring of pest appearance, intensity of occurrence and influence of natural enemies on the pest population can be used for decision making in pest management. Further, sampling plan is one of the most important activities in IPM programme. The present deliberation is directed to evaluate the efficacy of different schedules of newer pesticide molecules, various intercropping system for the management of okra pest complex viz., leafhopper, *Amrasca biguttula biguttula* (Ishida); whitefly, *Bemisia tabaci* (Gennadius); red spider mite, *Tetranychus cinnabarinus* (Boisd); and fruit borer *Earias vittella* (Fabricius) during kharif 2018 and 2019. Besides, sampling plan was worked out for assessing fruit borer incidence in okra. Results on correlation studies indicated that abiotic and biotic factors play an important role in regulation of this pest population in okra. Sequential plan was proved very useful in the proper intervention of control operation particularly at very low and very high fruit borer infestation. The sequential plan reduced the sampling effort in comparison to simple random sampling. Okra intercropped with cluster bean and spraying with Neem baan-spinosad recorded the lowest mean population of leafhopper (21.37 and 58.30 nos/15 leaves), red spider mite (108.42 and 101.42 nos/cm<sup>2</sup>) and lowest fruit damage on number (7.52 and 7.27%) and weight (7.84 and 7.34%) basis by *E. vittella*. while lowest mean population of whitefly in okra intercropped with baby corn and spraying with Neembaan-spinosad (9.20 and 9.13 nos/15 leaves). The population of coccinellids was highest in okra intercropped with cluster bean (4.56 and 4.30 nos/5plants) while spiders were high in okra intercropped with baby corn (5.22 and 4.33





nos/5plants). Among the all intercropping treatments, okra intercropped with cluster bean and spraying with Neem baan-spinosad (Rs 31973.50 and 35563.50/ha) and okra intercropped with baby corn and spraying with Neem baan-spinosad (Rs 30630.17 and 34663.50/ha) were identified as cost effective intercropping systems and higher additional return over sole crop of okra. Hence, it can be a potential component in IPM programme.

## **DESIGN AND DEVELOPMENT OF SEED METERING MECHANISM FOR GINGER RHIZOME**

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### **ABSTRACT**

Ginger planting is very tedious and drudgery operation due to regular bending posture at the time of sowing. The manual ginger planting operation requires about 200-250 man-h per hectare. The major ginger growing states face labour shortages, during planting season, as it coincides with the field operations other crops. The physical and mechanical properties of the ginger seed rhizomes were considered in the designing of a seed metering device. The mechanism consisted of a vertical rotating disc with cam and lever, seed box and agitator. The performance of the developed metering mechanism for ginger seed rhizome was evaluated in laboratory at three different forward speeds. The average seed spacing varied from 25.31 to 30.5 cm, missing index from 8.3 to 12.6%, multiple index from 18.5 to 37.9% and percent damage from 5 to 8.6% as the linear speed increase from 17.43 to 34 m/min. The performance of metering mechanism was found satisfactory to operate at an optimum speed of the 26.21 m/min. The developed metering mechanism will be used for the development of the automatic ginger rhizome planting machine.

## **PILOT TESTING OF FERTILIZER-MANURE BLOCKS IN OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH)**

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### **ABSTRACT**

The increase in food consumption and limitations in food production areas requires improved fertilizer use efficiency. With this intention, fertilizer-manure blocks (slow-release fertilizers) were developed and their efficiency were tested in okra. The study involved two experiments. In the first experiment, fertilizer-manure blocks were developed using different organic manures/fillers in five different proportions. The per plant dosage of fertilizers were calculated and used for formulating single block. The products were incubated in soil to evaluate the nutrient release pattern. The best proportion of fillers selected based on the experiment-I was used in experiment – II and fertilizer-manure blocks were prepared in two dimensions (100g and 25g) using three dosage of fertilizers. Three fertilizer dosages were taken as 100%, 50%, 25% POP of KAU and used for formulating fertilizer-manure blocks for a plant in a grow bag. The treatment with 100 g fertilizer-manure block with 25 % nutrients as basal placement and 50% nutrients as top dressing was identified as the best treatment for enhancing the productivity of okra in grow bags.

## **DEVELOPMENT OF SOIL BIN MODEL FOR DESIGN OF TRACTOR OPERATED COCONUT BASIN LISTER CUM FERTILIZER APPLICATOR**

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### **ABSTRACT**

India is the largest producer of coconut in the world and Kerala tops the list leading other states in 2018-19. For irrigating the coconut palm, basin listing operation is undertaken to form a 1.8 m radius basin around coconut palm for holding the water in confined basin space for the uptake of roots which in turn aids in growth of palms. Conventionally basins are formed manually around the coconut palm using spades, diggers, etc. A few research works on mechanical methods for basin listing viz., power



tiller operated basin listers were carried out in various research stations of Kerala and those models had the drawbacks of irregular basin and bund formation, lower depth of operation, time consuming, plant damage and accident prone. A soil bin model was developed to understand the soil dynamic behaviour with interaction of roto-tilling mechanism as this would be helpful to design a tractor operated coconut basin lister cum fertilizer applicator. Soil bin model consisted of rotor shaft, J-shaped blades, soil container, frame, soil collection unit, AC motor, chain, sprockets and bearings. A 3 hp AC motor drives the rotor shaft attached with J-shaped blades through chain and sprockets. These blades cut the soil beneath in soil container and throw it towards the soil collection unit. Laboratory evaluation was conducted in the soil bin model for two different arrangements such as whole width blades and spiral blades arrangements. Spiral blades arrangement yielded better outward soil throwing than whole width blades arrangement. Field test was conducted with spiral blades arrangement in rotavator hitched to tractor in the coconut palm plantation field and it resulted in desirable basin and bund formation around coconut palm.

## **ASSESSMENT OF GROWTH PERFORMANCE OF SWARNA DHARA POULTRY BREED UNDER STALL FED GOAT HOUSING SYSTEM**

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### **ABSTRACT**

In recent era, rearing of sheep/goat in the stall-fed housing system becoming more popular as compared to conventional grazing system. As their lot of space available underneath the housing system, that space will be effectively utilized for rearing poultry birds which will be an additional income to farmers. In this view, the growth performance, production and economy of rearing poultry birds underneath the small ruminant stall-fed housing system was systematically studied. In the present study, four-week age old Swarna dhara birds were reared, for every one sheep or goat ten birds can be kept under the shed. The results showed that there were no significant changes in body weight gain, feed conversion ratio, mortality, morbidity of poultry birds reared under stall fed housing system as compared to conventional system. There is significant decrease in the feed intake (10 %) in Swarnadhara breed and decrease in ectoparasite infestation (80 %) in goats was noticed. Hence this innovative methodology can be used to get additional income from poultry farming along with small ruminant rearing.

## **ROLE OF NANO FERTILIZERS IN SUSTAINABLE AGRICULTURE**

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### **ABSTRACT**

Nano-fertilizers intended to improve the nutrient use efficiencies by exploiting unique properties of nanoparticles. The nano-fertilizers are synthesized by fortifying nutrients singly or in combinations onto the adsorbents with nano-dimension. Both physical (top-down) and chemical (bottom-up) approaches are used to produce nanomaterials. Encapsulation of fertilizers within a nanoparticle is one of these new facilities which are done in three ways a) the nutrient can be encapsulated inside nanoporous materials, b) coated with thin polymer film and c) delivered as particle or emulsions of nanoscale dimensions. Nanostructured formulation might increase fertilizer efficiency and uptake ratio of the soil nutrients in crop production, and save fertilizer resource. Controlled release modes have properties of both release rate and release pattern of nutrients for water-soluble fertilizers might be precisely controlled through encapsulation in envelope forms of semi-permeable membranes coated by resin-polymer, waxes and sulphur. Nanostructured formulation can reduce loss rate of fertilizer nutrients into soil by leaching.

In order to meet sustainable development goals, agricultural production needs to be increased and the pollution and GHG emissions related to farming activity need to be decreased. We suggest that advances in the application of biotechnology and nanotechnology have the potential to facilitate improved nutrient management and use efficiency in agroecosystems. Regulated and sustained release of nutrients assists in improving the nutrient use efficiencies over the conventional fertilizers. Nano fertilizers based on slow-/controlled-release and/or carrier delivery systems have been shown to improve crop yields, soil productivity, and lower nutrient loss compared with conventional fertilizers. The work done on nanofertilizers is very



limited across the globe, but the reported literature clearly demonstrated that these customized fertilizers have a potential role to play in sustaining farm productivity.

## **IMPACT OF SKILLED TRAINING ON “SHEEP AND GOAT FARMING: A VENTURE FOR FINANCIAL SECURITY**

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### **ABSTRACT**

Sheep and goat farming is one of best profitable enterprise and play an important role in the livelihood of a large proportion of small, marginal and landless farmers with easy maintenance, good market and have more demand as compare to other livestock enterprise. Hence, paid vocational trainings on profitable sheep and goat farming were conducted by ICAR-Krishi Vigyan Kendra, Dharwad during 2017-18, 2018-19 and 2019-20. Based on the need identification of the farmers and youths, ICAR-KVK, Dharwad, conducted three days paid training on “profitable sheep and goat farming for economic security”. Total 181 farmers, farm women, employs and unemployed youths were the participants. Majority of the young male (58 %), degree holders (38 %) were the participants. Most of them wanted to have financial security through sheep and goat farming. The practical applicability, learning by seeing, learning by doing activities were focussed by method demonstrations. Visit to demo plots, practising farmer’s field, interaction with scientists and lending agencies were also facilitated. These programmes helped the farmers to improve the necessary knowledge and skills of trainee (97 %). About 69 per cent of trainees (125 no.) were self-employed with sheep and goat farming by average increase in annual income by 30 %.

## **THE DESERT LOCUST (*SCHISTOCERCA GREGARIA*): A CHALLENGE TO INDIAN AGRICULTURE - IT’S CONTROL & MANAGEMENT**

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### **ABSTRACT**

The insect generally known as pests are most important group of animals on earth. Indian agriculture and economy are currently at risk due to invasion and incidence of many insect pests like Fall Army Worm, Pink Bollworm of Cotton, Tomato Pin Worm, White Fly and Locust etc. Locust are the group of several species of short-horned grasshoppers in the family Acrididae, concerned a major agricultural pest in the world. out of 5000 different species of grasshoppers, those which can live in two different phases viz. Solitary & Gregarious are called Locust. These are solitary but in certain circumstances, they change their habit and behaviour, becoming gregarious. This phase is highly migratory, having marked polymorphism and voracious feeding behaviour. In present paper the Desert Locust, its challenge to Indian Agriculture and suitable remedies for control measures are discussed. As per secondary data report and feedback on pest & diseases survey & surveillance noticed that there are ten important species of Locust in the world, of which four species i.e. Desert locust, Migratory locust, Bombay locust & Tree locust are found in India. The origin of Desert Locust is basically African desert so called Desert Locust, which covering the middle east invade in India through Pakistan. It is an international pest affecting about 60 countries. It’s invasion & swarming since long back becoming a challenge to Indian Agriculture and economy, because when it’s swarm reached in India caused much damage & economic loss to Indian Agriculture which affected livelihood of farmers & poor families. Many times, when the climatic conditions become favourable, the locust swarm become uncontrolled and increase enormously as such it develop locust plague.

India has had many locusts plaque, there were total 13 plague until 1962, and 18 plague from 1962 to 2010, and more recently the locust swarm reached during May/ June, 2019-20 and attacked many crops, vegetation, plants & animals. During 2019-20, the major loss was reported in Rajasthan and Gujrat States and total area 1,79,584 hect & 19,313 hect was affected respectively. While during 2020-21, the swarm spreaded in more than ten states, and it was observed that alone in Rajasthan state approx 2235-hectare agriculture area was affected which reported 33% crop damage while in Haryana, Madhya Pradesh, Maharashtra, Uttar Pradesh & Uttarakhand states, the crop area affected was 6520, 4400, 806, 488 & 267 hect respectively, caused much loss to Agriculture & Indian economy and has social impact which invited attention of the Scientists & experts. No doubt Scientist & Technology developer is doing well in this line, and World Locust Organization and Locust Division,



PPQ & S Faridabad engaged at root level for control of locust attack and its management. Many technologies and package & practices are developed and demonstrated at farmers & stakeholders' level. Among these IPM is the best tool (Michel Lecog, 2020 Research Paper) and "Protective Umbrella" for crop protection and Desert Locust management.

## ASSESSMENT OF OKRA HYBRID/VARIETY FOR INCREASED YIELD AND YVMV RESISTANCE

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### ABSTRACT

Okra is one of the important vegetable crops of Koppal district which is grown in an area of 600 ha. The assessment was carried out in the vegetable belt of Koppal Halahalli during the year 2019-20 and 2020-21. Farmers basically go for cultivation of Okra crop with stable market price assurance. Generally, farmers go for cultivation of either local variety or private hybrid and they are facing the problem of YVMV incidence which resulted in the reduced yield of the crop. To address this issue KVK conducted On Farm testing of two okra hybrid Arka Nikitha and COBH4 and one variety Phule Vimukta for two years. The assessment showed that the two hybrids and the variety resulted in the increased fruit per plant and ultimately increased yield as compared to the farmers cultivated private hybrid. With respect to YVMV incidence Arka Nikitha expressed 5.33%, COBH4 4.67 as compared to Phule Vimukta 0% of YVMV incidence. In addition to this COBH4 fruits were of less trichome which was found good for harvesting as compared to Arka Nikitha and Phule Vimukta. Overall Phule Vimukta was found better acceptance followed by COBH4 and Arka Nikitha.

## EMS INDUCED VARIABILITY FOR POD YIELD IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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### ABSTRACT

An investigation was carried out to assess the variability in M<sub>4</sub> generation of GG 20 groundnut variety induced by different doses (0.2 to 0.6%) of EMS during Kharif 2019. Among the different doses of EMS treated GG 20 population, 0.2 % and 0.3 % EMS was found effective in inducing variability for pod and seed yield. Pod yield per plant was associated positively with seed weight per plant and number of seeds per plant in all EMS treated lines. Number of pods per plant associated negatively with hundred pod weight and positively with number of seeds per plant and seed weight per plant. The desirable mutants isolate can be useful for further improvement of Virginia bunch groundnut.

## MEASUREMENT OF IMPACT ON RESEARCH PUBLICATIONS IN PEDIATRIC CARDIOLOGY

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### ABSTRACT

Pediatric Cardiology is the study and treatment of disorders of the heart in children; It is a medical specialty which is involved in the care of all things associated with the heart and the arteries. Measurement of impact on research publications in pediatric cardiology is highly helpful. Scientometrics is the science of measuring and analysing science. Scientometric data can be useful to measure research collaborations among scientific environments and to monitor the evolution of special scientific subjects and fields. Scientometric tools can be used to measure and compare the scientific activities at various levels of aggregation including institutions, sectors, provinces and countries. A study on scientometrics analysis on pediatric cardiology was conducted to identify the geographical wise distribution of Publications in Pediatric Cardiology and to know the Citable documents. All publications on Pediatric Cardiology (Research Areas: "Pediatric Cardiology") in address field





were downloaded from *Web of Science database*. The data were exported and processed in the HistCite to find out the contribution of Authors, Citations in the field of Pediatric Cardiology research during years 1989–2016. Based on the analysis undertaken for the present study found that USA is the most productive Country with 904 (50.10 %) publications followed by Canada with 177 (9.8 %) publications and Germany with 110 (6.1 %) publications. The study found that top 20 positions occupied by USA Institutions except 5 and 6 (Canada). Similarly top-ranking source of titles is highly impact factor journals. Journal Circulation ranked first in order with 259 (14.3%) articles (Impact Factor is 14.43) and next to Journal of the American College of Cardiology ranked second with 156 (8.6%) articles (Impact factor is 17.76) during the period of study.

## A STUDY ON REDGRAM INTERCROP WITH MAIZE IN MAHABUBNAGAR DISTRICT OF TELANGANA STATE

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### ABSTRACT

Intercropping of legume with cereal is a recognized practice for economizing the use of nitrogenous fertilizers and increasing the productivity and profitability per unit area and time. Maize subjected to prolonged dry spells results in complete crop failure is common, in semiarid tropics of Southern Agroclimatic zone of Telangana State. A careful selection of crops having different growth habit can reduce the mutual competition to a considerable extent. The redgram being deep rooted and slow growing in its early growth stage, during which the more rapidly growing crop like maize can be conveniently intercropped to utilize the natural resources more efficiently. Practice of intercropping drought tolerant redgram with maize assures farmers some yield compensation to main crop. In view of this, an experiment was conducted during three consecutive years, from Kharif 2015 to Kharif 2017, in farmers field of Mahabubnagar district, Telangana state. A crop stand ratio of 2:1 Maize + Redgram system was implanted in farmers field at 5 locations of Mahabubnagar district to harness good returns from the component crops. Pooled data over three years indicated that intercropping of redgram and maize at 2:1 row ratio recorded 38.5 per cent increase in yield. As compared to sole crop of Maize. B:C ratios 2.5 in redgram intercrop with maize and 1.28 in sole crop Maize was realized.

## COMPUTATIONAL IDENTIFICATION OF MIRNA AND THEIR TARGETS IN BREAD WHEAT FOR SALINITY

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### ABSTRACT

Wheat (*Triticum aestivum* L. em. Thell) is staple food which provides essential nutrients for major chunk of the world population. Soil salinity, a leading constraint of crop productivity and quality, affects 88% yield of bread wheat and 50% of durum wheat. It causes osmotic and ionic stress in the plants resulting in stunting and premature death. To cope with salinity, plants adapt by enormous biochemical, physiological and molecular modifications. MicroRNAs (miRNAs) are well known for their potent regulatory roles in diverse aspects of development and stress responses in plants. They regulate gene expression of their target mRNAs through post-transcriptional degradation or translational repression. This study was conducted to identify miRNAs and their potential targets to understand the role of miRNA in wheat under salt stress. Genome sequences of all the 21 chromosome of wheat were retrieved from International Wheat Genome Sequence Consortium (IWGSC). These sequences were transcribed into RNA and palindrome sequences were predicted. Minimal free energy (MFE) of secondary structure of palindrome sequences was also predicted to predict the stability of the hairpin stem-loop structure. Seven hundred twenty-five putative miRNA were predicted and verified by using BLAST available in mir Base database. A total of 114216 potential targets which were involved in different biochemical, physiological and molecular processes were predicted for the putative miRNA using psRNA Target server. By following stringent filtering criteria, 23 gene potential targets were selected and sequences were retrieved. Two hundred thirteen SSRs were predicted by using SciRoko tool and primers were designed from the flanking regions of SSRs using batch primer3 software. In silico amplification was



recorded for 1522 SSRs using Fast PCR tool. These primers amplified successfully against wheat genome and can be further used for expression analysis.

## COLD TOLERANCE BREEDING—IN THE ERA OF CLIMATE CHANGE

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### ABSTRACT

Globally, 690 million people go to bed on an empty stomach each day. On the other hand, rising global temperatures are making sea levels to raise which in turn depleting the amount of arable land. Besides, due to this climate change plants have to overcome the stressful situation as nearly 42% of land involve in temperatures below -20°C. To have an overview, abiotic stresses adversely affect the growth, productivity by triggering a series of morphological, physiological, biochemical, and molecular changes in plants. Hence, plants require specialized mechanisms for their survival on exposure to low temperatures. Amongst, cold stress is a major environmental factor that limits the agricultural productivity of plants. Hence, there is an urge to develop and cultivate cold-resistant crop varieties. To fight with it, conventional breeding methods have met with limited success in improving the cold tolerance of important crop plants. In this scenario, utilization of genes through transgenic approach and Marker assisted introgression can greatly increase the potential of low temperature stress breeding. Besides, full genome profiling/ sequencing, mutational and transgenic plant analyses, have provided a deep insight into the complex transcriptional mechanism that operates under cold stress while developing cold-tolerant transgenics in crops of commercial importance viz., *Triticum sativum*, *Oryza sativa*, *Nicotiana tabacum*. Moreover, identifying quantitative trait loci using high-density mapping populations and genome-wide association studies could be a worthwhile approach for exploring novel genes involved in plant resistance to low temperatures.

## ADVANCED TECHNOLOGIES TRANSFORMING DAIRY INDUSTRY

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### ABSTRACT

An increase in the dairy products demand within past few decades has resulted in an increase in the average herd size in the dairy farms which has increased labour and animal management pressure on farmers. So, there is a need for advancement of dairy farms with modern technologies for proper management of farms and reduce the workload on farmers. Basically, these technologies can be categorised into two components- 1. Computed Technologies (ex. Health tracking devices, cattle monitoring drones, robotic milking machines etc.) 2. Biotechnologies (ex. Artificial insemination, Multiple ovulation embryo transfer, vaccination etc.). As the dairy industry is contributing majorly to global food security it is therefore essential to develop a holistic approach for efficient working of dairy farms for obtaining potential production.

## ASSESSMENT OF SPATIAL DISTRIBUTION OF DIAMONDBACK MOTH, *PLUTELLA XYLOSTELLA* (L.) ON CABBAGE

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### ABSTRACT

The experiment was laid out during Rabi, 2019-20 and 2020-21 at the Horticulture farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur which is located at South Eastern part of Rajasthan. The present investigation aimed to study the distribution pattern of larvae and pupae of Diamondback Moth on cabbage. The larval



and pupal population of Diamondback Moth were recorded on 60 randomly selected plants at weekly interval. Variance to mean ratio, exponent – K, patchiness index, clumping index, mean colony size, mean clump size, Iwao's patchiness regression and Taylor's power law were analysed to test the dispersion behaviour of Diamondback Moth. The data revealed clumped larval distribution. The mean crowding index for larvae and pupae were ranged from 6.82 to 103.70 and 2.75 to 15.41 during Rabi, 2019-20 and 2020-21, respectively. The value of dispersion index exceeded unity in most of the weekly observations indicating clumped type of distribution of Diamondback Moth larvae and pupae on cabbage field. The Lloyd's index was one and more which also indicated clumped type of distribution.

## IMPACT OF *INSITU* INCORPORATION OF PADDY STRAW WITH DIFFERENT NUTRIENTS MANAGEMENT PRACTICES ON GROWTH AND YIELD OF WHEAT (*TRITICUM AESTIVUM* L.)

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### ABSTRACT

A field experiment was carried out at Student Instructional farm, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Ayodhya (U.P.) during Rabi season 2019-2020 to evaluate the effect of *in-situ* applications of paddy in combination with various nutrients management practices on growth and yield of wheat. The experiments consist of six treatments T<sub>1</sub>-Control (No fertilizer), T<sub>2</sub>-RDF (120:60:40) No paddy Straw, T<sub>3</sub>-RDF (120:60:40) + Paddy Straw (5t/ha), T<sub>4</sub>-RDF (120:60:40) + Paddy Straw (5t/ha) + FYM, T<sub>5</sub>-RDF (120:60:40) + Paddy Straw (5t/ha) + Extra N (20kg/ha), T<sub>6</sub>-RDF (120:60:40) + Paddy Straw (5t/ha) + Extra N (30kg/ha). The result revealed that maximum plant height, no. of tillers, test weight, grain per spike, Grain yield (q ha<sup>-1</sup>) Straw yield (q ha<sup>-1</sup>), Harvest index were obtained with treatments applying T<sub>6</sub>-RDF (120:60:40) + Paddy Straw (5t/ha) + Extra N (30kg/ha) which is closely followed by applying T<sub>5</sub>-RDF (120:60:40) + Paddy Straw (5t/ha) + Extra N (20kg/ha).

## RELATIONSHIP OF AGE AND SOCIO-ECONOMIC STATUS WITH MENTAL HEALTH AND PARENTAL STRESS AMONG SINGLE PARENTS

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### ABSTRACT

Single parent is the uncoupled individual either father or mother alone is solely responsible for the upbringing of children and duties towards their families. The study on "Relationship of age and socio-economic status with mental health and parental stress among Single parents" was carried out in Dharwad and Bagalkot Districts. Study comprised of 120 Single mothers were selected from two villages of each taluka, through snowball technique. The Mental Health Inventory by Jagadish and Srivastava, Socio Economic Status scale by Agarwal et.al and Self structured questionnaire were used to collect the data. The results found that majority of the single parent had medium parental stress and poor mental health from both the locality. The study also showed that poor the mental health, higher the parental stress among single parents. There is significant relationship between SES and age with parental stress, whereas SES had significant relationship with Mental Health of single parents.

## EMERGING ERA OF INTEGRATED FARMING SYSTEM

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### ABSTRACT

At present, the farmers concentrate mainly on crop production which is subjected to a high degree of uncertainty in income and employment to the farmers. In this contest, it is imperative to evolve suitable strategy for augmenting the income of a farm throughout the year. The emergence of integrated farming systems (IFS) has enabled farmers to develop a framework for an alternative development model to improve the feasibility of small sized farming operations. This system is a commonly used



term to explain a more integrated approach to farming compared to monoculture approaches. It refers to agricultural systems that integrate livestock and crop production or integrate fish and livestock and may sometimes be known as integrated Biosystems. Integration of various agricultural enterprises viz., cropping, animal husbandry, fishery, forestry etc. in the farming system has great potentialities in agricultural economy. These enterprises not only supplement the income of the farmers but also help in increasing the family labor employment throughout the year.

## **INFLUENCE OF CLIMATE CHANGE ON FOOD QUALITY**

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### **ABSTRACT**

Climate change being a current global concern, has affected the food production system and supply chain at varying magnitudes. A change of climate which is attributed directly or indirectly to human activity that alter the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time period. Some factors responsible for climate change are volcanic eruption, cement manufacture deforestation, burning of fossil fuels, rice production (CH<sub>4</sub>&N<sub>2</sub>O)etc. Projection to the end of this century suggest that atmosphere CO<sub>2</sub> will at top 700ppm or more, whereas global temperature will increase by 1.8-4°C, depending on greenhouse emission scenario. Climate change affects the food quality. At critical high temperature, granules appear in the cytoplasm, viscosity increases and the cell membrane loses its permeability & coagulation of the entire cell contents takes place. High summer temperature aggravates incidence of various pests and diseases Reduction in photosynthesis capacity in the plant-results in slower growth and smaller leaves. In wheat, elevated CO<sub>2</sub> reduce N, protein, amino acid, and modified gluten composition. In potato tubers, eCO<sub>2</sub> increases the concentration of glucose (22%), fructose (21%) and reducing sugars (23%), responsible for browning and acrylamide formation in fried potatoes (hogy and fangmieir.2009). The reduction of N and essential minerals and increase in mycotoxins can have significant impacts on human nutrition. There are some conservation technologies viz. crop diversification, precision N management, use of biochar, agroforestry, improved planting technique and proper land use management have good potential in minimising the emission of GHGs from agriculture.

## **EFFECT OF TEMPERATURE HUMIDITY INDEX (THI) ON REPRODUCTION PERFORMANCE OF RED SINDHI CATTLE MAINTAINED ON ORGANISED FARM**

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### **ABSTRACT**

Livestock management is a typical weather-dependent livelihood, extremely vulnerable to climate-induced weather extremes like heat stress, drought, cyclones, tropical disease, shortage of fodder etc. Hence, climate change demonstrates a cascading effect on livestock sector, in terms of production and reproduction performance. The environmental conditions that induce heat stress can be calculated using the temperature humidity index (THI) which is used to study the effect on livestock production and reproduction. Red Sindhi is an important milch breed of cattle which is maintained at Division of Animal Husbandry and Dairy Science, College of Agriculture, Dhule (M.S). The data pertaining to reproduction performance of Red Sindhi cattle were collected from history cum pedigree sheet and subjected to analyzed by least square technique as suggested by Harvey (1991) to study the effect of period of calving, Season of calving and lactation order. Then data were corrected for the significant effect and used for assessing the effect of THI on reproduction traits. The least squares mean of age at first calving, service period, calving interval, dry period (days) and WTDMY at different stages of lactation were estimated by considering the effects of period of calving, season of calving, lactation order and THI as non-genetic effects. The frequency distribution patterns for PMY according to THI were worked out. The overall least squares mean for AFC, service period, calving interval, and dry period (days) were 1359.02 ± 28.83 (days), 94.36 ± 6.29 (days), 384.49 ± 7.62 (days) and 83.33 ± 5.41 (days) respectively. The effect of period of calving was significant on age at first calving and calving interval (p<0.05), while non-significant on service period and dry period. The variation due to season of calving was non-significant on all reproduction traits under study in Red Sindhi cattle. Also, the influence of lactation order on service period, calving interval and dry period were non-significant.

The THI had non-significant influence on all the reproduction traits indicating that the Red Sindhi cows were acclimatized to





the local climate if, optimum feeding with sound management are provided. The frequency distribution pattern for PMY according to THI indicated maximum number of cows giving PMY more than 8 kg was lies under THI5 (>89), THI3 (83-86) and THI4 (86-89). Under THI5 a total of 51 (85.00%) cows yielded more than 8 kg PMY, THI3 a total of 45 (88.23%) cows yielded more than 8 kg PMY and THI4, a total of 45 (81.81%) cows yielded more than 8 kg PMY. This was indicated that for the Red Sindhi cattle were comfortable between 83-89 zones THI (THI3 and THI5).

## VITAMIN AND MINERAL BIOFORTIFICATION IN GENETICALLY MODIFIED CROPS

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### ABSTRACT

Bio fortification refers to the indirect addition of essential nutrients or other substances to foods for the purpose of nutritional or health enhancement. “Biologic fortification” or “bio fortification” when referring to agriculture, indicates crops that have been nutritionally enhanced using agronomic practices, conventional plant breeding practices, or modern biotechnology. The intention is to provide nutrients that are essential for health and development, but for metabolic, physiological or economic reasons are not available to all population groups at all times for that bio fortification is very effective tool it will be helpful in different crops to enhance the nutritional aspects like in golden rice vitamin A rich, iron fortification of rice seed, Maize Vitamin E and high-iron bio-fortified pearl millet. Bio fortification crops in improving micronutrient status as constituent of regular diets and patterns of production and consumption worldwide, and it helps to overcome the malnutrition in human beings. To increment of plant or crop quality and increment of variety in germplasm. Easy distribution when released too needy. Fortification doesn’t require changes in existing food patterns nor individual compliance – which are very difficult to achieve. Bio fortified staple foods cannot deliver as high a level of minerals and vitamins per day as supplements or industrially fortified foods, but they can help to bring millions over the threshold from malnourishment to micronutrient sufficiency.

## KNOWLEDGE AND ADOPTION OF RECOMMENDED ISABGOL PRODUCTION TECHNOLOGY BY THE FARMERS IN JODHPUR REGION OF RAJASTHAN

Mahendra Sou

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### ABSTRACT

Isabgol (*Planta goovate* Forsk) is one of the important medicinal and commercial crops in India. Total area and production of Isabgol in Rajasthan was 4,17,109 ha and 2,26,480 tonnes respectively during the year 2017-18. Jodhpur region is leading at first position in terms of area and production of Isabgol in Rajasthan. The present study was conducted in Jodhpur region of Rajasthan comprising two districts namely Barmer and Jodhpur. Since these two are leading districts in terms of area production of Isabgol in Rajasthan. Two panchayat samities from each districts were identified based on area production of Isabgol and eight Isabgol growing villages were selected randomly from each panchayat samities. Likewise, sample comprised of a total 120 respondents (farmers). The data were collected with the help of interview schedule through personal interview method by the investigator himself.

The data so collected were classified, tabulated and analysed statistically which led to major findings that Majority (69.16 per cent) of Isabgol growers were having medium level of knowledge about recommended Isabgol production technology. The study indicated that farmers had maximum knowledge about “irrigation management” (86.66 MPS) and “harvesting” (84.58 MPS), while minimum knowledge about “Weed management” (57.22MPS) and “Plant protection Measure” (51.87 MPS). Majority (62.50 per cent) of Isabgol growers were having medium level of adoption about recommended Isabgol production technology. The results showed that farmers possessed high adoption regarding practices like “irrigation management” (82.36 MPS) and “harvesting” (78.33 MPS) and low adoption of practices like “weed management” (53.75 MPS) and “plant protection measure” (48.12 MPS). The knowledge level of farmers about recommended Isabgol production technology was negatively and significantly correlated with “age” and “land” respectively while “education”, “extension contacts” and social participation were positively and significantly correlated and “Income from agriculture” was negatively and non-significantly correlated and “income from non-agriculture” was positively and significantly correlated with knowledge about



recommended Isabgol production technology. The extent of adoption of recommended Isabgol production technology was found negatively and significantly correlated with their “age”, while “education”, “extension contacts” and social participation were positively and significantly correlated while “income from agriculture”, was negatively and non-significantly correlated and “income by non-agriculture”, was positively and non-significantly correlated, while “land” was negatively and non-significant correlated with their extent of adoption of recommended Isabgol production technology.

The results showed that among the enlisted Input constraints most important constraints was “Unavailability of high yielding varieties seeds at the time of sowing” (80.83 MPS) followed by “Lack of supply of quality seed” (77.50 MPS) and in Technical constraints most important constraint was “Lack of knowledge about improved varieties of Isabgol” (78.88 MPS) and “Lack of skill for seed treatment” (76.38 MPS) also the results showed that in Financial constraints most important constraint were “High cost of seeds of high yielding varieties” (75.00 MPS) and “High cost of labours” (73.88 MPS) and in Marketing constraints most important constraint was “High price fluctuation” (80.27 MPS) and “Lack of latest market information” (77.77 MPS).

## **POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES**

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### **ABSTRACT**

Horticulture plays a significant role in Indian Agriculture. It contributes 38% GDP of agriculture. India is the second largest producer of both fruits and vegetables in the world. Post-harvest losses in fruits and vegetables are very high (20-40%). About 10-15% fresh fruits and vegetables shrivel and decay, lowering their market value and consumer acceptability. Preservation the techniques of extending the storage life of the produce without deteriorating its edible quality for further use. Horticultural produce is biological entity with various physiological activities like transpiration and respiration continuing even after harvesting. This process leads to the bio-chemical breakdown and cause spoilage of the produce. Spoilage is initiated by enzymes present inside the produce, involvement of microorganism, infestation of insect-pest and invasion of pathogens. By taking care of these factors, food products can be stored for longer period. Processing is the application of techniques to prevent losses through preservation, processing, packaging, storage and distribution. The processed foods have now become more of a necessity than a luxury. It has an important role in the conservation and better utilization of fruits and vegetables. It is necessary in order to avoid glut and utilize the surplus during the peak seasons. It employs modern methods to extend storage life for better distribution and also processing technique to preserve them for utilization in the off season.

## **TRICHOGRAMMATIDS IN BIOLOGICAL CONTROL OF INSECT PESTS IN INDIA**

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### **ABSTRACT**

Biological control methods have a significant role in Integrated pest management. It has been utilized worldwide for more than a century, providing sustainable control of multiple major agricultural pests. Trichogrammatids, commonly known as stingless wasps, are known to parasitize a number of damaging insect pests, especially lepidopterans, in egg stage naturally in cotton, rice, chickpea, sunflower, tomato, okra and many more crops. Their ability to control the pests at egg phase makes them an efficient, effective, affordable and commercially viable option for biocontrol of insect-pests in India in several target crop systems, especially in vegetables, rice and sugarcane. About 230 species of Trichogramma are keystone natural enemies of a variety of agricultural and forest pests (nearly 200 insect species belonging to 70 different families) and at least 12 species are commercially used on a large scale in biological control programmes. Trichogrammatids offer an eco-friendly, less costly and long-term plant protection option in comparison to conventional insecticides. Biointensive insect pest management approach and development of multiple insecticide resistant and temperature tolerant strains are bright sides of exploiting trichogrammatids in coming future to save crops from insect pests. In India, many species of *Trichogramma* and *Trichogrammatoidea* have been used in applied/augmentative biological control programmes. They are probably the most widely sold and used biocontrol agents.



## **CORRELATION AND PATH ANALYSIS FOR YIELD AND YIELD ATTRIBUTING TRAITS IN CHICKPEA (*CICER ARIETINUM* L.)**

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### **ABSTRACT**

The seed yield is the manifestation of multiplicative interaction of several characters termed as yield components. The genetic architecture of seed yield is generally based on the balance or overall net effects produced by various yield components and their interaction with one another. The resultant yield is the combined effect of several component traits and environment. The present investigation was carried out during *Rabi* 2019-20 at College of Agriculture, Vijayapur campus with a view to study correlation and path coefficient analysis in chickpea to know the association, direct and indirect effects of various productivity traits. The experiment was consisted of eighty nine chickpea genotypes along with six checks. Days to first flowering (0.28), days to maturity (0.45), plant height (0.82), number of secondary branches (0.82), number of pods per plant (0.28), number of seeds per pod (0.24), 100 seed weight (0.34), seed vigour (0.28) and seed protein (0.45) showed significant positive correlation with seed yield per plant. Days to first flowering (0.198), days to first podding (0.063), days to maturity (0.176), plant height (0.002), number of primary branches (0.177), number of secondary branches (0.024), number of pods per plant (0.738), number of seeds per pod (0.003), 100 seed weight (0.187) and seed vigour (0.003) showed direct and positive effect on seed yield per plant. Path coefficient results indicated that hundred seed weight had highest positive direct effect on yield per plant followed by number of secondary branches and number of pods per plant, so these are the important characters for selection and improvement of seed yield in chickpea.

## **ROBOTIC WEEDING FOR PRECISION AGRICULTURE**

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### **ABSTRACT**

Precision agriculture is gaining popularity for its timely crop management, efficient use of input resources, reduced environmental pollution and cost of cultivation over long term practice. Increasing labour scarcity and limited working time coupled with lesser work efficiency that too under favourable environment is of vital concern in adopting precision agriculture. Technology showed that, robotics in agriculture is need of the hour to overcome these problems. Robots are majorly used in industrial sectors for their non-stop work and accuracy with which they perform the task than a highly skilled human. The robots through use of sensors based on GIS and GPS principles are gaining wider scope in precision agriculture in detecting minute temporal and spatial variations in the field than humans do. Robotic weed management is one such application, wherein the unwanted plants in the field are effectively controlled to provide competition-free environment for the crop in order to achieve higher crop yields. The robotic weed management involves detection of weeds based on spectral difference in the vegetation followed by mapping them according to spatial location and finally weeding is done either by spraying, cutting or flaming precisely the weed population without affecting crop plants. Research studies showed that robotic weeding has an advantage of accuracy, efficiency and early weed management with enhanced yield over traditional methods with reduced dependency on labours. The success of robotic weeding relies on the use of high-resolution cameras and sensors with suitable robot design for the field condition.

## **PRECISION NUTRIENT MANAGEMENT- A TOOL TOWARDS SUSTAINABLE AGRICULTURE**

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### **ABSTRACT**

India is facing huge fertilizer crisis, completely depend on imports for its potassium requirement. Fertilizer rates are increasing with the increasing demand for achieving higher food production. The conventional methods of nutrient supplementation viz., broadcasting, band application or any such local practice though at recommended rates are less efficient as they involve huge losses in soil and it may sometimes happen that the fertilizers applied may be excess/deficit in quantity than the crop required thus, causing fluctuations in food production systems in spite of intense crop care. Hence, precision nutrient management is



need-of-the-hour tool towards sustainable agriculture. Precision nutrient management basically involves assessment of temporal and spatial variations so as to optimally match the time and quantity of crop nutrient requirement based on soil viz., STCR approach, fertility assessment through use of remote sensing technology and laboratory estimations and crop conditions viz., indirectly by estimating chlorophyll content in plants through use of LCC for rice, SPAD meter reading and Green seeker. Studies also showed that these tools have given promising results in reducing the fertilizer demand and nutrient losses with improved nutrient use efficiency coupled with enhanced yield levels in major crops. In spite of its benefits viz., enhanced nutrient uptake by plants, avoids excess or deficit application and reduces nutrient losses, environmental pollution and costs involved in crop production it is still at infant stage in India due to lack of awareness and technical knowledge among the farmers coupled with non-availability of cheap handy tools.

## ENDOPHYTIC ENTOMOPATHOGENIC FUNGI AS BIOLOGICAL CONTROL AGENTS AGAINST STEM BORER IN MAIZE

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### ABSTRACT

Biological control is one of the most effective environmentally friendly alternatives in pest management. Entomopathogenic fungi, *Beauveria bassiana* and *Metarhizium anisopliae* have the ability to exist as endophytes in plants and protect the hosts against insect pests. Evaluation of NBAII entomopathogenic strains against maize stem borer, *Chilo partellus* was carried at Regional agricultural research station, Anakapalle, Andhra Pradesh with six *Beauveria bassiana* strains (NBAII Bb5a, Bb7, Bb14, Bb19, Bb23), one *Metarhizium anisopliae* strain (NBAII Ma35) during 2016-2018. NBAII entomopathogenic strains were applied as first spray at 20 days after seedling emergence and second spray at 30 days after first spray. Lab reared *Chilo partellus* neonates were released in leaf whorls of each treatment using bazooka applicator @ 5-8 larvae /plant at 5 days after first spray. Dead hearts caused by stem borer was significantly low in NBAII entomopathogenic endophytic strains i.e., Bb -19 (1.5% DH), Bb-5a (2.64 % DH) and Ma 35 (1.8% DH) as compared to Carbofuran whorl application (6.34 % DH) and was high in untreated control (12.48% DH). The data on exit holes/ plant revealed that Bb 5a, Bb19 (1.56 exit holes/plant) and Ma35 (1.67 exit holes/plant) recorded significantly less damage as compared to carbofuran (5.67 exit holes/plant) and untreated control (6.44 exit holes/plant). Stem tunneling caused by *Chilopartellus* was significantly low in Bb19 (4.2 cm/plant), Bb 5a (5.23 cm/plant) and Ma35 (6.89 cm/plant) as compared to carbofuran (8.72 cm/plant) and untreated control (18.47 cm/plant). Bb 5a, Bb19 and Ma35 gave significantly higher cob yields (71.37'000/ha, 68.94'000/ha and 67.27'000/ha respectively) than carbofuran (60.49'000/ha) and untreated control (50.62'000/ha). NBAII entomopathogenic strains Bb5a, Bb19 and Ma 35 were proved effective in the management of maize stem borer, *Chilopartellus*.

## EFFECTS OF GIBBERELIC ACID (GA3) ON NICKEL INDUCED MORPHOLOGICAL AND PHYSIOLOGICAL STRESS IN ZEA MAYS L.

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### ABSTRACT

Nickel (Ni), is an essential micronutrient for normal plant growth and development. It is a component and an activator of enzyme urease which metabolizes urea into ammonia. Presence of Ni when exceeds its required amount is the most eco-toxic and harmful metal to plants. To overcome the damaging effects of Ni stress exogenous application of plant hormones is an eco-friendly and emerging method. The present experiment was a field experiment carried out to assess the growth and physiological responses of maize plant to Ni stress alone or in combination with gibberellic acid (GA3). In this context, effect of Ni stress ( $\text{NiCl}_2$ ,  $\text{IC}_{50}$ -1  $\text{mM L}^{-1}$ ) on the maize (*Zea mays* L. var. PG-2458) plants was comprehensively investigated with/without GA3 application ( $\text{IC}_{50}$ -0.5  $\text{mM L}^{-1}$ ). Total 40 maize plants (10 days after sowing) were divided into four groups, with each group (n = 10) subjected to 4 different treatments (Control,  $\text{NiCl}_2$ , GA3 and  $\text{NiCl}_2$ +GA3). Morphological and





physiological parameters were measured fortnightly. Observation revealed reduction in stem height and diameter, leaf number, surface area of crown and seminal roots, length of primary root and number of brace roots, leaf surface area and shoot and root biomass in Ni-stressed plants. In contrast to Ni stress alone, GA<sub>3</sub> application with NiCl<sub>2</sub> was found to improve stem height, leaf number, leaf surface area, surface area of crown and seminal roots, root and shoot biomass. Maize plants treated with GA<sub>3</sub> and NiCl<sub>2</sub> also showed improvement in photosynthetic pigments and antioxidant potential and differential urease enzyme activity compared to NiCl<sub>2</sub> alone. Additionally, GA<sub>3</sub>+NiCl<sub>2</sub> application showed lesser localization of Ni<sup>2+</sup> ions in leaf and root tissue compared to NiCl<sub>2</sub> alone.

## **VICIOUS CYCLE OF MALNUTRITION AND MULTIDIMENSIONAL POVERTY: BIHAR'S IN DIRE STRAITS**

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### **ABSTRACT**

Despite of Bihar's miraculous growth rate, undernourishment prevalent in the state is well known. Even with several health and social welfare programs, the target seems far flanged. Mounting evidences have documented the fact that malnutrition is both the cause and result of poverty. Hence for understanding how nutrition plays a vital role in poverty estimation, present study has been undertaken for analyzing the multidimensional poverty and its contributing factors. Three dimensions i.e, health, education and living standards and 10 indicators were used in the analysis. For understanding the poverty nutrition inter relation, we included nutrition (stunting, wasting and underweight among the children under 5 years of age, BMI for individual aged 18-49 years and anemia) and child mortality under health dimension. Using the Alkire and Foster methodology, the study shows that extent of multidimensional poverty is very high ranging from 0.30 to 0.50. It highlighted the fact that more than 55 percent of the populations are deprived in health dimension. The present study seeks to explain the current status of the state through multi-dimensional poverty index, nutritional status across population groups followed by targeted interventions. District specific poverty focused intervention integrated with incorporating the biofortified crops into the commodity value chain can work for curbing the menace of malnutrition and multidimensional poverty.

## **GENETIC DIVERGENCE STUDIES FOR YIELD AND YIELD ATTRIBUTES IN BITTER GOURD (MOMORDICA CHARANTIAL.)**

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### **ABSTRACT**

The present experiment was conducted during rabi season 2017-18 to study genetic diversity for quantitative and qualitative traits in bitter gourd in vegetable research farm College of Horticulture, Mojerla, SKLTSHU. Using Mahalanobis D<sup>2</sup> statistics method, the 27 genotypes were grouped into eight clusters, indicating the presence of diversity for different traits. The cluster II had the highest number containing 12 genotypes followed by cluster I containing seven genotypes. The cluster VIII and V includes two genotypes. However, the cluster III, IV, VI, and VII were solitary. The maximum intra-cluster distance was recorded within cluster VIII (96.27) and the maximum inter-cluster distance between cluster VIII and I (1028.37), indicating the existence of wide genetic variability. Based on mean performances, the cluster VIII registered maximum vine length (329.15 cm). The genotypes included in clusters VI was with high number of primary branches per vine, cluster III took less number of days to first female flowering (45.40), cluster IV took less number of days to first fruit harvest (43.51) and cluster I took more number of days to last harvest (143.19). The cluster VI registered high number of fruits per vine (20.70) and high fruit length (19.31 cm). The genotypes included in clusters VIII took maximum of average fruit weight (41.90 g). The cluster VI registered less fruit fly infestation (21.17 %). The cluster VI registered high number of seeds per fruit (20.20). the clusters with genotypes VIII registered high 100 seed weight (19.49 g) and total fruit yield per vine (6.58 kg) can be utilised in breeding programme for enhancing their respective characters. Based on cluster mean analysis these genotypes can be used in crop improvement programme in bitter gourd for above-mentioned characters.



## DEVELOPMENT OF MOBILE APPLICATION FOR NUTRITION AND HEALTH ASSESSMENT USING ANTHROPOMETRY TECHNIQUES

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### ABSTRACT

Farmers are the assets of any country in the world growing food for the people but what if they themselves become unhealthy or affected by malnutrition that can eventually retard the growth of the country and that will not be a great thing. So, the farmers themselves and the government authority have the need to track the nutritional status of the farmers which will help them to do good for the farmers. In this era of digital revolution mobile phones are the most used electronic device all over the world and people are shifting from a simple mobile device towards the more advance smart phones. Many mobile applications related to agriculture have already been developed and many are yet to come in near future to give this sector a touch of digital revolution. So, in this context this study deals with the development of an android based mobile application that will help to evaluate the nutritional status of the farmers through different anthropometric measures which are efficient enough to show the basic overview of health condition of the farmers and guide them. With this purpose a mobile based decision support system 'NutriGuide' is developed that will help them assess their physical fitness, nutritional status and guide them with a brief note on importance of different types of foods for different age groups. This android based mobile application is developed with the help of different software tools like android studio development environment, Java programming language, eXtensible Markup Language for application user end development and to store the data of all the farmers MySQL server is used as a backend database. It also provides feature of downloading the data as an excel file for further analysis.

## IN VITRO MICROPROPAGATION OF SARPAGANDHA (*RAUWOLFIA SERPENTINA* L.)

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### ABSTRACT

An investigation was carried out with the aim of *in vitro* micropropagation of commercially important medicinal shrub Sarpagandha species (*Rauwolfia serpentina* L.) for its large-scale multiplication. In India, Sarpagandha has great medicinal and commercial value and has been listed under endangered species. An efficient protocol for rapid propagation has been followed using Murashige and Skoog medium (MS) with combination of growth regulators. Surface sterilants were used in different combinations and concentrations to achieve the maximum survival in initial stages. Surface sterilized nodal explant using 0.1% Bavistin, 1.0% Streptomycin, 1.0% NaOCl and 0.1% HgCl<sub>2</sub> were inoculated using MS medium with BAP (6-Benzyl amino purine), IBA (Indol 3-butyric acid). Effect of these media combination on survival, bud breaking frequency and rate of shoot multiplication were noticed. The preliminary result of the study shows a combination of MS with BAP and IBA in combination, gives best result during initial explant culture establishment. MS supplemented with BAP @ 5mg/l+ IBA @ 1.0mg/l was proved to be significantly best treatment and required less time *i.e.*, 6.53 days to initial shoot sprout after explants inoculated with 4.10 initial shoot multiples when compared with others treatment combinations. Effectiveness of MS with various combinations for high rate of shoot proliferation was found to be 81.30%. The root initiation was highest in half strength MS medium containing 2.5mg/l NAA and 2.0mg/l IAA. Efficiency of growth regulators was further assessed to establish reproducible tissue culture protocol for *Rauwolfia serpentina* L so as to rapidly multiply sarpagandha mother material through *in vitro* techniques.

## ROLE OF BIOSTIMULANTS IN FRUIT CROPS

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### ABSTRACT

The biostimulants, often used as a group of compounds that act neither as fertilizers nor as pesticides, but have a positive



impact on plant performance when applied in small quantities. Some major categories of plant biostimulants which are widely recognized by scientists, industrialists, and other stakeholders (Calvo *et al.*, 2014; Helper *et al.*, 2015) are humic and fulvic acids, protein hydrosylates and other N-containing compounds, seaweed extract, botanicals, chitosan and other biopolymers, inorganic compounds, beneficial fungi and beneficial bacteria. Major role of plant biostimulants is to increase soil fertility, nitrogen assimilation, antioxidant activity, plant nutrient uptake, abiotic stress tolerance, induction of plant defense enzymes, disease resistance and to improve the product quality and shelf life of fruits. Bud break enhancing compounds, such as Erger (biostimulant formulation containing inorganic nitrogen and polysaccharides), are widely used to promote earlier and more uniform bud break in kiwifruit. The seaweed extracts hastened veraison, improve anthocyanin accumulation and increases phenolic content in grape cultivar. Climate change affects horticulture production through the occurrence of late spring frosts. The biostimulants containing amino acids of animal origin (porcine blood) has shown to increase frost resistance, early flowering and yield in several strawberry cultivars. In the case of late spring frosts and other climatic hazards, use of porcine blood can help to grow strawberry in outdoor condition successfully.

### **SPLIT APPLICATION OF GIBBERELLINS AT DIFFERENT GROWTH STAGES TO IMPROVE THE YIELD AND QUALITY OF CAPE GOOSEBERRY (*PHYSALIS PERUVIANA* L.) UNDER SUBTROPICAL PLAIN**

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#### **ABSTRACT**

Present experiment was conducted to optimize the actual time of gibberellins spray in cape-gooseberry (*Physalis peruviana* L.) for improving growth, yield and quality attributes. Experimental finding revealed that the vegetative and physiological growth of the experimental plants had improved significantly by three repeated application of GA<sub>3</sub> @100 ppm each at vegetative, flowering and again at fruit setting stage. However, three application of GA<sub>3</sub> @ 25 ppm each produced maximum number of flowers and fruits per plant (197.67 and 85.67, respectively). Further, three application of GA<sub>3</sub> @ 25 ppm each also increased the fruit yield at maximum level (858.38 g plant<sup>-1</sup>) with at par fruit yield in three application @ 50-100 ppm each (806.23 - 856.07 g plant<sup>-1</sup>). However, foliar spray of GA<sub>3</sub> at any concentration increased the TSS: acid ratio significantly as compared to respective control. Total sugar content was estimated maximum under three GA<sub>3</sub> spray @ 75 ppm each (11.55%) which was statistically at par with its application during all the three growth stages @ 100 ppm (11.26%), 50 ppm (11.18%) or 25 ppm (11.10%). Similarly, application of GA<sub>3</sub> @ 25-100 ppm each at all the three growth stages increased the ascorbic acid and total phenol content of ripped cape gooseberry fruits to its maximum level with non-significant differences. Hence it can be concluded that the split application of GA<sub>3</sub> @ 25 ppm each at vegetative, flowering and again at fruit setting stage is optimum for improving the yield of better-quality cape gooseberry fruit significantly under subtropical climate.

### **POST-HARVEST HANDLING AND VALUE ADDITION OF HORTICULTURAL PRODUCE - A HELPFUL STRATEGY TO FOOD PROCESSING INDUSTRIES**

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#### **ABSTRACT**

India is among the topmost vegetable and fruit producer in the world. India's food processing sector covers fruit and vegetables. After harvest, fruits and vegetables are liable to accelerated physiological, chemical, and microbial processes that invariably lead to deterioration and loss of wholesomeness. Postharvest quality and shelf life of the fruit/vegetable in part will depend on some postharvest handling practices and treatments carried out after harvest. Handling practices like harvesting, pre-cooling, cleaning and disinfecting, sorting and grading, packaging, storing, and transportation played an important role in maintaining quality and extending shelf life. Using appropriate postharvest treatments like refrigeration, heat treatment, modified atmosphere packaging (MAP), 1-methylcyclopropene (1-MCP) and calcium chloride (CaCl<sub>2</sub>) application was also vital. Apart from handling of produce, value addition to food products has become necessary in order to improve the product



value. It is not merely to satisfy producers and processors by way of higher monetary return but also with better taste and nutrition. The processing of the food in the forms which are preferred by the consumer, have long shelf life and involve low cost of production. Some value-added products like dehydrated carrot powder, tomato and ginger powder, tomato ketchup and sauce, fenugreek leaf powder, potato flour, potato grits, chips, granules, sweet potato powder have been prepared as per consumer taste and to reduce the post-harvest losses. It was concluded by this study that the quality of the harvested produce can be maintained and shelf life extended by using appropriate postharvest handling practices, treatment methods and value addition.

## FIELD EFFICACY OF INSECTICIDES AND BIOPESTICIDES AGAINST SUCKING PESTS COMPLEX IN GREEN GRAM, *VIGNA RADIATA* (LINNAEUS) WILCZEK DURING SUMMER AND KHARIF

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### ABSTRACT

Green gram, third most important pulse crop of India is known to be attacked by black bean aphids, *Aphis craccivora* Koch; jassids, *Empoasca kerri* Pruthi; whitefly, *Bemisia tabaci* Gennadius, thrips, *Thrips palmi* Karny, flower thrips, *Megalurothrips usitatus* Bagnall; mites, *Tetranychus urticae* Koch; green bug, *Nezara viridula* Linnaeus; spiny brown bug, *Clavigralla* spp. with annual yield losses (30 %) and quantitative avoidable losses (7 – 35 %). There is a need to investigate the tools for the sucking insect pests of green gram to develop an effective management strategy. In sustainable farming, biocides have received much practical attention as substitutes to synthetic chemicals. In case of chemical insecticides, they are used as the frontline defense sources against insect pests in India. Among the various biopesticides viz., azadirachtin 0.15 EC, neem oil, *Beauveria bassiana* ( $1 \times 10^{10}$  CFU/ g), NSKE, *Lecanicillium lecanii* ( $1 \times 10^{10}$  CFU/ g), tobacco decoction (Hot water extraction), tobacco decoction (cold water extraction) evaluated for their field efficacy against sucking pests, tobacco decoction (2 %) extracted either with hot or cold water found to be more effective followed by *B. bassiana* (0.1%,  $1 \times 10^{10}$  CFU/ g). Neem oil @ 0.5% and NSKE @ 5% were found mediocre; *L. lecanii* @ 0.1% and azadirachtin @ 0.0006% were found inferior. Among the various synthetic insecticides evaluated, thiamethoxam 25 WG @ 0.01% and imidacloprid 70 WG @ 0.014% proved more effective in suppressing aphids, jassids, whitefly, thrips and flower thrips population under field conditions. Diafenthiuron 50 WP @ 0.05%, flonicamid 50 WG @ 0.015% and dimethoate 30 EC @ 0.03% followed by profenophos 50 EC @ 0.05% and acephate 75 SP @ 0.075%, while clothianidin 50 WDG @ 0.02% and dinotefuran 20 SG @ 0.008% were comparatively less effective against these sucking pests. Further, all the tested chemicals and biopesticides were comparatively safer to natural enemies viz., coccinellids (grubs and adults) and *Chrysoperla* spp. (grubs) with no any significant adverse effect. The effectiveness of these treatments also reflected on green gram yield.

## MOLECULAR CHARACTERIZATION OF FUNGUS FROM GRAPEVINE RESIDUES

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### ABSTRACT

Microorganisms play important role in decomposition process. The microbial consortium decomposes grapevine residues lead to the formation of humus and fertility of soil increase. A total of 6 samples of decompose grapevine residues were collected in paper bags from different places of 4 districts viz. Jalgaon, Dhule, Nashik and Latur of Maharashtra to isolate cellulolytic microorganisms. Then Screening of cellulolytic microorganisms takes place. The Carboxymethyl cellulase activity of fungal isolates ranged from 1 to 4.6 cm. Out of 20 isolates tested, 6 isolates were able to degrade cellulose. Amongst the cellulolytic fungal isolates maximum cellulase activity was shown by isolate NY1 (4.1 cm), NY2 (4.5cm), LA3 (4.5 cm), DS16 (4 cm), JC20 (4.6 cm), while the minimum activity was recorded in isolates F-20 (3.7 cm). After examining carboxy-methyl cellulase activity of all isolate six isolates of fungus viz. NY1, NY2, LA3, DS16 and JC20 having higher CMC'S activity were selected for development of microbial consortium. Grapevine residues were chopped into 2 to 3 cm pieces and filled in plastic bag layer by layer. The un inoculated pits served as control. The pits were watered frequently so as to maintain 60-65 % moisture





level. Turnings were given at 8, 15 and 30, 45th day after inoculation. The RAPD primers used for PCR amplification. All the 10 primers generated scorable polymorphic bands for the fungal isolates. Maximum polymorphic bands were observed in primer RFU-2 while minimum polymorphic bands were observed in RFU-8. Amongst all the primers the maximum amplification was observed with RFU-2, RFU-8 and RFU-9 primers, whereas least banding pattern was generated by RFU-10.

## EFFECT OF METHOD OF SOWING ON YIELD AND GROWTH OF TURNIP

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### ABSTRACT

As turnip is a direct sown root crop but some farmers in district Budgam of Jand K are transplanting the turnip crop. So a field demonstration was laid at the KVK Farm to assess the method of sowing in Turnip (*Brassica rapa subsp. rapa*) variety PTWG during 2020. Two treatments T1 (Direct Sowing) and T2 (Transplanted) were taken for the experiment and data was recorded on plant height (cm), root length, root diameter, root weight and yield. The results revealed that growth factors i.e shoot length(60.4cm) and tap root length (10.25 cm) was maximum in T1 however yield and yield contributing characters were maximum in transplanted turnip in terms of root length (8.2cm), root diameter (8.1cm), root weight (280g) and yield (360q/ha).

## ENHANCING INPUT USE EFFICIENCY IN CHICKPEA THROUGH HYDROGEL AND FOLIAR APPLICATION OF NUTRIENTS UNDER RAINFED SITUATION

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### ABSTRACT

India's water demand by is expected to be around 1,000 billion cubic meters (BCM) as against supply of 700 BCM in the coming years. The biggest demand will be from agriculture sector for sustaining the food security to a burgeoning population. Growing water scarcity across the various sectors has increased the need for improving water use efficiency in Agriculture. Various strategies such as rain water harvesting, water shed management, micro-irrigation, crop intensification and developing varieties with higher productivity etc. are being planned with an aim to conserve this precious and God gifted vital input. Its importance is more pronounced under rainfed situations due to non-availability of water. The development of technology which will enhance water use efficiency under rainfed areas and increase crop productivity as rainfed agriculture in India has been practiced since time immemorial and it extends over an area of 81 million hectares i.e.57.6 per cent of the net cultivated area of 142 million hectares and accounts for 44 per cent food grain production which supports nearly 40 per cent and 60 per cent of human and livestock population, respectively across diverse agro-ecological situations (Anonymous, 2007-08).The National Commission on Agriculture in 1976 predicted that even when the full irrigation potential is exploited, over 50 per cent of the arable land will still continue to remain rainfed in the foreseeable future.

Keeping in view the above facts, an experiment entitled “*Enhancing input use efficiency in chickpea through hydrogel and foliar application of the nutrients under rainfed irrigated situation*” was undertaken at Pulse Research Sub Station, Samba of Sher-e—Kashmir University of Agricultural Sciences and Technology of Jammu, during the rabiseason of 2020-21.

The first year data of the investigation indicated that the treatments where hydrogel was applied recorded higher grain yield of 902.50Kg/ha which was 27.9 % higher over the untreated plot of the hydrogel. Among the foliar applications of the nutrients, the foliar application of the NPK (19:19:19) @ 0.5 % recorded significantly higher grain yield (1027.75 kg/ha) which was closely followed by thiourea @ 500ppm with grain yield of 833.12 kg/ha. The minimum yield of 685 kg/ha was recorded with water spray. The significant observation was observed during the course of investigation that the grain setting was higher in the treatment where foliar application of the NPK (19:19:19) @ 0.5 % was made than the rest of the treatments. The same set of treatment recorded higher values of the net returns as well as BCR ratio

Henceforth, based on study, it can be concluded that an application of hydrogel supplemented with foliar application of the



NPK (19:19:19) @ 0.5 % have been found an innovative agronomic intervention for use of in chickpea crop under rainfed situations of Shiwalik foot hills of Jammu region.

## PROSPECTS OF CUSTOMIZED FERTILIZERS IN CHICKPEA UNDER RAINFED SITUATIONS OF SHIWALIK FOOTHILLS OF JAMMU REGION

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### ABSTRACT

Blanket fertilizer recommendations for different crops have caused poor nutrient supply, low nutrient use efficiency and limited crop response. Customized fertilizers may help to sustain soil health by ensuring appropriate fertilization. Hence, specific customized fertilizers should be promoted to counteract the problem of expanding multi-nutrient deficiencies in soils. In India, among the nutrients, NPK remain the major ones for increased and sustained productivity. However, the development of high yielding systems will likely exacerbate the problem of secondary and micronutrient deficiencies, not only because larger amounts are removed, but also because the application of large amounts of N, P and K to achieve higher yield targets, as a result in the intensive systems there is every possibility to build up of negative balance and deficiency of secondary and micronutrients. To attain high future targets, customized fertilizers will play a very important role. The development of site and crop specific readymade customized fertilizers based on scientific principles may prove to be more effective to meet the plant requirement and enhance nutrient use efficiency. Such an approach is also likely to boost crop yields and arrest soil fertility decline in a long-run. Thus, this article discusses the manufacturing methodologies, eligibility criteria, success in Indian fertilizer industry, adoption of fertilizer recommendations and problems in marketing of customized fertilizer.

Nutrition security in contrast to Food security has traditionally been viewed as being within the realm of health professionals. Yet the entire agri-food chain has a vital role to play in addressing this problem. Producing more nutritious food and feed, or 'farming for health', should therefore be a central objective. Keeping in view an investigation entitled "Prospects of Customized fertilizers in chickpea under rainfed situations of Shiwalik foothills of Jammu region" was undertaken at Pulse Research Sub Station, Samba of Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, during the rabi season of 2018-19 and 2020-21. The experimental findings indicated that the treatment where CFG-3( NPK S Zn Mo ) 100% based on recommended dose of the fertilizer was applied recorded significantly higher grain yield of 1154.50 Kg/ha followed by the customized treatment of CFG1 (NPKSZnMo) based on recommendation (100%) with grain yield of 1066.75 Kg/ha. However, the minimum grain yield of chickpea was recorded with the treatments RDF (966.25 Kg/ha). The statistical highernet returns as well as benefit cost ratio was also recorded higher with same set of treatments.

Henceforth, based on study, it can be concluded that an application of CFG-3( NPKSZnMo) 100% based on recommended dose of the fertilizer have been found an innovative agronomic intervention for use of customized fertilizer application in chickpea crop under rainfed situations of Shiwalik foothills of Jammu region.

## EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON FENUGREEK YIELD AND NUTRIENT UPTAKE IN CENTRAL PART OF INDIA

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### ABSTRACT

Crop rotation, green manure, compost, and biological pest control are examples of organic farming strategies used to sustain soil productivity and pest management on a farm. Organic farming excludes or strictly limits the use of manufactured fertilizers and pesticides, plant growth regulators such as hormones, livestock, antibiotics, food additive and genetically modified organisms. Organic farming maintains and improves the health of the land, plant, animal, person, and planet as a whole. The most natural and preferred approach of keeping the soil biological characteristics active is to use soil bacteria as biological fertilizers. Supplying FYM, vermicompost and *Rhizobium* culture were used as a soil and crop improvement by enhancing soil process. In this backdrop, a pot experiment was carried out at agriculture experimental farm, Nehru PG collage



Lalitpur (UP). Fenugreek was used as a test crop in this experiment. The experimental treatments were comprised with four levels of vermicompost, FYM and *Rhizobium* was conducted in the CRD with three replications. Application of integrated nutrient management increased the seed & straw yield (kg/ha) as compared to control. Seed and straw yield (kg/ha) of fenugreek crop was reported maximum in vermicompost followed by FYM and *Rhizobium* applied pots. The application of vermicompost (300 g/pot) resulted in significantly higher nitrogen, phosphorus and potassium plant nutrient, and enhanced uptake and quality of fenugreek than rest of the treatments.

### **BIO-EFFICACY OF SPINETORAM 12% SC (11.70% W/W) AGAINST FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (J. E. SMITH) IN MAIZE**

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#### **ABSTRACT**

Bio-efficacy of insecticide spinetoram 12% SC was assessed against the fall armyworm in maize during the *Kharif* 2019 season. The present investigation carried out in Randomized Block Design with six treatments with the standard check of Dimethoate 30% EC. The insecticide spinetoram 12% SC was evaluated at different concentration viz., 150, 200, 250 and 300 ml/ha against fall armyworm (*Spodoptera frugiperda* (J. E. Smith) in maize. At last interval of observation 14 days after the second spray, it was found that the most superior dose of spinetoram in recording the least larval population and in reducing plant damage was 300 ml/ha i.e., 0.6 ml/liter which registered 0.22 larvae per plant and 4.17 per cent plant damage, respectively. However, spinetoram 12% SC @ 250 ml/ha i.e., 0.5 ml/liter registered 0.26 larvae per plant and 4.22 per cent plant damage and found to be at par with spinetoram 12% SC @ 300 ml/ha. The highest yield is also recorded in the treatment with Spinetoram 12% SC @ 300 ml/ha (78.13 q/ha) and it was also at statistically equal to spinetoram 12% SC @ 250 ml/ha (77.27 q/ha). It is concluded from the findings that the spinetoram 12% SC @ 250 ml/ha is best tool in the management of fall armyworm in maize which is causing serious losses in maize ecosystem.

### **IMPACT OF VOCATIONAL TRAINING PROGRAMMES ON NURSERY WORKERS FOR MANAGEMENT PRACTICES IN DISTRICT BARWANI**

**U.S. Awasya, D.K. Jain, D.K. Tiwari, S.K. Badodiya, and R.S. Sikarwar**

*Krishi Vigyan Kendra, Malegaon, Barwani (Madhya Pradesh)*

#### **ABSTRACT**

The present study was conducted to ascertain the impact of vocational training courses on the average adoption rate of nursery workers amongst the trainees who acquired trainings from the KVK, Barwani during the last 5 years. It was observed that initial average adoption rate 51.60 per cent declined to 21.5 per cent and unemployed rural youths (26.9%) showed keen interest in Nursery management. The knowledge level of the respondent before and after training 68 percent increase for nursery management.

### **BACKYARD POULTRY FARMING AS A LIVELIHOOD SECURITY FOR RURAL WOMEN'S IN HILLY AREAS OF DODA DISTRICT IN JAMMU AND KASHMIR STATE**

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#### **ABSTRACT**

Backyard poultry farming is practiced by most rural households of the hilly areas throughout the developing world and poultry industry is the fastest growing sector in Indian agriculture also. Poultry keeping is thus, an activity that the women can undertake without having to leave the household and men do not have to allocate a lot of extra time to managing the poultry as compared to other income-generating activities, such as day laboring or petty commerce, which require them to leave their homes for many consecutive hours.

The study based on data obtained from about 100 households from two villages with an average flock size of 10-12 birds from



each household to analyze the cost and returns from poultry farming, income generation, human gender contribution and livelihood security for rural women's in hilly regions. It was found that the cost of production of the egg and meat has been found to be Rs. 3000. Whereas, the net return from each household per cycle was Rs. 4276 from meat and egg production and benefit cost ratio was 1.42 that means the return in each rupee invested in backyard poultry farming yield return of Rs. 1.42 and was economically profitable for the household and which add the additional income to the family. The overall feed conversion ratio decreased, while egg- feed price ratio and benefit cost ratio was greater than unity, hence backyard poultry farming is profitable venture for the rural peoples living in hilly areas of Doda district.

## ENHANCING THE PRODUCTION THROUGH WEATHER BASED AGRO ADVISORIES OF THE FARMERS

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### ABSTRACT

Weather factor is major role of increasing and decreasing agricultural production. Forecast can help to minimize the farm losses through proper management of agricultural operations. The complete avoidance of all farm losses due to weather factor is not possible but it can be minimized to some extent by making adjustments through timely and accurate information of weather forecast. A study was therefore, undertaken on adaptation of agromet advisory bulletin and economic impact of agromet advisory services for maize and gram during 2020-21 for assessing the economic impacts of agromet advisories services (AAS) over non users of agromet advisory services (Non AAS) from different selected villages of Barwani district of Madhya Pradesh under DAMU (District Agromet Unit). Results showed that the farmers, who followed the agromet advisories, are able to reduce the input cost and increase in the net benefit by 15 and 13 percent and maize and gram as compared to non AAS farmers in maize and gram. This input was due to the crop management done by the farmers according to agromet advisory bulletins based on the weather forecast. Thus the application of agromet advisory bulletin is a useful tool for enhancing the productions and income by minimizing the adverse effect of weather.

## PERFORMANCE OF CLUSTER FRONTLINE DEMONSTRATIONS IN ENHANCEMENT OF CHICKPEA PRODUCTION

**D.K. Tiwari, S.K. Badodiya, R.S. Sikarwar, D.K. Jain and U.S. Awasya**

*Krishi Vigyan Kendra, Barwani (Madhya Pradesh)*

### ABSTRACT

The cluster frontline demonstration (CFLDs) on chickpea was conducted by Krishi Vigyan Kendra, Barwani in three villages namely Mongari kheda, Diwani and Sengvi of Niwali block during the rabi season of 2020- 21. The results revealed that improved seed of RVG 202 + seed treatment (*Trichoderma viridi* 5 g/kg+ *Rhizobium* sp. 25 g/kg + PSB 25 g/kg) + RDF (20:60:20 NPK/ha) recorded average highest yield 18.65 q/ha followed by 14.20 q/ha in control plot. The same trend was found in case of gross and net monetary returns, which was Rs. 90918/- and Rs. 65918/-ha and for control Rs. 69225/- and Rs. 45225/-ha, respectively. Benefit cost ratio for demonstration and control was 3.63 and 2.88, respectively. It can be concluded that the pulses production could be enhanced by encouraging the farmers through adoption of recommended technologies which were followed in the CFLDs.

## PHENOTYPIC CHARACTERIZATION OF POONCHI CHICKEN IN JAMMU REGION OF J&K.

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### ABSTRACT

Poonchi chicken population are distributed in Jammu province of UT of J&K. A stratified survey was done in three different districts namely Poonch, Rajouri and Reasi of Jammu. This population is highly adoptable to the extreme environmental condition. Natural Breeding tract of Poonchi Chicken is under identification mainly in the Poonch district (33°51'N; 74°08'E)





and area of other districts adjacent to Poonch namely Rajouri (33.38°N; 74.3°E) and Reasi (33.08°N; 74.83°E). Total Number of chicken population studied were 3661 in which male were 926 and female were 2483. The district wise distribution of this population under study was Poonch-1389, Rajouri-1245, Reasi-1027. The flock (cock:hen) ratio were 1:3 (approx). Body weight (Kg) in male of Poonchi chicken under different age groups (4-8 months N-117), 9-12 months (423) and 13-24 months (238) were 1.24±.010, 1.684±.014 and 2.24±.02688 respectively. Body weight (kg) in female of Poonchi chicken under different age groups 4-8 months (403), 9-12 months (1012) and 13-24 months (864) were 1.09±0.037, 1.5514±.007 and 1.8421±0.182. They are well adapted to extreme cold climate (survive even on snow) and even survived at about 35°C. Black and brown plumage colour is prominent. Single comb is more but butter cup/ rose comb is also present. These birds are active but not fighty. These birds are let loose in the day time and kept in wooden house at night. This chicken population is mainly reared under very low inputs. No vaccination and medication are generally practiced.

## FARMER AWARENESS ON USE OF BIO-PESTICIDE IN JAMMU REGION OF JAMMU AND KASHMIR

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### ABSTRACT

Cow urine based bio-pesticides is very important in the management of large number of pests and diseases with focus on sustainable agriculture including clean milk production system. Bio-pesticides are the better alternative to synthetic chemicals which are expensive and pose potential danger to the farmers, consumers, and environment. Many plants are known to have pesticidal properties. The extract of such plants or its refined forms can be used in the management of pests. Among various plants identified for the purpose, Neem (*Azadirachta indica*) has been found to be effective in the management of approximately 200 insects, pests and nematodes. Under Women Scientist Scheme-B (WOS-B) project, Department of Science and Technology, GoI, Project is aimed at Swasth Bharat and Swachh Bharat by promoting bio pesticide considering clean dairy production and environmental protection. A rapport building program was organized at Village panchayat of Suchetgarh. In which about forty farmers participated maintaining the covid-19 protocol. Awareness camp was also organized at farmers' doorsteps in Suchetgarh (international border), Jammu, J&K regarding care and precautions to be adopted in this era of the pandemic of Covid-19 as well as importance social distancing. The major local population residing in this area depends upon agriculture. This area is known for its Basmati rice, a major crop that is exported, which needs intervention in order to avoid the residue of synthetic pesticide. Farmer Awareness Meet was organized under the project. The theme of this was Sustainable Livestock –Crop production for improving livelihood of farmers. More than sixty farmers were participated and were made aware about bio-pesticides and its significance. There were more than fifteen stalls under different theme to make farmers aware about sustainable agriculture with clean milk production system. Interaction and discussion with different areas of farmers regarding crop protection including bio-pesticide uses. Demonstration to the farmers regarding Clean dairy production and environment protection through model.

## EXPRESSION ANALYSIS FOR DROUGHT TOLERANCE IN TWO GENOTYPES OF TOMATO

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### ABSTRACT

Tomato (*Solanum lycopersicum*) is one of the most popular and nutritionally important vegetable crops around the world. Tomato cultivation suffers heavy losses due to drought worldwide including in India as well. Transcriptome sequencing is one of the important and widely used approaches to identify genes related to a trait of interest. In the present study, transcriptome sequencing was carried out on two genotypes viz. Kashi Vishesh (KV) and WIR-13706 (WIR) to investigate the molecular mechanisms and gene expression analysis under drought stress. A total of 436.8 million high quality transcriptome reads identified a total of 26,085 genes for all eighth samples representing two conditions (control and drought) and two biological replicates each for KV and WIR genotypes. The expression analysis between drought and control samples identified a total of 5095 and 4667 differentially expression genes (DEGs) in WIR and KV, respectively. Top 50 differentially expressing genes for KV and WIR were used to create a subset of 10 genes for the validation of RNA-seq based expression patterns through quantitative Real Time (qRT) PCR. A total of nine genes were used for scoring of expression kinetics as one of the primer pairs was not functional. Out of these, four genes (Solyc03g096290, Solyc06g074200, Solyc03g007230, Solyc06g067980) clearly



amplified differential expression profiles between control and drought samples of both the genotypes. The validation analysis was able to identify a key gene coding for aquaporin-related protein (Soly03g096290) having markedly differential expression pattern. Aquaporins are membrane channels that are involved in transport activity and regulation of molecules across the cellular membranes. Identification and validation of differentially expressing genes under normal and drought conditions will provide an insight into the molecular mechanism(s) associated with drought tolerance. The knowledge of drought tolerance molecular mechanism(s) could potentially lead to better breeding strategies in near future.

## **SPATIAL DISTRIBUTION OF NUTRIENTS IN SOILS OF KRISHI VIGYAN KENDRA, ROHTAK, HARYANA. NORTH-WEST INDIA**

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### **ABSTRACT**

Detailed soil survey of Krishi Vigyan Kendra Farmat Rohtak, was carried out using standard procedures. The farm is situated about seven km North-West of Rohtak on Rohtak-Jind road and lies between 28°57'10" N to 28°57'20" N latitude and 76°32'10" to 76°32'30" longitude with an altitude about 230 meters above mean sea level. The farm has a plain topography with gentle to very gentle slope. Physio graphically the farm is fall under Indo-Gangetic alluvial plain with an admixture of sediments brought down from the pre-cambrian as well as Himalayas from Holocene to recent time. The climate of the areas is subtropical, semi-arid continental and monsoonal type with annual rainfall of 452 mm. The base map of the area was prepared and auger samples (0-15 cm) were collected using grid and GPS system. The soils of Krishi Vigyan Kendra Farm, Rohtak were slightly acidic to slightly alkaline, slightly saline, low in available nitrogen (98-168 kg ha<sup>-1</sup>), low to medium in organic carbon (0.15-0.70%) & in available phosphorus (8-19 kg ha<sup>-1</sup>) and medium to high in available potassium (160-400 kg ha<sup>-1</sup>). DTPA extractable micronutrients Zn (0.42-1.34 mg kg<sup>-1</sup>) and Fe (2.10-3.64 mg kg<sup>-1</sup>) were found deficient whereas Cu (0.26-0.70 mg kg<sup>-1</sup>) and Mn (2.86-8.94 mg kg<sup>-1</sup>) in moderate to high category. Based on morphological and physico-chemical characteristics soils were classified according to Soil Taxonomy as Fine loamy, Calcareous, Mixed, Hyperthermic, Typic Haplustepts. Organic carbon was significantly correlated with N and P suggesting that higher available N and P are associated with higher organic matter.

## **DETECTION OF CROP DISEASES AND PEST BY USING AGRICULTURAL DRONE**

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### **ABSTRACT**

Agriculture is one of the keys to the critical development of human civilization. In this reformist world, automation has started its matchless quality in each field of work. Yet, automation in the field of agriculture isn't as cutting edge nearly. Subsequently, the prerequisite of fostering an automation framework in the field of agriculture is approaching. Probably the greatest difficulty looked by farmers is the detection of diseases and pests in crops during the beginning phases of development. Exact recognizable proof of many plant highlights requires a specific degree of ability, nonetheless. If by some stroke of good luck a modest bunch of human specialists are qualified and able to produce preparing information, the interaction takes any longer than if assignments could be dependably performed by hundreds or thousands of non-specialists. This places a weight on those specialists and makes a bottleneck in the model preparing measure. The problem can be solved by using the drones for detection of diseases and pests. When drones are used for detecting the occurrence of pests and diseases, the information about pests and diseases of crops should be standardized and digitalized. The drones can also be used for spraying of plant protection chemicals, saves time and labour of the farmer, and is very helpful especially in high density orchards or fields where monitoring is very difficult. Drones have been used for wide-ranging applications in the fields of climate simulation monitoring, real-time video monitoring of pests and diseases, and real-time early warning systems for predicting the occurrence of pests and diseases. For agroclimatic diseases (such as wheat powdery mildew), the establishment of climate models through data collected by small climatic instruments arranged in the field can markedly reduce the incidence of disease. Thus drone technology can be very useful for the farmer community.



## INTELLECTUAL PROPERTY RIGHTS IN FLOWERS

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### Abstract

Intellectual property rights (IPR) refer to legal rights over inventions to exclude its unauthorized commercial use by others. IPRs are protected in accordance with the provisions of the corresponding legislations of a country. Generation of IP involves huge investment in terms of money, talent, manpower and it is important to protect it in order to prevent duplication by others and to have ownership. Intellectual property rights are needed for number of reasons - to reward our own scientists and technologies for their endeavors, to provide a commercial orientation to our indigenous research and development, to create a climate for continuous innovation. Intellectual property rights in ornamental plants includes copy rights, trademarks, geographical indications, industrial design, layout design, trade secrets, patents. IPRs includes plant variety protection, plant breeders rights, farmers rights. A new variety should fulfil the Novelty, Distinctness, Stability, Uniformity, conditions for the protection under UPOV law. IPRs follows in climbing roses, grandiflora roses, lillies, jasmine and other flower crops.

## ENHANCING NUTRIENT USE EFFICIENCY THROUGH CUSTOMIZED FERTILIZERS

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### ABSTRACT

Over the past century to the present situation and with a future vision, where Agriculture contributes to improving the living standards of growing population. But the trends and challenges analyzed in Intensive agriculture resulted in decline crop productivity and poor sustainability which is due to imbalanced use of chemical fertilizers and nutrient-exhaustive crop varieties. There exists a wide gap between amount of nutrient added through fertilizers and removed by the crop resulting in depleted secondary and micronutrients in soil. This calls for 'Site-Specific Nutrient Management' (SSNM) and development of customized and value-added fertilizers, especially micronutrient fortified fertilizers. Considering the fact that present day fertilizers are registering low fertilizer use efficiency, new and improved fertilizers *i.e.*, customized fertilizers based on soil-test-crop response studies are critical to help feed the world's growing population, provide sustainable global food security and to protect the environment. It could contribute promoting SSNM in order to achieve the maximum fertilizer use efficiency of the applied nutrients in a cost-effective manner. Thus, customized fertilizers present a unique opportunity to prepare us for the future with a better crop response and higher productivity.

## NANO COATINGS - A NOVEL APPROACH FOR IMPROVING SHELF LIFE OF FRUITS AND VEGETABLES

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### ABSTRACT

India is the second largest producer of fruits and vegetables in the world. But about 20 to 30% of the produce is lost annually due to lack of infrastructure facility and limited use of modern technologies. Fresh fruits and vegetables have short shelf life because of high respiration rate, moisture content, bulky in nature and pathogen attack. Edible coatings are the best biologically safe coatings for the different types of food because of its film forming properties, antimicrobial action and biodegradability. It act as natural barrier to moisture, oxygen and minimize the rate of respiration and maintain the quality of the attributes. Nano technology includes all submicron size systems (<1000 nm) preferably those measuring 100- 500 nm. Recently, application of nanotechnology to the development of edible coatings have included the various nano systems,



including polymeric nanoparticles, nanoemulsions and nano components among others, in efforts to control the release of essential oils, poly phenols, fat soluble vitamins and maintain their functionality of volatile compounds present in the essential oils and other plant extracts in order for latter to achieve the goal of protecting the food. Elaboration of edible coatings with nano systems allows the incorporation of anti-microbial and anti-oxidant ingredients. There is need to find the novel alternatives for controlling mechanical properties, gas transport and thermal resistance for the edible coatings to adapt to environmental conditions by modifying its properties in relation to such factors as relative humidity and temperature.

## **AN INTEGRATED APPROACH FOR THE EVALUATION OF QUANTITATIVE SOIL MAPS THROUGH TAYLOR & SOLAR DIAGRAMS**

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### **ABSTRACT**

For many decades, soil scientists have produced spatial estimates of soil properties using statistical and non-statistical mapping models. Commonly in soil mapping studies the map quality is assessed through pair-wise comparison of measured and predicted values of a soil property, from which statistical indices summarizing the quality of the entire map are computed. Often these indices are based on average error and correlation statistics. In this study, we recommend a more appropriate and effective method of map evaluation by means of Taylor and solar diagrams. Taylor and solar diagrams are summary diagrams exploiting the relationship between statistical indices to visualize differentiable aspects of map quality into a single plot. An important advantage over current map quality evaluation is that map quality can be assessed from the combined effect of a few statistical quantities, not just on the basis of a single index or list of indices. We illustrate the area use of common statistical indices and their combination into summary diagrams with a stimulation study and two applications on real-world soil data. In the tables and summary diagrams with a stimulation study of nine maps with known statistical properties are produced and evaluated with tables and summary diagrams. In the first case study with soil data, change in the quality of a large-scale topsoil organic carbon map is tracked for a number of permutations in the mapping model parameters, whereas in the second case study several maps of topsoil organic carbon content for the same area, made by various statistical and non-statistical models, are compared and evaluated. We show that in all cases better insights in map quality are obtained with summary diagrams, instead of using a single index. This underpins the importance of using integrated summary graphics to communicate on quantitative map quality so as to avoid excessive trust that a single map quality index may suggest.

## **SOCIO-ECONOMIC PERSPECTIVE AND POSSIBILITIES OF ENHANCING FARM-BASED INCOME THROUGH AGROFORESTRY IN NORTH INDIA**

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### **ABSTRACT**

In Indian economy, farming plays an important role in ensuring the socio-economic development through comprehensive potential of agroforestry practices with economic and environmental benefits to the society. The article explains the outcomes of observations during socio-economic surveys carried out to understand and analyse the status of agroforestry, and its socio-economic imperatives with reference to the Indo-Gangetic plains of North India. Where agroforestry is practised in traditional ways, such as orchards, woodlots, modern ways such as farm plantations. The observations have been divided into three sections: Adoption and management of agroforestry practices, socio economics of agroforestry adoption and economic outcomes. However due to lack of sufficient training and extension facility discouraging farmers to adopt medicinal plant-based agroforestry practise. The economic indicators i.e., BCR and NPV have been found satisfactory making them





economically viable at the 4-10 per cent interest rate. Certain factors such as old age, medium or large land holdings, marital possession, exposure to trainings etc. affect the adoption and promotion of tree species and agroforestry practices in the farmland. The govt. and private agencies can play an important role in the demonstration and extension of such systems at the field level. Additionally, rotation of various components (tree/crop/animal) is required to develop a wide spectrum of income, and optimum resource replenishment, utilization, and management during the different years. Keeping research and adoption in concern, fodder crop-based agri-silviculture-pastoral model and agri-silviculture models can be proposed to obtain ensured profit over a period of time.

## CROP PLANNING BASED ON RAINFALL ANALYSIS FOR RICE CROP IN PATTAMBI REGION, KERALA

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### ABSTRACT

Rainfall is the main source available for water. The knowledge of the rainfall analysis is crucial for crop planning in a region and designing of water conservation structures. Hence, crop planning based on rainfall analysis for rice crop was studied in Pattambi region of Kerala. Daily rainfall data and all-weather parameters were collected from RARS, Pattambi, KAU for the period of 35 years (1983-2017). Using rainfall and weather data, expected rain water availability at given probability levels and ET demands of the rice crop at different growth stages were estimated and analyzed. Analysis revealed that mean annual rainfall for the study area was found to be 2377.96 mm and 89% amount of total annual rainfall occurred during monsoon season itself. The rainfall probability at different levels of exceedance were found by fitting "Incomplete gamma distribution" using Weather Cock software. Weibull distribution was identified as the best fit for weekly rainfall in the region based on chi-square test of goodness of fit. Weekly ET<sub>o</sub> values were calculated by using FAO-56 Penman-Monteith model and the probable weekly ET<sub>o</sub> values at 50% probability level were estimated. The total ET<sub>c</sub> demand of rice at 50% probability level was estimated as 469.162 mm whereas the total rainwater availability at 75% probability during the period was estimated as 933.85 mm which indicates that the rainwater availability was sufficient to meet the ET demands of the crop. Though the total expected availability of rainwater in the region is sufficient for crop growth, the growth stage wise distribution of rainwater was not sufficient to meet the ET demands.

## MORPHOLOGICAL CHARACTERIZATION OF *SCLEROTIUM* ISOLATES CAUSING FOOT ROT DISEASE IN FINGER MILLET

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### ABSTRACT

An *in vitro* study was conducted at ICAR-AICRP on Small Millets, Zonal Agricultural Research Station, V C Farm, Mandya on morphological variability of *Sclerotium* isolates causing foot rot disease in Finger millet based on mycelia radial growth, *Sclerotial* production and topography. Five different isolates of *Sclerotium sp.* collected from different parts of Zone-6 (Southern dry zone of Karnataka) were used for this experiment and they were designated as Sr VCM, SrHC, SrKH, SrMS and SrTH. Significantly variation with reference to mycelia and sclerotial characters were observed on potato dextrose agar media. Among five isolates screened maximum mycelial growth was observed in SrKH isolate (8.75 cm), followed by SrTH (8.32 cm) and least mycelia growth was observed in SrVCM isolate (6.75 cm) at 72hours of incubation on PDA media. With respect to sclerotial bodies production concerned the maximum number of sclerotial bodies recorded on SrVCM isolate (171 No) followed by SrKH isolate (97 No.) and least number of sclerotial bodies recorded on SrHC isolate (9No.). Regarding pattern and topography two isolates showed fluffy growth and another isolates showed flat mycelial growth and remaining one isolate produced smooth pattern of mycelial growth, with reference to sclerotial bodies two isolates were exhibit circular in pattern, another two isolates scattered pattern and one isolate showed peripheral pattern of sclerotial bodies production on PDA medium.



## EFFECT OF SOME INTEGRATED PEST MANAGEMENT (IPM) PACKAGE AGAINST MAIZE FALL ARMYWORM AND ITS CONSEQUENCE ON YIELD.

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### ABSTRACT

*Spodoptera frugiperda*, J.E. Smith commonly known as fall armyworm (FAW), is amongst the most native pests of maize in Latin America, which unexpectedly appeared in Nepal in 2019 and spread expeditiously. Integrated Pest Management emphasizes the growth of a healthy crop with the least possible disruption to agro - ecosystem and encourages natural pest control mechanisms. A study was conducted to evaluate the comparative effectiveness of four IPM packages on the basis of infestation level of fall armyworm (*Spodoptera frugiperda*) on leaf, ear and kernel of maize crops. The IPM package 1 consisting of mechanical control on light trap and pheromone; IPM package 2 comprising Thiamethoxam 12.6% EC+ Lambda cyhalothrin 9.5 %ZC, Cypermethrin 10% EC and Indoxacarb 14.5%SC; package 3 consists application of water on plants or left untreated; in IPM package 4, natural enemies were released. The maize crops treated with Thiamethoxam 12.6% EC+ Lambda cyhalothrin 9.5 %ZC resulted significantly lowest fall armyworm infestation compared to those of other treatments. Significantly the highest yield was obtained in crops treated with Thiamethoxam 12.6% EC+ Lambda cyhalothrin 9.5 %ZC. IPM packages with treated crops produced more healthy leaves, ear and kernel than untreated ones. The plant height, width and leaf angle of individual healthy kernel was higher in plants under IPM package 1, 3 and 4 utilizing treated maize in late ear stage. Integrate IPM components validate their effectiveness for insect pest.

## NEW GENERATION BIO-NANO FUNGICIDES IN MANAGEMENT OF SHEATH BLIGHT OF RICE

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### ABSTRACT

Silver nano particles were synthesized by using potential isolates of *Trichoderma* spp and *Pseudomonas fluorescens*. The study revealed that bionano preparations irrespective of the isolate source used, i.e., *Trichoderma* and *P. fluorescens* were found better in decreasing the sheath blight incidence *in vitro* though variation existed in terms of quantum of disease reduction. Bionano preparation from nutrient broth alone was also found effective in decreasing sheath blight severity compared to bioagents used alone or PDB. When the sensitivity of rice leaves from cv. NLR 34449 was assessed by dipping the leaf segments in 100% concentration of bionano silver (prepared using 170ppm silver nitrate), rice leaves turned yellow from the third day of incubation in detached leaf method *in vitro*.

## DEVELOPMENT OF TRAY TYPE TEMPLATE SEEDER FOR VEGETABLE SEEDS

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### ABSTRACT

Agriculture is the backbone of Indian economy. Fruits and vegetables account for nearly 90 per cent of total horticulture production in the country. A major portion of the area under vegetable cultivation adopts conventional methods for production of seedlings, which are still an eye-straining process and often multiple seeds in plug cell retards vigour of seedlings, increasing the thinning out time. Taking all these problems for consideration, a precision tray type template seeder was developed at College of Technology and Engineering, Udaipur, during 2018-19 for accurate sowing of vegetable seeds in entire tray at once. The developed precision tray type template seeder was comprised of suction unit with 1.2 m<sup>3</sup>/min maximum air flow rate to provide minimum air velocity desired by cabbage seeds at each orifice of the seed plate. The performance evaluation of developed precision tray type template seeder was done with the response characteristics like single



seed index, missing index, multiple seed index, seed utilization effectiveness. The maximum single seed index for cabbage seed was found to be 95.32 per cent with missing index of 1.94 per cent, multiple seed index of 2.74 per cent and seed utilization efficiency of 98.06 per cent by using 19-gauge orifice diameter size at 280 mm WC suction pressure.

## EFFECT OF DIFFERENT GROWING MEDIA ON ESSENTIAL ELEMENTS OF LETTUCE (*LACTUCA SATIVA* L.) GENOTYPES UNDER DIFFERENT GROWING SYSTEM

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### ABSTRACT

An investigation entitled “Effect of different growing media on essential elements of lettuce (*Lactuca sativa* L.) genotypes under different growing systems” was conducted in the Division of Plant Physiology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu. The experiment was conducted during September, 2019 to March, 2020 to visualize the effect of different growing media for the hydroponic cultivation of *Lactuca sativa* genotypes. Ten feet long, six feet wide and 8 feet height with 4-inch PVC pipes were used to create hydroponics system of 180 pot holes. Two varieties *Romaine* and *Grand rapid* were taken as experimental material. Seeds of the two varieties collected from PAU, Ludhiana, Punjab and HPKV, Palampur, Himachal Pradesh, were sown inside the laboratory of Division of Plant Physiology with the help of white lights. Seedlings at five leaves stage were transplanted to the hydroponic system with Nutrient Film Technique (NFT). In this technique, the roots of plants hang down to the bottom of the channel where they came into contact with the shallow film of the nutrient solution and absorbed nutrients from them instead of soil. The experiment was laid out in Factorial Completely Randomised Design, consisting of 7 treatments viz, T<sub>0</sub>: Coco peat (100 %), T<sub>1</sub>: Coco peat + Vermicompost (1:1), T<sub>2</sub>: Coco peat + Perlite (1:1), T<sub>3</sub>: Coco peat + vermiculite (1:1), T<sub>4</sub>: Coco peat + perlite + vermiculite (1:1:1), T<sub>5</sub>: Coco peat + perlite + vermiculite + vermicompost (1:1:1:1) and T<sub>6</sub>: Conventional method (soil + Vermicompost). After 1 week of transplanting, data was recorded at three different stages of crop growth (12 DAT, 35 DAT and 50 DAT). The present study was carried out to understand how growing system affects the nutrients of lettuce vegetable under different growing media. The experimental results revealed that, maximum nutrient content were noticed in the leaves of both varieties of lettuce that grown in hydroponic system under treatment T<sub>5</sub> rather in soil. Combination of treatment T<sub>5</sub>: coco peat + perlite + vermiculite + vermicompost in the ratio of 1:1:1:1 and hydroponic system were found the most promising treatment for enhancing the essential of both varieties of *Lactuca sativa* as compared to other treatments and growing methods.

## MANAGEMENT OF ROOT ROT AND BACTERIAL LEAF BLIGHT (BLB) DISEASE IN CLUSTER BEAN

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### ABSTRACT

Cluster bean [*Cyamopsistetragonoloba* (L.) Taub.] is popularly known as “Guar” or “Guwar” and belongs to family Fabaceae of kingdom Plantae. It is an important legume crop and mainly grown under rainfed conditions of arid and semi-arid regions of tropical India during *Kharif* and *Zaid* seasons. It is considered as one of the most drought tolerant grain legumes and very valuable within crop rotation cycle as it lives in symbiotic association with nitrogen fixing bacteria. The production of clusterbean crop is mainly hindered by several fungal and bacterial diseases and causes huge losses to farming community. Among these root rot and bacterial leaf blight (BLB) are the important diseases of clusterbean in Haryana and Rajasthan in India. To manage these important diseases, on farm trial on management of root rot and bacterial leaf blight disease in clusterbean were carried out at 5 locations at farmers’ fields to assess the suitability of a technology for a particular situation during *Kharif* season 2021. Effect of seed treatment with streptocycline and carbendazim along with foliar application of streptocycline and copper oxychloride was compared with control (Farmer’s practice). Seed treatment by soaking of seed with streptocycline (1g/kg seed) and carbendazim (2 g/kg seed) followed by two foliar sprays of streptocycline (75 g/ ha) and copper oxychloride (500 g / ha) at 55 and 70 DAS provided effective management of both root rot and bacterial leaf blight disease as compared to farmer’s practice. Minimum disease incidence was recorded in respect of root rot i.e 5.3% and bacterial leaf blight incidence was 7.1 %, however the disease incidence was in Farmer’s practice i.e 24.5% and 54.1%. The results indicate that application of the technology provided 23.9 percent higher yield than control. The B: C ratio was 1.61 percent as compared to Control (Farmer’s practice) i.e 1.37.



## EFFICACY OF PRE AND POST-EMERGENCE HERBICIDES ON WEED DENSITY, WEED DRY WEIGHT AND GROWTH AND YIELD OF DIRECT SEEDED PUDDLED WET RICE UNDER CAUVERY COMMAND AREA OF KARNATAKA

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### ABSTRACT

A field experiment entitled “Efficacy of pre and post-emergence herbicides on weed density, weed dry weight and growth and yield of direct seeded puddled wet rice under Cauvery command area of Karnataka” was conducted during *Kharif* 2015 at Zonal Agricultural research station, V. C. Farm, Mandya, Karnataka. The experiment consisted of 13 treatments laid out in randomized complete block design with three replications consisting of two pre-emergence herbicides (pendimethalin and Pretilachlor + Bensulfuron methyl) and three post-emergence herbicides (Penoxsulam, Bispyribac sodium and Azimsulfuron) along with manual hand weeding. These herbicide treatments were compared with hand weeding and weedy check. The major weed flora observed in the experimental plot were, *Alternanthera sessalis*, *Eclipta alba*, *Monochoria vaginalis*, *Marsilia quadrifolia* and *Mollugo distica* among broad-leaved weeds; *Echinochloa colona*, *Echinochloa crusgalli* and *Leptochloa chinensis* among the grassy weeds and *Cyperus iria*, *Cyperus difformis* and *Imbristylis miliaceae* among sedges. The results revealed that pre-emergence application of Pendimethalin 750 g a.i./ha at 3 DAS fb Penoxsulam (24 % SC) 22.5 g a.i./ha at 30 DAS, recorded significantly higher grain yield and straw yield (6328 and 7432 kg/ha), lower weed population and dry weight (9.20/m<sup>2</sup> and 3.70/m<sup>2</sup>).

## ECONOMICS OF CHEMICAL WEED CONTROL IN DIRECT SEEDED PUDDLED WET RICE UNDER CAUVERY COMMAND AREA OF KARNATAKA

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### ABSTRACT

A field experiment was entitled “Economics of chemical weed control in direct seeded puddled wet rice” was conducted during *kharif* 2015 at Zonal Agricultural research station, V. C. Farm, Mandya, Karnataka. The experiment consisted of 13 treatments laid out in randomized complete block design with three replications consisting of two pre-emergence herbicides integrated with hand weeding twice at 20 and 40 days after sowing, compared with weed free and unweeded check. The predominant weed flora observed in the experimental field were, *Alternanthera sessalis*, *Eclipta alba*, *Monochoria vaginalis*, *Marsilia quadrifolia* and *Mollugo distica* among broad-leaved weeds; *Echinochloa colona*, *Echinochloa crusgalli* and *Leptochloa chinensis* among the grassy weeds and *Cyperus iria*, *Cyperus difformis* and *Imbristylis miliaceae* among sedges. The results revealed that pre-emergence application of Pendimethalin 750 g a.i./ha at 3 DAS fb Penoxsulam (24 % SC) 22.5 g a.i./ha at 30 DAS recorded significantly higher grain yield and straw yield (6328 kg ha<sup>-1</sup> and 7432 kg ha<sup>-1</sup> respectively), lower weed population and their dry weight (9.20 /m<sup>2</sup> and 3.07 g m<sup>2</sup> respectively). Further the net returns (Rs. 34753) and B:C (2.03) Ratio was also high with the pre-emergence application Pendimethalin 750 g a.i./ha at 3 DAS fb Penoxsulam (24 % SC) 22.5 g a.i./ha at 30 DAS.

## EFFECT OF FOLIAR SPRAY OF NUTRIENTS AND PLANT GROWTH REGULATOR ON VEGETATIVE, REPRODUCTIVE GROWTH, PHYSICAL CHARACTER AND LEAF CHLOROPHYLL CONTENT OF ACID LIME (*CITRUS AURANTIFOLIA* SWINGLE)

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### ABSTRACT

The present study was conducted to see the effect of foliar spray of nutrients and plant growth regulator on flowering, yield





and quality of Acid lime (*Citrus aurantifolia* Swingle). Result revealed that maximum increase in plant height (0.52 m), increase in plant spread East-West direction (0.55 m), increase in plant spread North-South direction (0.57 m) and canopy volume (82.80 m<sup>3</sup>), maximum number of flowers per shoot (18.03), fruit set(s) per shoot (8.95), minimum fruit drop (24.33%) and maximum fruit retention (75.67%), maximum fruit length (4.82 cm) and fruit diameter (4.37 cm), juice content per fruit (27.72ml), volume of fruit (37.52 ml), chlorophyll content in leaves (70.51), were found with foliar spray of KNO<sub>3</sub> @ 2% + GA<sub>3</sub> @ 75 ppm + ZnSO<sub>4</sub> @ 0.6% (T<sub>15</sub>).

## EFFECT OF POLYAMINES ON POST HARVEST QUALITY AND VASE LIFE OF GERBERA (*GERBERA JAMESONII* L.) CUT FLOWER

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### ABSTRACT

The present investigation “Variability and post-harvest studies in gerbera (*Gerbera jamesonii* L.) under naturally ventilated polyhouse” was carried out at College of Horticulture, Rajendranagar, Hyderabad. The best gerbera genotype Goliath has excelled in recording longest field life of the flower scapes was used for post-harvest studies by using polyamines and packaging. Addition of polyamines to the holding solutions viz., spermine, spermidine and putrescine at different concentrations on different parameters viz., Physical parameters of scape bending curvature and flower diameter, Physiological parameters of fresh weight flower, water uptake, transpirational loss of water, water balance, relative water content, and vase life and Biochemical parameters of optical density, total soluble solids, electrolyte leakage, carotenoid content and membrane stability index at an interval of 3 days were recorded during vase life period of cut gerberas. Among the polyamine treatments, spermine 1.0 mM recorded best results for almost all the parameters studied and resulted in higher vase life of 9.46 days in cut gerbera cv. Goliath compared to control (4.54 days). In the other experiment on polyamines in combination with packaging materials during storage at ambient conditions, flower scapes pulsed with 5% sucrose + 1mM spermine when packed in plastic sleeves for whole stalk with 30% ventilation was found best by regarding on physiological loss in weight, Wilted flowers, percentage of faded flowers, Scape bending and flower diameter. Moreover, pulsing with 5% sucrose + 1mM spermine for 24 hours markedly conserved flower quality and may be recommended for storage and transportation to nearby and distant markets.

## EFFECT OF LOCALLY AVAILABLE PRESERVATIVES ON EXTENSION OF VASE LIFE OF CUT CHRYSANTHEMUM CV. ARCTICQUEEN

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### ABSTRACT

The investigation to study the “Effect of locally available preservatives on extension of vase life of cut chrysanthemum (*Dendranthema grandiflora*) cv. Arcticqueen” was carried out in the Department of Floriculture and landscape Architecture laboratory, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad to find out the efficacy of different locally available floral preservatives on physical (fresh weight of flower, diameter of flower, percent neck bending, vase life and over all acceptability of flowers), physiological (water uptake, transpiration loss of water, fresh weight change, relative water content, chlorophyll content in calyx) and biochemical parameters (TSS of petals, pH of vase solution, optical density of vase solution, electrolyte leakage). Artemesia oil, pongamia oil, rosemary oil, geranium oil at 2.5% and 5% concentrations were used after pulsing with 10% sucrose solution. Pongamia seed oil at 1% recorded the highest fresh weight (7.15 g) and lowest TLW (11.36 g/f) of flowers, might be due to more water uptake and more retention, also could be due to its antimicrobial property due to chemical constituents of pongamia seed oil which might have prevented the growth of microbes which in turn inhibited the plugging of water conducting tissues. Pulsing with sucrose acts as a respiratory substrate and also as an osmolyte helps in maintenance of better water relations in cut chrysanthemum flower. The enhanced and continuous water uptake might be responsible for retardation of senescence of flowers. The adequate and controlled TLW might have contributed to the



retardation of senescence process and enhanced vase life of cut flowers. Pongamia seed oil 1% recorded highest overall acceptability (9.46 days) of cut chrysanthemum cv. Articqueen due to good water uptake, lower transpiration loss of water and by maintaining good water balance in cut flower.

## GENETIC VARIABILITY IN GROUNDNUT GENOTYPES (*ARACHIS HYPOGAEA* L.)

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### ABSTRACT

Groundnut (*Arachis hypogaea* L.) is an important food, feed and oilseed crop. It contains 48-50% oil and 26-28% protein, and is a rich source of dietary fiber, minerals, and vitamins. It is grown in nearly 100 countries. Major groundnut producers in the world are: China, India, Nigeria, USA, Indonesia and Sudan. Groundnut is gaining importance as a food crop, on account of high digestible proteins, vitamins, minerals, phytosterols and due to increased consumer preference after value addition. Over 100 countries worldwide grow groundnut. Developing countries constitute 97% of the global area and 94% of the global production of this crop. The production of groundnut is concentrated in Asia and Africa (56% and 40% of the global area and 68% and 25% of the global production, respectively). In India, the area, production and productivity of groundnut during 2018-19 were 48.537 lakh hectares, 69.696 lakh tones and 1436.00 kg/ha, respectively. While in Rajasthan, the area, production and productivity of groundnut during 2018-19 were 6.689 lakh hectares, 16.381 lakh tones and 2449 kg/ha, respectively. There is a need to identify high yielding groundnut genotypes which will be useful and economic to farmers of the area. Hence, keeping in view, the field experiments were conducted at Instructional Farm, CTAE (MPUAT), Udaipur.

Among the tested entries viz., UG 225 gave maximum Mean Dry Pod Yield (4798 Kg/ha) followed by other entries and significantly superior over all the checks viz. TG 37 A (3308 kg/ha), SG 99 (3263 kg/ha), JL 501 (3161 kg/ha), GJG 9 (2991kg/ha), GG 7 (2865 kg/ha) and Pratap Raj Mungphali (2254 kg/ha). Kernel yield were ranged from 1566-3399 kg/ha. The shelling out-turns of different entries ranged from 65-72%. Sound mature kernels were ranged from 85-92 percent. 100-kernel weight ranged between 41-62g. The days to maturity ranged from 104-109 days.

## ARTIFICIAL INTELLIGENCE : BOON TO INDIAN AGRICULTURE

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### ABSTRACT

In present scenario, there is huge need for the increment of the Agricultural production with shortening of Agricultural land so that fulfilment of demand of present population could be satisfied to eradicate extreme poverty and hunger. Deforestation and degradation of soil quality remain significant threats to food security and have a negative impact on the economy. Farming precisely have many goals like sustainability, profitability and efficiency as with the decreasing of cultivated area farmers must take some crucial steps for increasing production, smartly with use of technology. In India mostly mechanical work is done which requires lots of labour, hard work, economic loss, less precise work. For this Artificial intelligence could be boon to the farmers and other agricultural related fields. Government of India is trying to increase the income of farmers by 2022, for this a committee has been made for examining the weak points and to overcome them. Industry has projected to experience 6% decline in agricultural work until 2024. CR00 robotics claims that its robot can harvest 8 acres in a single day and replace 30 human labourers, as 40% of annual farm costs funding into wages, salaries and contract labour expenses. With the increase in technology many problems have been easily solved through internet facilities, chatbots (Alexa, bixby, google), Kisaan call centres, My ciphert application as well as other application software in mobile for identifying the problem and provide immediate solution. Kisaan m-portal, e-National Agriculture Market provide online platform to farmers for selling their goods. Drones and satellites being used for image analysis and detect every aspect required for increasing production whether it is related to disease, insect, nutrient deficiency detection or even weather forecast, precise insecticidal spray, yield boosting algorithms, robotic harvesting equipment. Latest techniques like. Species recognition can be one of the merit of artificial intelligence. Recent researches gave helping hand to farmers for improving their socio-economic condition.



## ORGANIC FARMING FOR SUSTAINABLE CROP PRODUCTION IN INDIA

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### ABSTRACT

Organic farming is an alternative agricultural system which originated early in the 20<sup>th</sup> century in reaction to rapidly changing farming practices. Organic farming is a system of farming that aims at maintenance the soil breathings, maintaining its good health, cultivating the land and then raising the crops and today organic farming continues to be developed by various organizations. The available statistics, India's rank in terms of worlds organic agricultural land was 9<sup>th</sup> and in terms of total number of producers was 1<sup>st</sup> as per 2018 data (FIBL & IFOAM Year Book 2018). India is home to 30 percent of the total organic producers in world but accounts for just 2.59 percent (1.5 million hectares) of the total organic cultivation area of 57.8 million hectare (World of Organic Agriculture 2018). It is a method of farming system which primary aimed at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes like a crop, animal and farm wastes, green manure, aquatic wastes and other biological material along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an ecofriendly pollution free environment, protective soil quality using organic material and encouraging biological activity. Organic agriculture is a production system that sustains the health of soils, ecosystem and people it relies on ecological processes biodiversity and cycles adapted to local conditions, rather the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

## ABUNDANCE AND DIVERSITY OF POLLINATOR FAUNA OF EGYPTIAN CLOVER (*TRIFOLIUM ALEXANDRINUM* L.) AND CORRELATION WITH WEATHER PARAMETERS AT MODERN BEE RESEARCH AND TRAINING CENTER, PANTNAGAR, UTTARAKHAND

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### Abstract

The temporal abundance of different floral visitors on Egyptian clover, *Trifolium alexandrinum* L. and correlation with weather parameters was studied at Honey Bee Research and Training Center, Pantnagar, Uttarakhand, during 2019 and 2020. The mean temporal abundance of *Apis. Mellifera* was the maximum (4.90/m<sup>2</sup>/5 min.) followed by *A. dorsata* (3.89/m<sup>2</sup>/5min), *A. cerana indica* (2.57), *Trigonairidipenni* (2.38), *Spodopteralitura* (3.69), *Helicoverpa armigera* (2.24), *Eristalinus* spp. (1.59) and *A. florea* (1.39/m<sup>2</sup>/5 min.) during 2019. During 2020, *A. mellifera* abundance decreased to and it 3.80/m<sup>2</sup>/5 min. followed by *A. dorsata* (2.92), *A. cerana indica* (2.53), *Trigona iridipenni* (1.28), *P. brassicae* (2.63), *Eristalinus* spp. (1.91), *Coccinellaseptempunctata* (1.63) and *A. florea* (1.12/m<sup>2</sup>/5 min.). *A. cerana* abundance during 2019 was 2.57/m<sup>2</sup>/5 min. but became almost negligible (0.04) in 2020. Floral visitor's abundance was maximum at 1200 h (4.90/m<sup>2</sup>/5 min.) followed by at 1400 noon (2.66) and 1600 h (2.38) and least during the morning hours of 0600 (0.12) and 0800 h (0.32/m<sup>2</sup>/5 minutes). Abundance of *A. mellifera* and *A. dorsata* during 2019 had a highly significant positive correlation with wind speed ( $r=0.67$  and  $0.76$ ) at 0800 h while the later was also correlated with maximum (negative) and minimum relative humidity at 1800 h ( $r=-0.69$  and  $0.73$ , respectively).

## INFLUENCE OF BIO FERTILIZERS ON SUSTAINABLE PRODUCTION OF CHILLI (*CAPSICUM ANNUAM* L.)

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### ABSTRACT

Chilli *Capsicum annuum* L.) is one of the important vegetable –cum-spice crops of India. It is a good source of proteins,



vitamins particularly ascorbic acid and it is reported in many therapeutic uses. Chilli crop is very important for agricultural economy and is used in processing industries. India is the largest producer, consumer and exporter of chilli, which contributes to 25% of the world's production. In India the most important chilli growing states are Andhra Pradesh, Karnataka, Tamilnadu, Orissa, Maharashtra, Rajasthan and West Bengal. Andhra Pradesh is the largest producer of chilli in India and contributes about 30% to the total area under chilli followed by Telangana and Karnataka. Chilli is input responsive and application of organic manures as well as inorganic fertilizers has been reported to influence yield and quality. Since application of chemical fertilizers alone may not sustain the productivity as reported by many workers and integrated use of all potential sources of plant nutrients seems to be the option to maintain soil fertility and crop productivity. Among the several agronomic/management practices, as a component of INM, use of bio-fertilizers and bio-control agents is gaining importance because of their low cost, capacity to enrich soil fertility and no residual toxicity. There is greater demand in the international market for organically produced chilli.

An investigation was carried out at Horticultural Research Station, Lam, Andhra Pradesh during 2015-16 to 2017-18 with an objective of studying the effect of biofertilizers and biocontrol agents on yield of chilli cv. LCA-620. The treatments included biofertilizers (Azospirillum, PSB and K<sup>+</sup> solubilizing bacteria @ 2kg/acre as basal application) and bio control agents (*Trichoderma viride* @ 2kg/acre and VAM @ 5kg/acre as basal application) along with 50%, 75%, 100% RDF in different combinations. The treatment receiving 75% RDF along with bio fertilizers and bio agents recorded the highest no. of fruits per plant, dry chilli yield per ha<sup>-1</sup>, seed yield per ha<sup>-1</sup>, seedling vigour index-I and seedling vigour Index-II proving the favorable influence of bio fertilizers on yield and seed quality parameters.

## EFFICACY OF DIFFERENT MICRONUTRIENTS TREATMENTS ON LEAF NUTRIENT CONTENT OF GUAVA

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### ABSTRACT

Guava is a widely known fruit that belongs to Myrtaceae family, having strong nutritional value and wide range of health advantages. Fruit crops are extremely important in the agricultural industry. Guava is recognized as the "Apple of the Tropics," and recognized a major fruit crop, owing to its vast climatic flexibility and high nutritional value. Micronutrients are typically more effective when applied to horticultural crops through foliar application rather than soil treatment. A study was conducted to assess the effect of micronutrients application on leaf nutrient status of guava cv. Hisar Safeda in district Hisar, Haryana. The experimentation was set up in randomized block system of 8 separate treatments T1(0.5% ZnSO<sub>4</sub>), T2(0.5% ZnSO<sub>4</sub> + 0.2% MnSO<sub>4</sub>), T3(0.5% ZnSO<sub>4</sub> + 0.3% H<sub>3</sub>BO<sub>3</sub>), T4 (0.3% H<sub>3</sub>BO<sub>3</sub>), T5(0.3% H<sub>3</sub>BO<sub>3</sub> + 0.2% MnSO<sub>4</sub>), T6(0.2% MnSO<sub>4</sub>), T7(0.2% MnSO<sub>4</sub>+0.3% H<sub>3</sub>BO<sub>3</sub> +0.5% ZnSO<sub>4</sub>), T8 -Control (only water spray) replicated three times. Two years study indicates that foliar application of zinc sulphate, boric acid and manganese sulphate alone and their combinations significantly influenced leaf nutrient content of guava. The maximum zinc, boron and manganese leaf content was found with foliar application of 0.5% ZnSO<sub>4</sub>, 0.3% H<sub>3</sub>BO<sub>3</sub>, 0.2% MnSO<sub>4</sub> nutrient.

## DEVELOPMENT AND VALIDATION OF HEAT-RESPONSIVE MIRNA-SSR MARKERS FOR CHARACTERIZATION OF WHEAT GENOTYPES IN RESPONSE TO TERMINAL HEAT STRESS

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### ABSTRACT

Wheat is the 2<sup>nd</sup> principal staple food cereal of the world fulfilling the maximal carbohydrates dietary requirement. To meet the food demand of the rapidly growing population, wheat productivity should be enhanced by 40–50% by 2050. Terminal heat stress is the serious issue in wheat cultivating regions due to rise in temperature every year because of the global warming effect. It affects approx. 40% of the wheat cultivating regions of the world. Therefore, there is a critical need to develop improved terminal heat tolerant wheat varieties. Marker assisted breeding with genic SSR (simple sequence repeats) markers have been used for developing terminal heat tolerant wheat varieties; however, only few studies involved the use of miRNA





based SSR markers (miRNA-SSRs) in wheat, which were found as key players in various abiotic stresses. In the present study, we identified 104 heat stress responsive miRNAs reported in various crops. Out of these, 70 miRNA-SSR markers have been validated on a set of 20 terminal heat tolerant and susceptible wheat genotypes. Among these, only 19 miRNA-SSR markers were found to be polymorphic, which were further used to study the genetic diversity and population structure. The polymorphic miRNA-SSRs amplified 61 SSR loci with an average of 2.9 alleles per locus. The polymorphic information content (PIC) value of polymorphic miRNA-SSRs ranged from 0.10-0.87 with mean value of 0.48. The dendrogram constructed using unweighted neighbour joining method and population structure analysis clustered these 20 wheat genotypes into three clusters. Further, polymorphic marker miR159c was declared very promising since this marker discriminated terminal heat tolerant genotypes from the susceptible genotypes. Thus, this identified miRNA-SSR marker will play significant role in genetic diversity studies and marker assisted breeding programs, which will ultimately fasten the development and release of terminal heat tolerant wheat varieties.

## PERFORMANCE OF MUNGBEAN AND SESAME TO DIFFERENT SULPHUR LEVELS UNDER INTERCROPPING SYSTEM IN ARID RAJASTHAN

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### ABSTRACT

Present study was carried out on “Intercropping of sesame (*Sesamum indicum* L.) with mungbean [*Vigna radiata* (L.) Wilczek] under different levels of sulphur” during *kharif* season of 2017-18 at Agriculture Farm of OPJS University, Churu district of Rajasthan India. In India, mungbean occupies 3.0 million hectares and contributes 1.3 million tons in pulse production. Total area under pulses is 24 million hectares with an annual production of 15.19 million tons in the country with productivity of 658 kg/ha. Sesame commonly known as til is an ancient oil seed crop grown in India and perhaps the oldest oil seed crop in the world. Its oil content generally varies from 46 to 52 per cent and also used anointing body, for manufacturing perfumed oils and for medicinal purpose. Both the crops are much affected by the soil fertility factors like sulphur management during the crop season. For this an experiment comprising of twenty treatments combos of five intercropping systems *viz.*, sole mungbean (Var.-RMG-268) and sole sesame (Var.-RT-125), mungbean + sesame in 2:1, 3:1 and 4:1 row magnitude relation, with 4 sulphur levels *viz.*, 0, 15, 30 and 45 kg S/ha. The experiment was conducted in RBD with three replications. The experimental results showed that among the various row ratios, sole planting of crops gave considerably higher seed yield and uptake of nutrients. The best productivity in terms of mungbean equivalent yield (1.21 t/ha) was obtained under sole mungbean followed by mungbean + sesame in 4:1. Higher growth and yield of mungbean and sesame was recorded with increase in levels up to 45 kg S/ha. Intercropping of mungbean + sesame (4:1) gave considerably highest land equivalent magnitude relation. Such studies are much important for enhancing the sesame- mungbean yield in low fertility areas.

## SORGHUM (*SORGHUM BICOLOR* L.) BASED INTERCROPPING SYSTEM UNDER LIMITED WATER CONDITION

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### ABSTRACT

A field experiment was conducted during *Kharif* season of 2019 at Soil Conservation and Water Management Farm of the C.S. Azad University of Agriculture and Technology, Kanpur to find out effect of intercropping systems on growth, yield attribute and yield, water use efficiency, splash loss and economics of crops under limited water condition. The treatments comprised of 10 intercropping systems i.e. (i) Sorghum sole, 45 cm a part (ii) Moongbeen sole, 45 cm a part (iii) blackgram sole, 45 cm a part (iv) Soybean sole, 45 cm a part (v) Sorghum + moongbeen (2:1) (vi). Sorghum + blackgram (2:1) (vii).Sorghum + soybean (2:1) (viii).Sorghum + moongbeen (3:1) (ix). Sorghum + blackgram (3:1) and (x) Sorghum + soybean (3:1) were tested in Randomized block design with 3 replications. Results obtained that yield of sorghum, moongbeen, blackgram and



soybean were maximum in their sole stands. The yield of sole and intercropped mungbean, blackgram and soybean in terms of sorghum equivalent grain yield showed significant variation, whereas sorghum + blackgram (2:1) brought out significantly the highest production as compared to other cropping systems. Moreover, the land equivalent ratio, water use efficiency, gross return, net return and cost: benefit ratio were also found to be the highest simultaneously, maximum splash loss was observed under sole sorghum and minimum under blackgram treatment.

## EFFECT OF DIFFERENT FUNGICIDES AGAINST *SCLEROTIUM ROLFSII* CAUSING FOOT ROT DISEASE IN FINGER MILLET UNDER *IN VITRO* CONDITION

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### ABSTRACT

Finger millet (*Eleusine coracana*) is one of the important millet crops widely cultivated across India, and more than 60 per cent of its area is concentrated in Karnataka. Although, it is found to be a hardy crop, it is also affected by many diseases, among them foot rot caused by *Sclerotium rolfsii* has been an increasing problem especially in irrigated and heavy rainfall areas in Southern dry zones of Karnataka. A total of 17 fungicides were screened under *in vitro* condition against *S. rolfsii* causing foot rot of Finger millet. Out of which fungicides like Propiconazole 25% EC, Tebuconazole 25.9% EC, Hexaconazole 5% SC and combi products viz., Carbendazim 12% + Mancozeb 63% WP, Metiram 55% + Pyraclostrobin 5% WG, Tebuconazole 50% + Trifluoxystrobin 25 WG and Carboxin 37.5% + Thiram 37.5% DS were found effective at 125ppm, 250ppm, 500ppm concentration, but among contact fungicide, the Mancozeb 75% WP was found to be effective at 250ppm, 500ppm, 750ppm concentrations. Other fungicides like Chlorothalonil (contact), Isoprothiolane (systemic) and Azoxystrobin 18.2% + Difenconazole 11.4%, Cymoxanil 8% + Mancozeb 64%, Metalaxyl M4 + Mancozeb 64 % in combi products are slightly effective at higher concentrations. When compared to the control plate without any fungicide treatment. Fungicides like Copper oxychloride, Captan, Dimethomorph, Carbendazim were found to be ineffective at all different concentration against *S. rolfsii*.

## CLIMATE CHANGE AND PLANT DISEASES

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### ABSTRACT

Climate change is a major problem of concern globally. Plant and animal communities are now experiencing rapid and significant changes in temperature, drought, precipitation and evaporation patterns. From the agricultural point of view the most likely consequences are shifts in the geographical distribution of host and pathogen and altered crop losses, caused in part by changes in the efficacy of control strategies. They affect the incidence and severity of the disease for crops. Changes in the environmental conditions are most likely to lead emergence of new pest and diseases, modification in host susceptibility, rapid multiplication of pathogen and better adaptability that enhances their number and range. For instance in recent years, serious concern has been caused by the evolution of new virulent races of *Puccinia graminis* f.sp. *tritici*, a pathogen causing wheat stem rust that can result in close to 100% yield losses on susceptible wheat cultivars in favourable weather conditions. The warmer climate with lower relative humidity and enhanced turbulence will lead to ~40% increase in the urediniospore emitting potential of an infected field as global average. These changes affects the measures farmers use to effectively manage diseases as well as feasibility of particular cropping systems in particular regions. The changing disease scenario has highlighted the need of better agricultural practices and use of eco-friendly methods in disease management. Weather based disease monitoring, inoculum monitoring and rapid diagnostics may play important role in such conditions. Other approaches include selection of resistant cultivars/varieties, new forecasting model with higher efficacy, change of date of sowing to avoid cause of epidemic, use of bio-agents and botanical pesticides, disease management through integration of all the existing technologies. As research on impacts of climate changes on plant diseases has limited, intensified research on climate change-related issues could result in improved understanding and management of plant diseases in the face of current and future climate extremes.



## EVALUATION OF BOTANICALS AGAINST *SCLEROTIUM ROLFSII* SACC. CAUSING FOOT ROT IN FINGER MILLET UNDER *IN VITRO*

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### ABSTRACT

Finger millet is one of the major nutritive millet of India, it ranks third among after sorghum and pearl millet. It has high nutritional quality and one of the hardiest crop. Among the different fungal diseases, foot rot of finger millet caused by *Sclerotium rolfsii* is one of the important emerging disease in heavy rainfall area. Under adverse condition dormant sclerotial bodies are formed and act as main source of primary inoculum. The present investigation was carried out to evaluate the efficacy of botanicals at AICRP on Small Millets Plant Pathology laboratory by using *Agave americana* leaf, *Curcuma longa* rhizome, *Parthenium hysterophorus* leaf, *Azadirachta indica* leaf, *Datura stramonium* leaf, *Zingiber officinale* rhizome, *Aloe barbadensis* miller leaf, *Allium sativum* bulb, *Eucalyptus globulus* leaf, and *Gliricidia sepium* leaf extracts and these were evaluated at 3 different concentrations (5, 15, and 25%). Among the botanicals tested against *Sclerotium rolfsii*, *Agave americana* leaf extract showed maximum inhibition of the sclerotium mycelia growth (53.3%, 63.8%, 86.6% at 5, 15, 25% concentration respectively), followed by *Curcuma longa* (51.1%, 61.1%, 67.2% at 5, 15, 25% concentration respectively). While least inhibition of mycelium was observed (13.3%, 22.2%, 26.6% at 5, 15, 25% concentration respectively) in *Gliricidia sepium* leaf extract.

## EFFECT OF RHIZOBIUM, PSB AND KMB CONSORTIUM ON YIELD OF CHICKPEA

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### ABSTRACT

In order to reduce the cost of biofertilizer production and ease in application, consortium of nitrogen fixing (Rhizobium), phosphorus solubilizing (PSB) and potash mobilizing bacteria (KMB) has been prepared by Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.). The effect of consortium on yield of chickpea (variety Digvijay) was evaluated by conducting a field trial during rabi 2019-20. Treatments comprised of chickpea seed treatment with lignite based formulation of consortium in combination with different levels of chemical fertilizers as basal dose application. Observation on germination, different growth parameters, viz. number of branches, plant height, number of nodules/plants and yield was recorded to assess the effect of various treatments. It was revealed that seed treatment with MPKV consortium consisting of Rhizobium, PSB and KMB@ 25 g/kg along with 75 per cent recommended dose of chemical fertilizers i.e. 19kg nitrogen, 37 kg phosphate and 22 kg potash was found to be best for obtaining higher yield (20.40 q/ha) which ultimately saved 25 % cost of chemical fertilizers in chickpea crop. Significantly increased number of branches, plant height and number of nodules were also recorded in this treatment. Thus, seed treatment of MPKV consortium was found beneficial for chickpea, which is the most important rabi pulse crop of India grown mostly under rainfed condition.

## EFFECT OF POST-HARVEST TREATMENTS AND DIFFERENT MATURITY STAGES ON SHELF LIFE OF MRIGBAHARKAGZI LIME (*CITRUS AURANTIFOLIA*, SWINGLE) FRUITS

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### ABSTRACT

Among the different maturity stages viz., mature green (25% yellowing), half green (50% yellowing) and yellowish green (75% yellowing), the fruits harvested at matured green stage recorded maximum effective shelf life (19.64 days), per cent marketable fruits retain [78.66% after 18 days of storage (DAS)], minimum per cent of rotting and culled fruits (7.33 and 14.22%, respectively). The fruits harvested at bright yellow coloured stage recorded maximum juice content (41.84%),



TSS (7.67<sup>0</sup>B), acidity (7.02%), ascorbic acid content (32.95 mg/100 ml) and organoleptic scores (3.10, 4.00, 3.33 and 3.54 for peel colour, pulp colour, juice flavor and taste and overall acceptability, respectively).

Among the different postharvest treatments viz., CaCl<sub>2</sub> (2%), GA<sub>3</sub> (100 ppm), Wax (6%), KMnO<sub>4</sub> (2%), Chitosan (0.5%) and untreated fruits (control), maximum effective shelf life (25.71 and 21.56 days), maximum marketable fruits (87.40 and 82.96%), minimum rotten fruits (5.18 and 6.29 %) and culled fruits (9.62 and 6.29%) were recorded in wax @ 6% and CaCl<sub>2</sub> @ 2 per cent treated fruits, respectively at 18 DAS. The minimum PLW (10.14 and 10.48%), maximum juice content (40.98 and 39.67%), maximum titrable acidity (6.89 and 6.73%) and ascorbic acid content (31.33 and 31.53 mg/100 ml of juice) were recorded in wax @ 6 per cent and CaCl<sub>2</sub> @ 2 per cent treated fruits, respectively at 18 DAS.

The highest score for peel colour, pulp colour, juice flavor and taste and overall acceptability were recorded in wax @ 6 per cent treated fruits (3.44, 3.88, 3.34 and 3.73 respectively) at 24 DAS. This treatment was on par with CaCl<sub>2</sub> at 2 per cent treated fruits. The post-harvest treatments with wax emulsion @ 6% and calcium chloride @ 2% extend the shelf life of kagzi lime fruits upto 25 days and 21 days, respectively in mrighbahar fruits at ambient storage conditions.

## IDENTIFICATION OF PROMISING VARIETIES OF SORGHUM TO PRAKASAM DISTRICT OF ANDHRA PRADESH

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### ABSTRACT

In Andhra Pradesh, Sorghum is grown in different agro-climatic conditions throughout all cropping seasons viz., *kharif*, *rabi* and *maghi* seasons as a dual purpose crop for grain and fodder and it occupies sizeable area of 1.4 lakh ha with a productivity of 2382 kg/ha.. As a part of location specific research, identification of suitable varieties with high yield performance for Prakasam district of Andhra Pradesh is the responsibility of Agricultural Research Station, Darsi. Therefore, a study was taken up at ARS, Darsi during 2017-18 *rabi* season with six sorghum genotypes obtained from Regional Agricultural Research Station, Nandyal. The experiment was done in Randomized block design with four replications. Among six genotypes tested, NJ-2647 was found to be highly productive over three check varieties viz., NTJ-2, NTJ-4 and M-35-1 and is having desirable characters like early flowering (67 days) and desirable panicle length (30.7 cm). It recorded 35 % increased yield (3596 kg/ha) over the best white sorghum check variety NTJ-4 (2663 kg/ha). It is categorized as a dwarf genotype with a plant height of 150 cm and therefore amenable to mechanical harvesting. This genotype may further be tested in large scale demonstrations in farmers' fields for assessing its suitability for commercial cultivation in Prakasam district of Andhra Pradesh.

## NUTRITIONAL PROFILING OF ADVANCE BREEDING LINES AND PROMISING VARIETIES OF CHICKPEA (*CICER ARIETINUM* L.)

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### ABSTRACT

Chickpea is a chief source of protein for resource poor people mostly in developing countries that are reliant on plant proteins to fulfill their nutritional needs and hence, its global demand is continuously growing. The richness of chickpea in dietary fibers, minerals, vitamins, starch, sugars, lipids and unsaturated fatty acids make it a functional food source (Chavanet *et al.*, 1989). Assessment of genetic variability in existing chickpea gene pool for nutrient and protein content is one of the competent methods to identify potential genotypes for breeding strategy (Dwivedi *et al.*, 2012). A study was taken up with 11 promising chickpea genotypes at Regional Agricultural Research Station, Nandyal, Andhra Pradesh, India during 2016-17 and 2017-18 for protein content and mineral nutrient composition (Fe, Zn, Cu and Mn). Protein and mineral nutrients in 11 genotypes were studied as per standard procedures and the data pertaining to both the years were subjected to pooled analyses. On pooled basis, the differences among the protein, iron, zinc and copper contents of 11 chickpea genotypes were significant. Significant differences were also observed between mean protein, iron, zinc and copper contents of 11 chickpea genotypes in two years indicating influence of growing environment on response of genotypes. Promising genotypes for various nutritional traits are NBeG507 and NBeG458 for protein; NBeG 779 , NBeG 49 and NBeG 47 for Fe and Zn and NBeG 49 and NBeG 47 for Cu as superior lines. These lines can be further evaluated for their combining ability and can be utilized in breeding programmes for developing nutritionally rich chickpeas with respect protein and the three micro nutrients.





## RESOURCE CONSERVATION TECHNIQUES IN RICE-WHEAT CROPPING SYSTEM

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### ABSTRACT

Predominant cropping system in India is the Rice-wheat cropping system as both rice and wheat are main staple food for the people of the country. Threat to sustainable food production has resulted due to the continued adoption of exhaustive rice-wheat cropping system. In order to address the problems like stagnant productivity, increasing production costs, declining resource quality, receding water table and increasing environmental problems alternative technologies are the major drivers. For improving and sustaining higher yields there are various efficient technologies that can be adopted in rice wheat system. Various Resource conservation technologies are Laser land-levelling, direct seeded rice (DSR), Zero tillage (ZT), furrow-irrigated raised-bed system (FIRBS) etc. Zero tillage (ZT) generally saves irrigation water in the range of 20–35% in the wheat crop compared to conventional tillage. Adoption of furrow-irrigated raised-bed system of wheat saves 25-30% seed, 30-40% water and 25% nutrients without affecting the yield. Direct seeded rice followed by zero tillage wheat reduced the global warming potential of rice wheat system by 41% as compared to conventional system. Happy Seeder technology provides an alternative to burning for managing rice residues. Direct seeded rice under double no till with laser land levelling reduced cost of cultivation and improved the crop yields and system productivity while conserving natural resources and should be practiced in different ecologies including upland, lowland, deep water and irrigated areas by large as well as small farmers

## IMPACT OF DROUGHT ADAPTIVE MECHANISM ON ROOT AND ROOT ASSOCIATED TRAIT OF RICE PLANT

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### ABSTRACT

Roots are very important for plants for a wide variety of processes, including nutrient and water uptake, anchoring and mechanical support. Some phenomenal literature supports several root characters which have relevance for stress adaptation. Root characteristics such as root length density, rooting depth and root distribution have been established as constituting factors of drought resistance. Under drought situation, roots can adapt to continued growth while at the same time, sending signals to shoot that exhibit growth above ground parts of the plant. Development of plants with deep roots may in fact stimulate photosynthetic yields as these are considered to be more controlled by the carbon sinks of plants. In this view an experiment was conducted to study the root and root associated traits among the mutants of rice. And observed that the root length ranged from 24.46 cm to 38 cm with a mean of 32.40 cm {WT (Wild type) 32.33 cm} and the root volume ranged from 21.67cc to 65cc with a mean 35.51cc (WT 27.92 cc) and the root weight ranged from 4 g to as high as 34.30 g with a mean of 17.13g (WT 18.49g). Besides these, the mutants also exhibited a wide variation in total dry matter (TDM). There were TDM ranged from 16.39 g<sup>-1</sup>plant to 92.12 g<sup>-1</sup>plant with a mean of 52.73 g while, the WT had a TDM of 55.12g. Therefore, results indicated that, the selected activation tagged mutant lines exhibited a wide variation for growth parameters and root traits, which have more root dry weight will draw more water and contributes to more TDM and also could changes in root to shoot ratios. The information may stated that, the environmental demand may provide an opportunity to exploit the observed variability to improve production for a wide range of growth condition.

## ASSESSMENT OF GENETIC VARIABILITY FOR CELLULAR LEVEL TOLERANCE THROUGH TEMPERATURE INDUCTION RESPONSE (TIR) TECHNIQUE IN RICE CROP

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### ABSTRACT

The screening technique to identify the thermo-tolerant lines from the segregating population have been developed, which is



referred as temperature induction response technique. A novel Temperature Induction Response (TIR) technique has been developed and standardized for the rapid assessment of cellular level tolerance in crop plants. This approach is based on the fact that, drought stress develops gradually and the plants are normally exposed to sub lethal stress before being exposed to more severe stress. A significant variability in the parameters associated with cellular level tolerance (CLT) was observed among the mutants. Accordingly, the percent seedlings survival ranged from as low as 0% to as high as 100% with a mean survivability of 74.01%. Similarly, the recovery growth ranged from 0 cm to 3.74 cm with a mean recovery growth of 1.37 cm. The percent reduction in the recovery growth of induced seedlings ranged from 35.58% to 100% with a mean % RRG of 82.03%. The results revealed that existence of wide and significant variability for cellular level tolerance in rice plant activation tagged mutant line. Interestingly, the wild type (JBT 36/14) showed 60% seedling survival with a recovery growth of 1.98 cm and %RRG of 72.59%. However, studies showed that acclimated plants survive when exposed to a severe stress that would be lethal to non-acclimated plants. Therefore, relevance of a physiological or biochemical trait for stress tolerance can be the best study by pre-exposure of seedlings/plants to a sub-lethal acclimation stress to get the better survivability and recovery growth.

### **CARBON ISOTOPE DISCRIMINATION ( $\delta^{13}\text{C}$ ) IS A SURROGATE APPROACH TO STUDY WATER USE EFFICIENCY (WUE) OF ACTIVATION TAGGED MUTANTS**

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#### **ABSTRACT**

There is an increased need for improvement in the efficiency with which crop plants convert applied water into harvestable production, or water-use efficiency (WUE). In the recent past there has been considerable gains in WUE and notably in cereals, by selecting for plants with high transpiration efficiency (TE) using stable carbon isotope discrimination approach procedure. The carbon isotope discrimination ( $\delta^{13}\text{C}$ ) during growth can be an excellent surrogate for direct measurement of WUE. Therefore, towards looking at the variation in WUE based on  $\delta^{13}\text{C}$  values, all the 234 activation tagged mutants of rice were characterized for WUE. The mutants exhibited a wide and significant variation in  $\delta^{13}\text{C}$  values to indicate that the WUE of the mutants are quite distinct and different. Accordingly, the  $\delta^{13}\text{C}$  values of the mutants ranged from 16.91‰ to 22.55‰ with a mean of 20.56‰ while, the wild type had a  $\delta^{13}\text{C}$  value of 20.42‰. The total dry matter (TDM) of the mutants ranged from 20.36g to 72.73g with a mean of 49.03g and the wild type had a mean TDM of 48.99g. Incidentally, high WUE genotype was selected based on  $\delta^{13}\text{C}$  values. Therefore, it is likely that the promising mutants identified in the present study could also be useful not only to understand the involvement of genes for WUE but also for crop improvement programme.

### **STUDIES ON GENETIC PARAMETERS FOR YIELD AND YIELD ATTRIBUTING CHARACTERS IN SORGHUM (*SORGHUM BICOLOR* L. MOENCH) IN SCARCE RAINFALL ZONE OF ANDHRA PRADESH**

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#### **ABSTRACT**

Sorghum (*Sorghum bicolor* L.) is an important irrigated and rainfed crop and the principal food grain crop next to rice in southern part of Andhra Pradesh cultivated in *kharif maghi* and *rabi* seasons. The area under Sorghum in Andhra Pradesh is 1.55 lakh ha with annual production of 3.89 lakh tonnes yielding about 2510 kg/ha during 2019-20 with major area in Kurnool (55,000 ha), Guntur (40,000 ha) and Ananthapuram (30,000 ha) districts and Scarce Rainfall Zone (Kurnool and Ananthapur districts) alone accounted for 54.8% of total AP state area. As a researchable issue, development and identification of suitable sorghum cultivars through study of segregating populations and selections in breeding material will be fetching to identify the best genotypes for Andhra Pradesh and in particular for Scarce Rainfall Zone. As a part of this research, a study was taken up



at Regional Agricultural Research Station, Nandyal with 20 genotypes were tested in Advanced Yield Trial in Randomized block design with 3 replications in which days to 50 % flowering ranged from 56 to 70 days, plant height of 119 cm to 267 cm and 100 seed weight from 2.6 g to 4.5 g indicating the early and late duration genotypes with semi dwarf and bold grain types and grain yield ranged from 2006 to 4167 kg/ha. A Perusal of estimates of coefficient of variation for yield and yield attributing characters revealed higher phenotypic coefficient of variation compared to genotypic coefficient of variation indicating the influence of environment. Further high (>20%) estimates of coefficients of variation were recorded for grain yield and fodder yield indicating the presence of large variation among the genotypes studied for these characters and the effectiveness of simple selection for their improvement. High heritability (>60%) estimates were observed with the characters viz., days to 50% flowering, Plant Height, Panicle length, 100 seed weight indicating the low influence of environment on these characters. Further, high (>20%) estimates of genetic advance as percent mean was observed in Plant height, Panicle length and 100 seed weight. In addition, high heritability coupled with high genetic advance as percent mean was recorded with Plant height, Panicle length and 100 seed weight indicating that these characters are governed by additive gene action and therefore simple selection would be effective for improvement of these characters.

## ANATOMICAL STUDY ON INTERACTIONS BETWEEN *FUSARIUM OXYSPORUM* F. SP. *CICER* AND *CICER ARIETINUM*

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### ABSTRACT

Chickpea (*Cicer arietinum*) is one of the most important food legumes grown worldwide, especially in the dry areas of the Indian subcontinent. The experiment was conducted to study the correlation between resistant traits of chickpea and vascular anatomy. The changes in anatomical structures during infection were observed in wilt resistant and susceptible lines under Electron Microscope. The uninfected roots remained free of any hyphal growth whereas Foc produced a net like mycelium on the surface of the infected 'JG-62' root tip which was detected with lactophenol-cotton blue staining. Also, the germinating conidia of Foc and their germ tubes appeared to be attached to the root surface of infected 'JG-62' by a mucilaginous sheath. Whereas, 'WR-315' root did not show any prominent mycelial growth on its root surface. After 72 hrs of inoculation, the vascular region of infected 'JG-62' roots were observed as a disorganized mass of few protoxylem and sparsely distributed enlarged metaxylem. In the 'WR-315' plants, the presence of highly densely stained polysaccharide deposits was observed. Similarly, the occurrence and intensity of these polysaccharide deposits was apparently less in the infected 'JG-62' plants. The result of experiment reveals that with the help of root anatomy able to differentiate the *Fusarium* wilt resistant and susceptible lines of chickpea.

## STUDIES OF ADOPTION TECHNOLOGY OF TRAINED AND UNTRAINED FARM WOMEN'S OF DIFFERENT VILLAGES OF DISTRICT –CHANDAULI

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### ABSTRACT

Studies of 260 farm women; both who had undergone six days training and untrained on the subjects namely Scientific Mushroom cultivation, Kitchen gardening. Layer farming and fish farming was carried out in four villages of (Dulhipur, Baghahi, Khutahanand Kodochak) Block Niyamtabad and Sahabganjof Chandauli-District. A total of 14 character were selected based on the examine performance and past research studies. It was found that among the various groups of character of the farm women; most of the farm women belonged to mid age group. Had primary level of education, opting equally to have either agriculture as the main or subsidiary occupation. Possessed medium to low level of farm experience, with medium level of annual income followed by medium to low level of contact with extension agency, social participation, mass media exposure, economic motivation, scientific orientation, innovativeness, perceived effectiveness towards the training and operated small size holding. This study was undertaken to assess the behavior traits of the farm women Chandauli District



which will help in giving appropriate policy implication based on the derived conclusions to uplift the behavior status of the farm women.

## **LABORATORY SCREENING OF PULSE – GRAIN COPWPEA VARIETIES FOR ITS MOISTURE STRESS TOLERANCE**

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### **ABSTRACT**

An experiment entitled ‘Laboratory screening of pulse-grain cowpea varieties for its moisture stress tolerance was conducted at the soil and water testing laboratory of Krishi Vigyn Kendra Kollam, Kerala Agricultural University, Sadanandapuram, Kottarakkara, to study the response of seven varieties of cowpea under varying levels of moisture stress induced by polyethylene glycol. The study was conducted in 3 separate experiments using 3 different concentrations of PEG6000 with 7 treatments (different varieties) and three replications. Each experiment was laid out in a complete randomized block design. The treatments were T1 -Local variety I, T2- Local Variety II, T3- DC-15, T4-Hridhya, T5-Sreya, T6-Subhra and T7-TC55-1 using the three different concentrations of PEG 6000 viz., 0 % (without PEG control), 10% PEG, and 20 % PEG. The seeds were grown in germination paper by roll towel method. Water stress condition was created by Polyethylene Glycol 6000 at varying concentrations of 10 and 20% and without PEG. Observation on germination percentage, shoot length, root length, seedling length and seedling vigour index were recorded in all varieties at 10 days and the data were subjected to statistical analysis using the statistical software WASP (ICAR Coastal Research Station Goa). The results showed that different cowpea varieties responded differently to drought induced by PEG at different concentrations. All varieties at 0 % PEG (without PEG) registered maximum germination percent and was found to be decreased as the concentration increased. In all the concentration of PEG, the local variety 1 (Parippally) and local variety 2 (Karimani) recorded higher germination percent and the variety DC-15 (popularised by KVK) and Sreya registered next higher germination percentage when compared to other varieties. The lowest germination was recorded with TC55-1 (T7). By increasing osmotic potential PEG 6000, germination of seeds of different varieties decreased while germination percent of all varieties in distilled water that is without PEG (0%) was higher. This shows that the local varieties were the most drought tolerant varieties followed by DC-15 and Sreya. There was a significant reduction in the shoot length of all varieties under different PEG concentration. As the concentration of PEG increased, the shoot length was decreased. In all concentration the performance of local varieties was better than the released high yielding varieties. Among the released varieties, the variety DC15 and Sreya performed significantly better than the other varieties. At 20% PEG induced drought stress there was significant reduction in shoot length of all varieties. Significant variation in root length was observed only at 10% PEG induced drought tolerance and all varieties performed uniformly under 20% PEG and without PEG but the water stress reduced root length in all varieties. The total seedling length was also significantly affected by the PEG induced drought stress in 10% and 20% concentrations. The local varieties responded well at 10% and 20% PEG induced drought and without PEG. There was significant reduction in total seedling length in the most popular variety DC15 when compared to the local variety. The seedling vigour index also, the same trend i.e., the local varieties performed better than released varieties. The performance of released varieties DC15 and Sreya with respect to seedling vigour index were better than other varieties except local varieties. Hence it can be concluded that the local varieties performed better than the released varieties under moisture stress conditions and among the released varieties the variety DC 15 and Sreya performed better than other varieties except local varieties.

## **A STUDY ON ECONOMIC IMPORTANT TRAITS OF INDIGENOUS SAHIWAL CATTLE**

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### **ABSTRACT**

Livestock is an important and integral part of agriculture sector and plays an important role in the national economy and in the socio-economic development of the country. Cattle are the most important livestock in India and play vital role in agriculture related economy. Among them Sahiwal is considered as the best milch dairy breed of the country and is well adapted to the tropical and sub-tropical conditions of Indian sub-continent. Their special characteristics like disease resistance, adaptability





to harsh climatic conditions and ability to sustain on poor quality roughages. The present study was conducted on 105 Sahiwal cattle in 2020, which were maintained under All India Coordinated Research Project (AICRP) on cattle Sahiwal (DRU) at instructional dairy farm, G.B.P.U.A. & T., Pantnagar. The semen of proven bulls from Progeny tested sires of superior genetic merit provided by CIRC (ICAR), Meerut/ NDRI, Karnal is being used to inseminate females of university farm. The performance record of Sahiwal cattle maintained at Instructional Dairy Farm at Pantnagar University were utilized to estimate means of economically important traits. It was found that the overall average age of first calving, lactation milk yield, lactation length, peak yield, dry period, service period, calving interval, wet average and herd average were  $1176.33 \pm 24.86$  days,  $1878.37 \pm 67.39$  kg,  $269.44 \pm 7.36$  days,  $12.15 \pm 0.23$  kg,  $140.18 \pm 7.89$  days,  $153.88 \pm 6.65$  days,  $422.75 \pm 7.89$  days,  $7.14 \pm 0.27$  kg and  $4.55 \pm 0.17$  kg respectively.

## EFFICACY OF SEQUENTIAL APPLICATION OF PRE AND POST-EMERGENCE HERBICIDES ON SOIL MICROBIAL ACTIVITY IN *KHARIF* GREEN GRAM (*VIGNA RADIATA* L.)

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### ABSTRACT

The experiment was conducted during *Kharif* season of 2013 to evaluate the efficacy of sequential application pre and post-emergence herbicides on soil microbial activity in *Kharif* green gram (*Vigna radiata* L.) in clay loam soil under rainfed condition at Main Agricultural Research Station, Dharwad. The experiment comprised of fifteen treatments included three pre-emergence herbicides (Pendimethalin, alachlor and oxyfluorfen) and two post-emergence herbicides (Imazethapyr and fenoxypyr-p-ethyl) and their sequential applications along with the cultural practices. These herbicide treatments were compared with farmers' practice, weed free check and weedy check. Experiment was laid out in complete randomized block design with three replications. Results revealed that, among the sequential application of herbicides, pre-emergence application of pendimethalin @  $1.0 \text{ kg ha}^{-1}$  post-emergence application of imazethapyr @  $75 \text{ g ha}^{-1}$  recorded significantly lower activities of microbes (Bacteria, Fungi and Actinomycetes) in soil. However, at 14 DAS, all weed control treatments recorded on par microbial activities as that of non-herbicides treatments. But, at 21 DAS the soil microflora in the herbicide treatments were improved and recorded more microbial activities as compared to non-herbicide treatments. As a result of effective control of weeds and higher soil microflora the same treatment recorded significantly higher seed yield ( $1110 \text{ kg ha}^{-1}$ ) with weed index of 5.6%, net monetary returns (Rs. 41156  $\text{ha}^{-1}$ ) and BC ratio (3.44). This treatment was statistically comparable with weed free check. This is because of the recovery of microbial population and enzyme population after initial inhibition due to microbial adaptation to these chemicals or due to their degradation. It can also be due to microbial multiplication on increased supply of nutrients available in form of microorganisms killed by herbicides. The uncontrolled weed growth caused 57.4% reduction in seed yield of green gram.

## NUTRIENT UPTAKE BY CROP AND WEEDS IN *KHARIF* GREEN GRAM (*VIGNA RADIATA* L.) AS INFLUENCED BY SEQUENTIAL APPLICATION OF PRE AND POST EMERGENCE HERBICIDES

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### ABSTRACT

The experiment was conducted during *Kharif* season of 2013 to know the nutrient uptake by crop and weeds in *kharif* Greengram as influenced by sequential application pre and post-emergence herbicides in clay loam soil under rainfed condition at Main Agricultural Research Station, Dharwad. The experiment comprised of fifteen treatments included three pre-emergence herbicides (Pendimethalin, Alachlor and Oxyfluorfen) and two post-emergence herbicides (Imazethapyr and Fenoxypyr-p-ethyl) and their sequential applications along with cultural practices. These herbicide treatments were compared with farmers' practice, weed free check and weedy check. Experiment was laid out in randomized complete block



design with three replications. Among the sequential application of herbicides, pre-emergence application of pendimethalin @ 1.0 kg ha<sup>-1</sup>/b post-emergence Application of imazethapyr @ 75 g ha<sup>-1</sup> recorded significantly higher nutrient uptake of NPK by crop (24.4, 6.2 and 18.7 and 59.1, 14.5 and 52.3 NPK kg ha<sup>-1</sup> at 30 and 60 DAS, respectively) and reduced weed growth and nutrient uptake by weeds. As a result of effective control of weeds and higher nutrient uptake, the same treatment recorded significantly higher seed yield (1110 kg ha<sup>-1</sup>) with lower weed index of 5.6%. This treatment was statistically comparable with weed free check. This was mainly attributed to higher uptake of nutrients by the crop as a result of effective control of weeds since from sowing to maximum vegetative stage which created conditions similar to weed free environment due to sequential application of pre and post emergence herbicides. The effective reduction in weed growth in the above treatments resulted in reduced competition offered by weeds for precious crop growth resources like nutrient, moisture, space and solar energy. The uncontrolled weed growth caused 57.4% reduction in seed yield of green gram.

## EFFECT OF COVER CROP ON SOIL ORGANIC CARBON RESTORATION AND CROP PRODUCTIVITY

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### ABSTRACT

Soil organic carbon (SOC) is one part in the much larger global carbon cycle that involves the cycling of carbon through the soil, vegetation, ocean and the atmosphere. The SOC pool stores an estimated 1500 PgC in the first meter of soil, which is more carbon than is contained in the atmosphere (roughly 800 PgC) and terrestrial vegetation (500 PgC) combined (FAO and ITPS, 2015). Cover crops perform well for the maintenance and restoration of soil organic carbon (SOC) and soil productivity of previously eroded soil. Cover crops are plants mostly grown after a primary crop is harvested, in regions of the world where only a single main crop is grown (such as North Europe, North China and Canada). Cover crops (CCs) minimize the loss of soil in permanent cropping systems where the soil is usually bare due to intense tillage or overuse of herbicides. Increasing crop productivity with reduced inputs and lower impacts on the environment is a major current challenge for global food production. Cover crops are able to increase soil organic matter by protecting the soil surface from erosion, adding biomass to the soil (especially below the soil surface), and creating a habitat for microorganisms like fungi that contribute to the soil biology and provide more pathways for nutrient management in the soil ecosystem. Legume crops were found to increase levels of soil organic matter by 8% to 114%. Non-legume cover crops, including grasses and *Brassicas*, were found to increase soil organic matter levels by 4% to 62%. A major pathway to build soil C storage is by increasing the quantity of C inputs. Adoption of cover crops (CC) in the cropping system is recommended as a management strategy for increasing SOC stores. In addition to providing C inputs, CCs offer numerous agro-ecosystem services such as reduce N losses via leaching, increase yield of subsequent crop, and improve overall soil quality. Despite the aforementioned benefits, CC-induced effects on soil and crop productivity are highly dependent on CC management practices (time of CC planting and termination, CC species, and cropping system), quantity and quality of CC residues, and the climatic conditions.

## MANAGEMENT OF CARNATION WILT CAUSED BY *FUSARIUM OSYSPORUM* F. SP. *DIANTHI*

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### ABSTRACT

Carnation (*Dianthus caryophyllus* L.) is one of the important flower crop grown under polyhouse condition. Amongst the diseases of carnation, Fusarium wilt is most damaging one causing great loss. In the present study, three plant extract, four bioagents and five fungicides were evaluated in *in vitro* to study their efficacy in inhibiting the mycelial growth of *Fusarium oxysporum* f. sp. *dianthi*. Among the botanicals and fungicides carbendazim @ 0.1% recorded highest mycelial growth inhibition 84.85% followed by captan @ 0.2% (66.28) against *Fusarium oxysporum* f. sp. *dianthi* while in *in vitro* studies of bioagents, *Trichoderma viride* and *Trichoderma harzianum* were found most effective in inhibiting the mycelial growth of test fungus i.e 73.58 and 71.59 per cent. In the *in vivo* trial in glass house for management of Fusarium wilt of carnation, the



treatment of soil drenching with carbendazim (0.1%) was found most effective which showed maximum PDC (90.00%) followed by captan (0.2%), *T. viride* (5g/lit. water) and *T. harzianum* (5g/lit. water).

## ROLE OF GENDER EQUALITY AND RELATION BETWEEN WOMEN AND THE DEVELOPMENT

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### ABSTRACT

“The whole issue of Women and Development is a process full of conflicts.” Jan Pronk, Minister for Development Cooperation, Netherland Women constitute half of the world’s population. In 1948, the Universal Declaration of Human Rights reaffirmed the equal rights of men and women. Despite this, women experience considerable disadvantage and discrimination in societies perpetuating gender-differentiated structures. In 1985 it was reported to the U.N. Committee on the Status of Women that woman composed one-half of the world’s population and performed two-thirds of the world’s work hours, earned one-tenth of the world’s income, owned less than one hundredth of the world’s property, and were everywhere poorer in resources and poorly represented in positions of power. It was pointed out that, in all societies, men and women have different responsibilities for the tasks necessary for the survival and development of the community. However, within the existing division of labour, responsibility for the maintenance of human resources fell largely on women’s shoulders. Gathering fuel and water, processing food, caring for the children, nursing the sick, and managing the household is heavy and time-consuming work. This is widely seen as a woman’s role, and is economically not recognized. The Human Development Index (HDI), constructed to measure achievements in basic human development across the world, measures gender inequality in terms of economic and political opportunity and gender empowerment in terms of participation and decision making. The 2001 HDI indicated that gender inequality was present in every country, although there were considerable variations across nations. It is now increasingly recognized that development efforts will not succeed without the full participation of the women in all aspects of national and international life. The main thrust for Women in Development should today and in near future be on the implementation of programmes and decisions such as demonstrate and draw attention to the role of women, include matters pertaining to women on the political agenda, create a political will to enhance the role of women and apply these methods globally and nationally.

## BIOEFFICACY OF BIOAGENTS, ANTIBIOTICS, CHEMICALS AND LEAF EXTRACTS AGAINST *X. ORYZAE* PV. *ORYZAE* (XOO) ISOLATES.

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### ABSTRACT

Bacterial leaf blight (BLB) of rice caused by *Xanthomonas oryzae* pv. *oryzae*, is one of the most destructive diseases in rice cultivation throughout the worldwide due to its growing concern as this disease is wide spread, devastating and its control measures. The antibacterial potential of *Pseudomonas fluorescence* (Liquid base) and *Pf* Gr (isolate), different broad-spectrum antibiotics such as streptomycin, tetracycline, chloramphenicol and ampicillin chemical such as copper oxychloride (COC) and leaf extract such as *Adhatoda vasica* (Adulsa) and *Occimum sanctum* (Tulas) were used to observe the sensitivity of five different bacterial isolates (KOO1, PMX2, KAX3, IGX4 and GAX5) *in vitro* by paper disc method (Disk diffusion). Out of two bioagents, four antibiotics, one chemical and two phyto extracts, chloramphenicol (0.1%) and tetracycline (0.1%) were found highly effective in inhibiting the growth of all *Xoo* isolates. The average inhibition in growth was 33.89 and 31.00 per cent respectively irrespective of isolates. Maximum growth inhibition was recorded in tetracycline while minimum inhibition was observed in copper oxychloride. Leaf extract of *Occimum sanctum* (10%) and copper oxychloride (0.25%) showed less inhibition against all five *Xoo* isolates.



## REACTION OF MAIZE GENOTYPES AGAINST CHARCOAL ROT (*MACROPHOMINA PHASEOLINA*)

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### ABSTRACT

Maize is one of the most versatile emerging crop, can be grown over wider range of agro-climatic conditions. Charcoal rot caused by *Macrophomina phaseolina* (Tassi) Goid. is one of the economically important diseases of maize all over the world with reported yield losses as high as 70 per cent. The typical symptoms of charcoal rot include premature drying of plant, disintegration of affected internodes and appearance of small pinhead like black sclerotia on the rind of the stalks. In present study, fifty-three maize genotypes of different maturity groups were screened against charcoal rot by using tooth pick inoculation technique at AICRP on Maize, MPKV, Rahuri. Out of the 53 genotypes, only two genotypes AH-8246R & VNR-4361 recorded least disease and categorized as resistant against charcoal rot. Four genotypes, viz. IT8582, PM10205L, Buland and G 25(C) recorded highly susceptible reaction to the disease. Twenty-four genotypes were found moderately resistant and twenty-three genotypes moderately susceptible reaction against *M. phaseolina*.

## INFLUENCE OF DIFFERENT PACKAGING MATERIALS ON SHELF LIFE OF PAPAYA

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### ABSTRACT

Papaya is an important fruit crop cultivated in around 129130 hectare with production of 5160390 M.T.in India and in Bihar it covers around 2000 ha with annual production of 60,000 tonnes (Technical bulletin papaya in Bihar, 2013). It is highly nutritive fruit. Its nutritional values in 100gm of edible portion are moisture 86.6%, protein 0.5%, fat 0.1%, carbohydrate 9.5%, calcium 0.01%, phosphorus 0.01%, iron 0.4%, vitamin A 2020 IU, vitamin B 0.04mg, vitamin C 40mg, nicotinic acid 0.2%, riboflavin 250 gm and calorific value 40 calories. But one major challenge is very short shelf life and lack of storage and cold storage facilities for it. To overcome this problem trial is conducted obtained with treatment of LDPE (low density polyethylene) sheet, newspaper wrapping and CFB (corrugated fiber box) as compared to control at room temperature. During storage observations were recorded on three days interval for various physical characteristics, chemical constituents and organoleptic evaluation were done. The minimum physiological loss in weight were recorded is 8.02% in case of low-density polythene wrapping followed by corrugated fiber box and newspaper wrapping as compared to control. Spoilage losses were 12.75% in case of LDPE followed by CFB and newspaper wrapping. The titratable acidity was minimum 0.08 % in case of LDPE application which was at par with control followed by newspaper wrapping [0.088%) and CFB (0.090%) respectively. The TSS were maximum in case of LDPE (9.87%) followed by CFB (9.68%) and by newspaper wrapping (9.21%) as compared to control (8.35%). The maximum marketable (%) of fruit were in case of LDPE (87.25%) followed by CFB (83.97%) and newspaper wrapping (81.96%) as compared to control (80.63%). Thus, we found that LDPE were most effective packaging material for improving the shelf life of papaya as compared to other treatments.

## IDENTIFICATION & DEVELOPMENT OF NITROGEN & PHOSPHOROUS RESPONSIVE MIRNAS AND GENIC SSRs IN BREAD WHEAT

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### ABSTRACT

Bread wheat is one of the most widely cultivated crops as it provides the main source of energy (20% calories) and adds vitamins to human diet. According to Union State Department of Agriculture (USDA), global wheat production was 763Mt





(in 2019), which increased by 1.4% in 2020(772.64Mt). Production of wheat is dependent on macronutrients; deficiency in any macronutrients triggers the molecular process, biological process and transport of nutrients which ultimately leads to yield losses. Nitrogen (N) & Phosphorous (P) are applied to crops in huge quantity as chemical fertilizers. Out of the total amount of fertilizers applied, only 30-40% is utilized by plant while excess of applied fertilizers lost through the surface run off, leaching, volatilization and denitrification. To overcome these problems, breeders needs to develop the wheat varieties with high yield under low-nutrient conditions so that maximum amount of nitrogen and phosphorous may be available to crop. Marker assisted breeding is the good approach to develop varieties with high nutrient efficiency. Therefore, in our study, we identified miRNAs and Gene specific SSRs which are responsive to N & P signaling, uptake, transport and utilization. A total of 115 SSRs (80 miRNA & 35 Genic SSRs) are identified, among which 68 miRNA SSRs and 32 genic SSRs have been validated on a panel of 10 wheat genotypes, a total of 35 SSRs were found to be polymorphic. The polymorphic information content (PIC) values of polymorphic SSRs were ranged from 0.19-0.99 with mean value of 0.50. Target genes of miRNA used in this study were obtained from psRNA Target server. Binary data of polymorphic markers obtained after validation were used for genetic diversity and population structure analysis. Two polymorphic markers one for N (Mir171a) and other for P (Mir 167a) were found to be tightly linked with NUE & PUE respectively. These two markers were found to be distinguishing the wheat genotypes in efficient and deficient in nitrogen and phosphorous. These will help in screening of wheat variety for use efficiency of N & P at early stage and in molecular breeding program to develop the variety which will be able to efficiently utilize the given N & P fertilizers.

## PRODUCTION OF KACHRI (*CUCUMIS CALLOSUS*) (AHK-119) WITH SALINE WATER IRRIGATION IN HOT ARID REGION

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### Abstract

In hot arid region, Kachri (*Cucumis callosus*) is the most important vegetable crop and potential source of income for farmers. The availability of good quality of irrigation water is very less. Thus sustainable irrigation systems using saline soils and waters have the potential to improve crop production in arid region. The field experiment was conducted at ICAR- Central Institute for Arid Horticulture, Bikaner during 2017-18 and to investigate the effect of saline water with the combination of different amendments on Kachri crop performance. It was observed that the maximum vine length (cm), number of fruit plant<sup>-1</sup>, number of vine plant<sup>-1</sup> and leaf size (cm) were (1.47cm, 16, 5, 9.0cm x 8.8 cm) respectively observed under the treatment of gypsum @5ton/ha + 4EC (dS m<sup>-1</sup>)<sub>IW</sub> followed by vermicompost @10 ton/ha+ 4EC(dS m<sup>-1</sup>)<sub>IW</sub>, FYM @15 ton/ha + 4EC (dS m<sup>-1</sup>)<sub>IW</sub>, 4EC (dS m<sup>-1</sup>)<sub>IW</sub>, 2EC (dS m<sup>-1</sup>)<sub>IW</sub> and .5EC (dS m<sup>-1</sup>)<sub>IW</sub>. The highest yield was observed with the treatment of gypsum @5ton/ha+ 4EC (dS m<sup>-1</sup>)<sub>IW</sub> that was (66.25 q/ha) followed by vermicompost @10 ton/ha+ 4EC(dS m<sup>-1</sup>)<sub>IW</sub> (60.00 q/ha) and FYM @15 ton/ha+ 4EC(dS m<sup>-1</sup>)<sub>IW</sub> (57.50 q/ha). 4EC (dS m<sup>-1</sup>)<sub>IW</sub> (32.30 q/ha), 2EC (dS m<sup>-1</sup>)<sub>IW</sub> (40.00 q/ha) and .5EC (dS m<sup>-1</sup>)<sub>IW</sub> (50 q/ha). This is clearly indicated that Kachri crop performance was good in the treatments where gypsum @5ton/ha+ 4EC (dS m<sup>-1</sup>)<sub>IW</sub> were applied.

## SOCIO-ECONOMIC STATUS OF GOAT FARMERS IN UTTARAKHAND STATE : AN ECONOMIC ANALYSIS

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### Abstract

Present study has been conducted in four districts of Kumaon and Garhwal regions of Uttarakhand state to explore the socio-economic status of goat farmers in these regions. About 156 goat rearing households have been covered. Study revealed that there were 51% goat farmers belongs to general category however, 32.43 percent belong to ST social group. The rest were from other backward class (OBC) 16.22%. Educational status of goat farmers indicated that 23% goat farmers were illiterate however, 19% farmers were educated upto primary level (class 5<sup>th</sup>). About 55% of respondents educated between 6 to 12th standard whereas merely 3% farmers were found to be graduated. The overall family size was 5.24 members; it was found about 6 in Kumaon region and 5.5 members in Garhwal region. Distribution of respondent according to occupation revealed that about 51% households were engaged with goat farming followed by wages (25%). Agriculture was found to be third



important occupation whereas, 6% farmers were engaged with service and about 5% were doing some other work as occupation. Goat farming and wages were found to be the major source of the household's income. Goat farming contributing around 26% of total household income however, the wages contributes 22%. Agriculture contributes around 9.39 % of total household income of respondent goat farmers. The other income sources were service (14.5%) and other sources (23%). The overall annual income was about Rs. 81,000 per household per year. The land holding size of goat farmers were quite small. The average land holding size was 1.09 acre. The annual employment generation of goat farming was more than 300 days. The flock composition in goat rearing households revealed that the overall flock size in study households was 14 goats. Majority of goat farmers reared their goats under extensive management system. The average hours of grazing were found to be about 5 hours per day. Goat housing was identified as one of important constraints in goat production in hill regions. Even after extreme climatic conditions, most of the goat houses were *Kaccha* type with poor hygienic condition and lack of space resulted in overcrowding and morbidity losses. The net income per goat per year in Dehradun district was estimated to be Rs 3494/-. The result of the study indicated that there is a need of breed improvement, health management, nutrition improvement and need to develop market linkages through cooperatives, SHGs, FPOs and producers' organizations for their better livelihood and more income generation in goat production.

## FARMERS' COPING MECHANISM FOR MITIGATING ADVERSE EFFECT OF FLOOD - A STUDY IN FLOOD AFFECTED DISTRICTS OF ASSAM

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### Abstract

Recurring flood is a major challenge in the Flood Prone Areas of Assam. Annually 39.58% area and around 33,27,968 population are affected by flood. The present study was conducted in Jorhat and Majuli district of Assam to assess coping mechanism adopted by farmers for mitigating adverse flood effect in the flood affected areas. All total 160 farmers were selected randomly as respondents from eight purposively selected villages of Jorhat and Majuli district of Assam where flood occurred regularly for last ten years. "Floor elevation of dwelling house", "making elevated grain storages" are found to be adopted by people at a higher rate (98.13% and 95.63% respectively) as infrastructural coping mechanism to avoid damages of household articles and seed and planting materials. Practice of mixed cropping with season specific cereals, pulses oilseeds and vegetables for avoiding total loss and satisfying household food security was another coping mechanism adopted by majority of farmers (91.88%). "Cultivation of *baor* rice in low land", "cultivation of traditional tall *sali* rice variety with low inputs but cultivation *rabi* crops with high input" were technological coping mechanism adopted by majority farmers possessing low land for compensate the loss due to flood damage. In medium land of flood affected areas, cultivation of submergence tolerance varieties, "raising of seedlings with fellow farmers in nearby flood free areas with sharing basis" for ensuring quality seedling after flood were followed as coping mechanism by more than 80% farmers. Documentation of location specific flood coping mechanisms of farmer can be replicated in other similar regions and also help the policy makers to develop more appropriate flood adaptation policies for the state.

## GENETIC DIVERGENCE STUDIES IN SUGARCANE (*SACCHARUM* SPP. HYBRID COMPLEX) UNDER WATERLOGGED CONDITIONS

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### Abstract

Forty-four sugarcane clones/varieties were evaluated in a randomized complete block design with two replications at PAU, RRS Kapurthala during cropping season 2019-20 under waterlogged conditions to study the genetic divergence among sugarcane clones/varieties. The water logging conditions were imposed at tillering, grand growth and maturation stages. The assessment of genetic diversity was based on the seven cane yield and its components traits i.e. germination (%) at 45 days, number of millable canes (000/ha), stalk length (cm), stalk diameter (cm), single cane weight (kg), cane yield (t/ha) and six



juice quality traits i.e. brix (%), sucrose (%), CCS (%), purity (%), extraction (%) and CCS (t/ha). The results indicated that the clones/varieties differed significantly with respect to the traits studied and were grouped into seven clusters separately for cane yield components and quality traits based on the squared euclidian distance using Ward's method. Highest intra cluster distance was found in cluster VII for cane yield and its components traits, while in cluster II for quality traits. Maximum inter cluster distances were observed between clusters VI and VII for cane yield and its components traits, whereas between clusters II and VII for quality traits, which indicates that clones/varieties belonging to these clusters can be used in breeding programme because of presence of maximum diversity. The analysis of cluster means revealed that clusters III and VII presented higher index for cane yield and its components traits, while Cluster IV and VII presented better quality traits. It is suggested that clones/varieties within these clusters could show greater potentiality for breeding purpose by virtue of their desirable traits and these should be used for future breeding programme.

## CHANGES OF UNSATURATED FATTY ACID ON HERBAL COW GHEE SUPPLEMENTED WITH FLAXSEED OIL AND BRAHMI LEAVES

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### Abstract

Ghee is a traditional milk product in India. It is generally prepared from cow and buffalo milk. In Ayurveda, ghee has been generally used as a medium for delivering different Ayurvedic medicine. Presently, several types of herbal ghee are available in the local and urban market. Flaxseed oil is also known as Linseed. It is also used for medicinal properties since ancient times. Flaxseed contains a higher amount of omega-3 fatty acid, rich in dietary soluble and also a high content of lignans. Flaxseed acts as an anti-oxidant property. Brahmi leaves have been used for brain tonic. It is used as a herb. In the present investigation, flaxseed oil was added at three different levels @ 5%, 10% and 15% and brahmi leaves were added at four different levels @ 5%, 10%, 15% and 20% in cow ghee samples. The herbal cow ghee samples were analysed for monounsaturated and polyunsaturated fatty acid. It has been observed that the mean value of Palmitoleic acid (% of Total Fat) was found in the range of 0.22 to 1.57 for treatment T0 to T12. Similarly, the mean value for Oleic acid (% of Total Fat) was recorded 20.40 to 22.33 for sample T0 to T12. The mean value oleic acid of herbal cow ghee has been increased from control sample to treated samples. The highest mean value for Linoleic acid (% of Total Fat) was found in the range of 1.27 to 3.47 for sample T0 to T12. Furthermore, the mean value for Octadecatrienoic acid (% of Total Fat) of herbal cow ghee was recorded from 0.18 to 6.91 for sample control sample to treated samples. It has been observed that the monounsaturated fatty acid of herbal cow ghee was observed highest in treatment T12 due to presence of higher amount of flaxseed oil.

## ELITE VARIETY OF RICE 'VL DHAN88' FOR CULTIVATION UNDER IRRIGATED TRANSPLANTED CONDITION OF NORTHERN HILLS

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### Abstract

VL Dhan88 is an early duration rice variety suitable for cultivation under irrigated transplanted condition of Uttarakhand, H.P. and Meghalaya. This has been developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand which is released and notified by the Central Sub-Committee on Crop Standards Notification and Release of Varieties for Agricultural Crops, New Delhi vide S.O.500(E) dated the 29th January, 2021. In irrigated early duration segment under hill rice trials, after 13 years VL Dhan 88 (VL 32224) was found promising, exhibited stable and significant yield superiority over the checks. VL Dhan88 is derived from the cross Vivek Dhan 82/VL 31629 with maturity duration of 115-120 days. On an average of four years, it provided grain yield of 4,963 kg/ha in lower hills as compared to national check, VL Dhan



86 (4,471 kg/ha); regional check, Shalimar Rice 3 (4,065 kg/ha) & Local check (4,365 kg/ha) with yield advantage of 11.01, 22.10 and 13.71 per cent, respectively over these checks. Under medium elevation, it yielded 4,332 kg/ha and found superior to VL Dhan 86 (national check) by 15.93%, Shalimar Rice 3 (regional check) by 97.07% and local check by 33.03%. This variety possesses semi-erect, intermediate and non-lodging plant type, green basal leaf sheath colour, erect to semi erect flag leaf, compact, semi-erect and well exerted panicle, awless grains and straw apiculus colour. VL Dhan 88 recorded very good quality characteristics viz., hulling (77.5%) and milling (68.4%), head rice recovery (54.2%), intermediate ASV (4.0), amylose content (22.47%), gel consistency (32mm), grain chalkiness is very occasionally present. It has long bold grain with kernel length (6.10mm), kernel breadth (2.21mm) and L/B ratio (2.76). It has shown moderate resistance against leaf blast, neck blast, sheath blight and bacterial leaf blight. VL Dhan 88 will help in yield stabilization, varietal diversification and fulfill the requirement of irrigated rice growers of hill farmers.

## EFFECT OF PLANTING GEOMETRY AND PLANKING ON GROWTH AND YIELD OF FINGER MILLET IN GULI METHOD

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### Abstract

Finger millet (*Eleusine coracana* L.) is one of the important millet grown in various regions of India. With regard to protein (6-8%) and fat (1-2%) it is comparable to rice and with respect to mineral and micronutrient contents it is superior to rice and wheat. Nutritionally it has high content of calcium (344 mg/100g), dietary fiber (15-20%) and phenolic compounds (0.3-3%). Guli method of cultivation of finger millet is popularizing in recent days in Andhra Pradesh. This is innovation of the farmers of Karnataka. Guli is simple and similar to SRI. This practice involves the use of FYM alone @10 t/ha. This method involves passing of wooden log over the crop. Farmers reported that increase in number of tillers was noticed due to passing of wooden log over the crop during early stages. Hence, this experiment has been conducted to evaluate spacing, nutrient management and also to know the effect of passing of wooden log over tillering and crop yield. The site of experimentation was Regional Agricultural Research Station, Nandyal during 2020-2021. The experiment was laid out in 3 factorial design with 3 replications. The treatment details are as follows Factor 1: Spacing levels (S): 3 S<sub>1</sub>: 30 cm X 10 cm, S<sub>2</sub>: 30 cm X 30 cm (pit method) and S<sub>3</sub>: 45 cm X 45 cm (pit method) Factor 2: Planking (P): 2 P<sub>1</sub>: Without planking and P<sub>2</sub>: 20 & 40 DAS Factor 3: FYM levels (F): 3 F<sub>1</sub>: 7.5 t/ha, F<sub>2</sub>: 10 t/ha and F<sub>3</sub>: 12.5 t/ha. The soils are deep vertisols with initial soil fertility status N: 259 kg/ha, P<sub>2</sub>O<sub>5</sub>: 46.6 kg/ha and K<sub>2</sub>O: 375 kg/ha. The crop was sown at a spacing of 30cmX10cm. Maximum plant height was recorded with S<sub>3</sub>: 45 cm X 45 cm (111.8 cm) over S<sub>1</sub>: 30 cm X 10 cm (108.5 cm) and the lowest was recorded with S<sub>2</sub>: 30 cm X 30 cm (107.6 cm). Planking and FYM levels were not significantly superior. Significantly higher grain yield was recorded with spacing S<sub>1</sub>: 30 cm X 10 cm (3247 kg/ha) over S<sub>2</sub>: 30 cm X 30 cm (2899 kg/ha) and S<sub>3</sub>: 45 cm X 45 cm (2808 kg/ha). FYM levels and Planking levels were not significantly influenced. Maximum straw yield was observed when sown at a spacing of 30 cm X 10cm (6155 kg/ha) significantly superior over 30 cm X 30 cm (5731 kg/ha) and 45 cm X 45 cm (5701 kg/ha). Significantly higher straw yield was noticed with without planking (5977 kg/ha) compared to planking at 20&40 DAT (5748 kg/ha). Straw yield was not significantly influenced by FYM levels.

## COMPATIBILITY OF ENTOMOPATHOGENIC FUNGI AND BOTANICAL OILS USED IN PEST MANAGEMENT

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### Abstract

Agricultural pest management is becoming a serious challenge in perspective of economic and environmental challenge due to indiscriminate use of chemical pesticides. Hence we need to focus more on the organic pest management options and its possible combinations for use. Among the organic pest management options, botanicals and entomopathogens are the main resources we have, but we need to check the compatibility of these two when apply together. Botanicals are the plant secondary metabolites, the vast untapped source of phytochemicals that can be greatly used in insect pest management





(Forimet *et al.*, 2012). The major botanicals that were commonly employed in pest management include neem oil, neem seed kernel, pongamia oil and cashew nut shell liquid. The entomopathogenic fungi like *Beauveria bassiana*, *Lecanicillium lecanii* etc. plays a major role in suppressing pests in the field. Since organic pests management has its own limitations, sometimes we may need to combine botanicals and entomopathogenic fungi field application. In this view, an in vitro study to assess the sensitivity of entomopathogens (*B. bassiana* & *L. lecanii*) to three different botanicals (neem oil, pongamia oil and cashew nut shell liquid (CNSL)) was carried out and the growth and percent inhibition of entomopathogenic fungi was recorded. The inhibition percentage of *B. bassiana* recorded in different treatments were in the range of 4.34 to 30.33 per cent. CNSL 0.5% showed lowest inhibition of 4.34 per cent when compared to CNSL 1% (7.24 per cent) & CNSL 1.5% (13.04 per cent), Pongamia oil 1% (13.04 per cent) and Neem oil 2% (30.33 per cent). According to Hassan's classification scheme, none of the treatments viz., CNSL 0.5 %, CNSL 1%, CNSL 1.5 %, neem oil 2 % and pongamia oil 1 %, tried in the in vitro trial does not produced any harmful effect on the growth of the entomopathogenic fungus, *B. bassiana* or found to cause any inhibition. Even though neem oil was found to be compatible, it caused the highest inhibition among the different botanicals tried. The percentage growth inhibition is less than 10 per cent for CNSL at different concentrations and pongamia oil. In the case of *L. lecanii*, the percentage inhibition ranged 16.25 to 69.40 per cent for different botanicals. According to Hassan's classification scheme neem oil 2%, pongamia oil 1% were found to be harmless but CNSL 0.5%, 1% & 1.5% were slightly harmful to *L. lecanii*. Sundaran (2018) reported the safety of CNSL to *B. bassiana*, *L. lecanii* and *Metarhiziumanisopliae*. The results of the present study clearly revealed the safety and possibility of combining the botanicals like cashew nut shell liquid, neem oil and pongamia oil along with the commonly used entomopathogens like *B. bassiana* and *L. lecanii*. The possibility of combining these two options will greatly add to the pest management utility and reduce the cost of application and enhance the efficacy of pest control.

## MORPHOLOGICAL AND BIOCHEMICAL POTENTIAL OF INDIAN MUSTARD (*BRASSICA JUNCEA*) AFTER PHYSICAL MUTAGENESIS

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### Abstract

Mutation breeding is an effective way to generate rare variations in germplasm collections in a comparatively short time. The seeds of two low Erucic acid varieties were irradiated with different doses of gamma rays & treated in combination with different EMS concentrations with an aim to achieve the nutritional content of the mustard. The treated seeds were then grown for several generations. As, induced mutagenesis also brings about changes in the overall morphology of the plants, distinct morphological mutants were observed in the M1, M2 & M3 generations. Following is a brief account of the mutations recorded: Black seeds produced yellow seeded plants, both yellow seeded & black seeded siliqua were present in the same plant, colour variation of seeds from black to grey & light grey, light grey & yellow seeded siliqua in the same plant, white flower bearing plant, plant with whorl pattern of branching of siliqua, plants ranging up to 245cms to as low as 135cms in height & plants with big leaves. In the present study, investigation was up taken to collect the data of such morphological mutants and analyse the differences from the non mutated plants.

## RELATIVE EFFICIENCY OF INDUSTRIAL BY-PRODUCTS AS SOIL AMENDMENTS FOR REMEDIATION OF CADMIUM CONTAMINATED SOIL

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### Abstract

Environmental pollution is the biggest menace the world faces today. Recently various industrial by-products like fly ash, press mud, steel slag and red mud has been used as a potential soil amendment for remediation of contaminated soil. An incubation studies and pot culture experiment was conducted to study the effect various amendments (fly ash, steel slag and press mud) either alone or in combination with FYM and their application rates (1, 2.5 and 5% dry w/w basis) on heavy metal cadmium stabilization in a Cd contaminated soil. Application of press mud, steel slag and fly ash either alone or in combination with FYM resulted significantly positive effects on soil pH, EC and SOC content after the end of incubation



period of 30 days and in pot culture experiment. Application of steel slag significantly increased the soil pH over control; however, FYM application resulted in significant decrease in soil pH. Among the amendments, only press mud and FYM amended cadmium contaminated Vertisol resulted in significant increase in soil organic carbon (SOC) over control. Among the amendments used in the present study based on incubation studies, application of steel slag was proved to be significantly better in reducing DTPA extractable Cd content as compared to other amendments like press mud, fly ash and FYM. Among the treatments, the lowest cadmium content in spinach leaf was observed in soil amended with steel slag (5%) alone in the Cd contaminated soil. Steel slag application in a Cd contaminated soil resulted in 43.2 reduction in spinach leaf cadmium content over control, respectively. Application of FYM also significantly reduced the cadmium content in spinach leaf of Cd soil over unamended soil. The mobility of cadmium in soil and its subsequent uptake by spinach crop was significantly reduced in the amended soil as it was evident from lowest values of transfer coefficient over the unamended soil (control). Further it was evident from the result that in a Cd contaminated soil, the transfer coefficient value for cadmium was lowest in the steel slag (5%) alone amended soil (1.63). The lowest transfer coefficient value of Cd in the steel slag amended soil indicates greater reduction in mobility of heavy metal (Cd) from soil to plant system as compared to other treatments. From the study, it was clearly evident that press mud and steel slag addition either alone or in combination with FYM as soil amendment has greater potential in reducing the mobility of heavy metal in soil and its subsequent transfer to edible plant parts (spinach leaf) as evidenced by reduction in DTPA extractable Cd in soil and lower transfer coefficient value in a Cd Contaminated soil.

## **INCREASED INFECTIONS SUSCEPTIBILITY FROM MICRONUTRIENT DEFICIENCIES AND PRE- EXISTING CONDITIONS**

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### **Abstract**

To live a healthy and disease-free life, humans require a strong immune system. Micronutrients like vitamins A, C, D, and E, as well as minerals such as iron, zinc, folic acid, selenium, and magnesium, all play vital roles in the immune system's overall health. In Indians, however, poor micronutrient consumption and unbalanced diets prevail. The impact of micronutrient insufficiency on immune function response is investigated in this study. It also studies COVID-19 to evaluate its susceptibility to a variety of diseases, and it investigates the effects of supplements on immune system function and infections, as well as immunity-boosting diets. Inadequate nutrition have been proven in numerous studies to decrease immune system functioning and weaken the immunological response. Micronutrient deficiencies (sometimes known as "hidden hunger") can affect immune system functions and increase vulnerability to a variety of infections, with COVID-19 being the most vulnerable at the moment. Infectious diseases are also more susceptible to death and morbidity. Despite the fact that there are contradictory facts, present evidence suggests that several micronutrient supplements that enhance immunity may regulate immune response and reduce infection risk. Vitamin C, vitamin D, and zinc have the strongest evidence for supporting immunity and lowering infection risk. Micronutrients have been discovered to play an important function in regulating inflammatory responses. As a result, micronutrient insufficiency affects the poorest of the poor, affecting their total nutritional condition. This has an impact on their higher odds of contracting COVID-19 and susceptibility to infection. Clinical research addressing micronutrient dosage in infected and healthy populations must be designed in order to compare dose-dependent results and outcomes.

## **INTEGRATING INDIGENOUS TRADITIONAL KNOWLEDGE AND ETHNOVETERINARY PRACTICES FOR SUSTAINABLE LIVESTOCK REARING IN UTTARAKHAND**

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### **Abstract**

A study was conducted to know the Indigenous Traditional Knowledge (ITKs) and ethno- veterinary practices being followed to assess the possibility of integrating them with livestock farming in the hilly state of Uttarakhand. Uttarakhand is recognized for its biodiversity throughout the world. The Indigenous Traditional Knowledge (ITKs) of any community is its native



knowledge about its natural resources. The medicinal plants available from higher altitudes of Uttarakhand are utilized for the preparation of various ethno-veterinary medicines. *Echinochola frumentacea* (Jhingora) seeds and *Grewia optiva* (Bheemal) tree leaves with high protein content are fed by the livestock rearers to increase the milk production. *Curcuma longa* (haldi), *Ageratina adenophora* (Kala Baans) and Devdar tree oil is used to treat wounds. The livestock rearers of Uttarakhand use *Urtica dioica* to cure anemia as it is a rich source of iron. It is used for treating anemia as it is very rich in iron. The powder of *Dalbergia sissoo* leaves and pulp of *Aegle marmelos* is used to treat diarrhea. *Dioscorea bulbifera* is used in skin diseases because of the presence of diosgenin and diosbulbin in it. The ITKs associated with the Garhwali and Kumouni community have significant scientific evidence behind them. These ITKs are on the verge of extinction because people are forgetting their ancestral knowledge. Efforts should be made to conserve and scientifically validate and share these ITKs with other parts of the world to make organic livestock rearing sustainable.

## BENEFITS PERCEIVED BY THE MEMBERS OF THE FARMER PRODUCER ORGANIZATION

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### Abstract

Farmer Producer Organization is an appreciating step of Government of India which help in solving multifold problems of small farmers of India like lack of transportation facilities and storage facilities in rural areas, access to latest information and technology and recent market trends and distress sale. Various institutional interventions, formal or informal, were started either by government, or by private corporate to link smallholders to the input and or output markets in the form of agricultural cooperatives, self-help groups, commodity interest groups, contract farming, direct marketing, farmers producing organizations, producer companies etc. So the present study was conducted with an objective to study the benefits perceived by the members of Farmer Producer Organization in Udaipur Districts. For studying the benefits perceived by members of FPOs, four FPOs viz. Bhomat Agro Food Producer Company Ltd. Ogha, Jhadol, Wakal Agro Food Producer Company Ltd. Ogha, Jhadol, Jhadol Producer Company Ltd. Jhadol and Mewar Green Agro Producer Company Ltd. Kolyari, Jhadol were selected purposively having both male and female members and working since three years. Information on personal benefits and economic benefits were gathered from the members of FPOs through interview schedule. After analysis of data it was found that the overall personal benefits perceived by both male and female members before joining the FPO were to a medium extent with MPS 46.06 and 47.15, respectively whereas overall benefits perceived by both male and female members after joining FPO were to a higher extent with MPS 78.41 and MPS 73.37 respectively which were found to be highly significant. In case of economic benefits it was seen that there was a mean gain of Rs.21050 and Rs.22531 in annual income of male and female respondents after becoming the members of FPO and it was found highly significant where as mean gain of annual saving of Rs.4531.25 and Rs.9468.75 was found for male and female respectively which was also found to be highly significant.

## FORMULATIVE RESEARCH ON SATISFACTION LEVEL OF FARMERS USING INFORMATION CHANNELS FOR BANANA CULTIVATION TECHNOLOGIES IN TRICHY DISTRICT, TAMIL NADU

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### Abstract

Agriculture is the back engine of Nation's developmental agenda. But our farmers still miserably struggling due to non-adoption of modern farm technologies. Information and Communication Technologies when used sufficiently can speed up the process of transfer of technology in agriculture. Thus role of mass media in dissemination of farm information to the farmers is vital. The present study was undertaken to determine the satisfaction level of mass media users in accessing in Banana production technologies of Trichy district of Tamil Nadu. After converting the qualitative information into a quantitative one using a five point scale, the average scores were obtained from the respondents on various factors to determine the overall



satisfaction on the functions of the media for getting information & technology on banana cultivation made as a dependent variable like Newspapers, Magazines, Radio, Television, New media. The independent variable which affects the dependent variable was studied from the major banana cultivating blocks of Thottaiyem, Lalgudi, Andanallur, Manachanallur and Tiruverambur in Tiruchirappalli district. It was inferred that the maximum overall satisfaction on the activities/ functions of the media for getting information & technology on banana cultivation was found among female respondents. The age group of 26 – 35 years felt high Level of satisfaction on the activities/ functions of the media for getting information & technology on banana cultivation. The socio economic characteristics such as educational qualification, annual income and ownership of land also had an impact in deciding the satisfaction level of mass media users.

## EFFECT OF MICRONUTRIENTS AND PLANT BIOREGULATORS ON FRUIT YIELD/PLANT IN OKRA-POTATO-FALLOW CROPPING SYSTEM

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### Abstract

Okra (*Abelmoschus esculentus*) or ladies finger which is also known as Bhindi is one of the important vegetables of India. It is grown throughout the tropical, sub-tropical region and also in the warmer parts of temperate region. Okra and Potato (*Solanum tuberosum*) are important vegetable crops. Deficiency of micronutrients is common problem in vegetable crops. Foliar fertilization with multi-nutrients to achieve balanced plant nutrition is considered to play a significant role in modern sustainable vegetable production. A field experiment study was conducted on the effect of micro nutrient and bioregulators on the yield. The data obtained from the field experiment clearly indicates that different micronutrients have their significant influence on fruit yield/plant of okra. Maximum fruit yield/plant was 301.57 and 320.11 was noted with application of RDF which was statistically on par with application of M2 and M4 during first year however during second year it was at par with M2 only. Minimum fruit yield/plant was 216.08 and 229.79 was noted under treatment M3 during first and second year of experimentation respectively. Combined effect of micronutrients and bioregulators was also significant that max fruit yield/plant was 365.40 and 388.80 was recorded under combination of M1 x P2 followed by rest combinations. Minimum fruit yield/plant of okra was noted when M3 was combined with P3 the trend of data was similar during both the years of study.

## DEVELOPMENT AND EVALUATION OF ADVANCED LOW ERUCIC BREEDING LINES IN INDIAN MUSTARD (*BRASSICA JUNCEA* L.)

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### Abstract

The study involves development of fifteen advanced low erucic lines of Indian mustard using pedigree method of selection from the crosses generated by involving high yielding (NRCHB101, NRCDR02) and low erucic (Pusa Mustard-21, Pusa Mustard-22) parents. These lines along with quality check (Pusa Mustard-29) and non-quality check (RH-749 and RGN-73) were evaluated in randomised complete block design in 6 rows of 5 m length with 30 cm row to row length for two years (2018-19 and 2019-20). The data had been recorded for seed yield (kg/6m<sup>2</sup>) and other morphological traits attributing to seed yield from middle 4 rows. The seed yield was then converted into kg/ha. Seed yield in these lines ranged from 1513 kg/ha (DRMRQ16) to 2408 kg/ha (DRMRQ204). The lines along with checks were characterised for quality traits which include beta carotene (ppm), total flavonoid (QEmg/g), antioxidants (AAEmg/g), saturated fatty acid (%), oleic acid (%), linoleic acid (%), linolenic acid (%), erucic acid (%) and glucosinolate content (μmole/g of defatted seed meal). The beta carotene content ranged from 1.44 ppm (DRMRQ 5-2) to 5.34 ppm (DRMRQ 32-6), total flavonoid content ranged from 0.25 QEmg/g (DRMRQ 18-3) to 3.48 QEmg/g (DRMRQ 5-2), antioxidants ranged from 12.35 AAEmg/g (DRMRQ 15) to 50.65 AAEmg/g (DRMRQ 204), saturated fatty acid ranged from 3.7% (DRMRQ 5-5-1-15) to 4.8% (DRMRQ 204), oleic acid ranged from 30.64 % (DRMRQ 16) to 43.19% (DRMRQ 5-5-1-15), linoleic acid ranged from 30.61% (DRMRQ 32-6) to 42.91% (DRMRQ 21), linolenic acid ranged from 10.25% (DRMRQ 21) to 18.16% (DRMRQ 18-3), erucic acid ranged from 0.87% (DRMRQ 5-1) to 2.51% (DRMRQ 15) and





glucosinolate content ranged from 14.61  $\mu\text{mole/g}$  (DRMRQ 204) to 92.36  $\mu\text{mole/g}$  (DRMRQ 14-1). However in the quality check (Pusa Mustard-29) and non-quality checks (RH-749 and RGN-73), the value for beta carotene (4.27, 3.55, 0.58 ppm), total flavonoid (1.34, 1.14, 1.47 QEmg/g), antioxidants (19.55, 25.86, 25.35 AAEmg/g), saturated fatty acid (4.6, 3.8, 3.1%), oleic acid (36.2, 11.4, 13.5%), linoleic acid (17.6, 19.4, 17.1%), linolenic acid (24.6, 16.3, 19.5%), erucic acid (2.52, 39.4, 41.3%) and glucosinolate content (79.36, 137.82, 125.84  $\mu\text{mole/g}$  of defatted seed meal) respectively were recorded. These advanced low erucic lines can be used for development of low erucic genotypes of Indian mustard with enhanced antioxidants and beta carotene content.

## EFFECT OF DIETARY SUPPLEMENTATION OF VITAMIN E ON THE PERFORMANCE OF BROILER CHICKEN

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### Abstract

Poultry is one of the fastest growing and hugely competitive segments of the agricultural sector in the world. Feed availability is the prime index for poultry industry. Micronutrients especially vitamin E or tocopherol is the essential nutrient required to perform various vital physiological functions in the poultry species. It is an antioxidant that reduces the generation of reactive oxygen species at their initial phase. The present study determined the efficacy of supplementation of synthetic vitamin E on growth and nutrient utilization. Day-old broiler chicks ( $n=72$ ) were randomly allocated into two different groups (control and Vitamin E @100g/tonne feed), with three replicates of twelve chicks in each treatment during the month of March and April, 2021 at the experimental shed of College of Veterinary and Animal Sciences, Pantnagar., GBPUAT, Pantnagar. Body weight of the chicks was significantly ( $P<0.05$ ) higher in Vitamin E treated group at 21<sup>st</sup> (703.61  $\pm$  7.64), 28<sup>th</sup> (1131  $\pm$  8.62), 35<sup>th</sup> (1687  $\pm$  23.62) days as compared to control group (669.40  $\pm$  7.33; 1113.89  $\pm$  6.83; 1576.33  $\pm$  25.26 respectively). Feed conversion ratio from third week onwards was lower in Vitamin E group with significant ( $P<0.05$ ) decrease in fourth week (1.52  $\pm$  0.09) in comparison to control group (1.77  $\pm$  0.13). To conclude, the results demonstrate that chicks fed vitamin E supplemented ration attained greater body weight and have lower feed efficiency as compared to control, suggesting the involvement of Vitamin E for elevating the performance of broilers.

## PREVALENCE OF *THEILERIA ANNULATA* IN BOVINES OF DISTRICT UDHAM SINAGH NAGAR, UTTARAKHAND

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### Abstract

The prevalence of *Theileria annulata* in cattle and buffaloes was studied in district of Udhm Singh Nagar, Uttarakhand state over a period of one year. The prevalence of the disease was determined host wise, area wise, season wise and month wise. A total of 694 blood samples (541 from cattle and 153 from buffaloes) were collected and then brought to the Department of Veterinary Parasitology, College of Veterinary and Animal Sciences, Pantnagar. All blood samples stained with Giemsa's stain were thoroughly examined microscopically and confirmed positive for *T. annulata* following the presence of either piroplasms and schizont stage of the parasite. Out of total 694 blood samples of bovines, 338 animals (48.70%) were found positive with *T. annulata*. Maximum (54.34%) prevalence of *T. annulata* was observed in cattle and than in buffaloes (28.75%). Area-wise prevalence of *T. annulata* in cattle revealed maximum (100%) in Sitarganj area and the lowest (50%) in Kashipur area. However, in buffaloes, it was recorded maximum (39.39%) in Kichha and the lowest (0%) in Sitarganj areas. Seasonal prevalence of *T. annulata* in cattle was recorded maximum (63.73%) in summer followed by rainy (60%) and the lowest (45.62%) in winter season. In buffaloes also it was recorded highest in summer season followed by rainy and then in winter with infection rate of 40.67%, 25.58% and 17.64%, respectively. Month-wise prevalence of *T. annulata* in both cattle and buffaloes revealed maximum prevalence in the month of May with infection rate of 70.58% and 47.05%, respectively. However, it was recorded minimum (41.53%) in the month of February in cattle and 0% during January and February in buffaloes. On the basis of present study, it can be concluded that prevalence data may be used for formulating an effective control strategies against *T. annulata* infection in cattle and buffaloes of district Udhm Singh Nagar.



## CEREBRAL BABESIOSIS IN SAHIWAL CATTLE—A CASE STUDY

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### Abstract

Bovine babesiosis is an economically important tick borne disease of tropical and sub tropical parts of the world including India. The disease causes high morbidity and mortality in cattle and buffaloes. An adult Sahiwal cattle aged between 5-6 years from Kamaluaganja area of Haldwani, District Nainital, Uttarakhand presented with the fever, anorexia, icterus, anaemia, corneal opacity, haematuria, convulsions and hyperexcitability. It was suspected for haemoprotozoan infection. Blood sample was collected and brought to the Department of Veterinary Parasitology, Pantnagar, Uttarakhand for microscopic examination. Thin blood smear microscopic examination was done using Giemsa Stain. Blood smear examination revealed the presence of piroplasmic forms of *Babesia* sp. in RBC of the cattle. The cattle was treated with single dose of intramuscular injection of diminazine aceturate @3.5mg/b.wt. along with consecutive three days injectable doses of Oxytetracycline @10mg/kg.bwt. Injectable haematinics and multivitamins were given on alternate day interval. The cattle quickly responded to therapy within 72 hours. Blood sample was again examined after 7 days of post-treatment. Blood sample examined on 7<sup>th</sup> day was found negative for piroplasmic stages and the animal showed no corneal opacity and convulsions after treatment.

## FIELD EVALUATION OF *METARHIZIUM RILEYI* (DEUTEROMYCOTINA : HYPOMYCETES) AS A MYCOINSECTICIDE FOR MANAGEMENT OF LEPIDOPTERAN PESTS

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### Abstract

Six native entomofungal strains of *Beauveria bassiana*, *Metarhizium anisopliae*, *M. rileyi*, *Paecilomyces fumarosus* and *Lecanicillium lecanii* were evaluated against 2<sup>nd</sup> instar larvae of the maize fall armyworm (FAW) *Spodoptera frugiperda* (J. E. Smith) and *Spodoptera litura* (Fabricius, 1755) (Lepidoptera: Noctuidae) in a laboratory bioassay. Among the six strains tested, *M. rileyi* UASRBC-Mr2 showed LC<sub>50</sub> of 5.37 x 10<sup>7</sup> spores/ml and UASRBC-Bb52 showed LC<sub>50</sub> of 1.92 x 10<sup>6</sup> spores/ml. Field evaluation with these six promising strains were conducted against maize fall armyworm and *S. litura* during 2020 at UAS Raichur, Karnataka, India. Field trial results indicated that highest per cent reduction was recorded in *M. rileyi*, UASRBC-Mr2 (91.34 per cent) followed by *M. anisopliae* UASRBC-Ma2 (86.89 per cent) on 30 days after spraying and increase in yield were observed in the plots treated with these six entomofungal pathogen. Maximum yield recorded in *M. rileyi*, UASRBC-Mr2 (9256.67 Kg/ha) treated plot followed by *M. anisopliae* UASRBC-Ma2 (8986.67 Kg/ha) (F value = 323.22; P<0.0001). The results indicated that potential of *M. rileyi* UASRBC-Mr2 as biocontrol agent for management of the fall armyworm and *S. litura* in maize and cabbage cropping ecosystem.

## IDENTIFICATION OF NEWLY DEVELOPED DROUGHT TOLERANCE MAIZE INBRED LINES UNDER MANAGED FIELD SCREENING

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### Abstract

Maize is traditionally a kharif season crop in India and nearly 85% maize grown under rainfed area. Drought is one of the major causes of yield reduction in maize among abiotic stresses. Development of high yielding and drought tolerance maize



hybrids essentially required heterotic and drought tolerant parental lines in addition to high productivity for drought prone areas. Screening of germplasm under managed abiotic stress field conditions is an efficient way to identify stress tolerant germplasm. Eighty-eight newly developed fixed inbred lines and 12 parental lines of released hybrids were evaluated under normal and drought environment at Regional Maize and Seed Production Centre (ICAR-IIMR), Begusarai during rabi-2020-21. The drought stress was imposed by withholding irrigation for three weeks starting before flowering and continues to grain filling stage. Drought severely affected the reproductive development of plant and seed setting due to widening of anthesis-silking interval (ASI). Kernel test weight was also reduced 12.17% to 27.43% under drought environment. Grain yield was reduced 8.8 % to 38.4% under drought environment. Forty inbred lines showed drought susceptibility index less than unity showing better drought tolerance. On the basis of per se performance and drought susceptibility index eleven inbred lines namely IMLSB 49-2, WNC 72347, IMLSB 301-, IMLSB 1299-5, IMLSB 93-1, IMLSB 591-2 IMLSB 43-2, IMLSB 37-2, IMLSB 2034 and IMLSB 2166 were identified comparatively more drought tolerant. Two inbred lines IMLSB 49-2 and IMLSB 43-2 showed less yield reduction as compared to normal environment and high yield under normal and drought environment. These eleven lines may be utilized for the development of drought tolerant hybrids after estimating combining abilities and heterosis. These inbred lines may also be utilized for constitution of drought tolerant base population following chain crossing for further extraction of next generation drought tolerant inbred lines.

## MANAGEMENT OF POWDERY MILDEW OF OKRA THROUGH NATIVO (TEBUCONAZOLE 50% + TRIFLOXYSTROBIN 25% WG) CHEMICAL UNDER FIELD CONDITIONS

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### Abstract

Powdery mildew of okra caused by *Erysiphe cichoracearum* DC is one of the important diseases affecting the crop. A field trial was conducted at Agricultural Research Station, Nipani, during kharif/Rabi 2016-17 to 2017-18 to find out the effective fungicidal application for its management. The crop was sprayed with seven different fungicides along with check starting from the first appearance of the disease. Two sprays of Nativo (Tebuconazole 50% + Trifloxystrobin 25% WG) 0.23% (T2), Nativo (Tebuconazole 50% + Trifloxystrobin 25% WG) 0.28% (T3), Nativo (Tebuconazole 50% + Trifloxystrobin 25% WG) 0.32% (T4), Trifloxystrobin 50% WG 0.66% (T5), Tebuconazole 250 EC (Tebuconazole 25.9% w/w EC) 0.66% (T6), Sulphur 80% WP 2.93% (T7) and Nativo (Tebuconazole 50% + Trifloxystrobin 25% WG) 0.16% (T8) were taken up in the treated plots. Effect of each treatment on the disease incidence and yield was recorded. The disease index was significantly reduced in plots treated when compared to the untreated control. Analysis of the data for one season/year showed that okra powdery mildew can be significantly reduced by spraying 0.28% Nativo (Tebuconazole 50% + Trifloxystrobin 25% WG) @ 150+75 a. i. (g)/ha followed by 2.93% Sulphur 80% WP @ 2504 a. i. (g)/ha in both the year 2016 and 2017. Highest bhendi yield of 14.07 and 13.19 t/ha was harvested in the treatment spraying with 0.28% Nativo (Tebuconazole 50% + Trifloxystrobin 25% WG) @ 150+75 a. i. (g)/ha followed by 2.93% of Sulphur 80% WP @ 2504 a. i. (g)/ha 13.25 and 12.21 t/ha in both the year 2016 and 2017. There were no symptoms of phytotoxicity and other harmful effects on okra plants either on leaves or on stem after application of Nativo @ 175+87.5 a. i. (g)/ha and Nativo @ 350+175 a. i. (g)/ha used in this trial (by visual observation).

## OPTIMIZATION OF PROTEIN RECOVERY FROM COMMERCIAL DEFATTED RICE BRAN (CDRB) BY ULTRASONIC ASSISTED ALKALINE EXTRACTION

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### Abstract

Defatted rice bran has approx. 15% (w/w) protein content, which is considered to be of high nutritional value protein, although it is difficult to extract protein from by-products, such as Defatted Rice Bran. Central Composite Rotatable Design is used to study the effects of variables X1 (temperature: 40, 50, 60°C), X2 (pH: 9, 10, 11) and X3 (stirring time: 30, 45, 60 min) on



responses like Extraction Efficiency %, Recovery %, Yield (g) of obtained protein and subsequently in optimization process for extraction of protein from commercial de-oiled rice bran. Maximum protein content in CDRB was 80% at pH 11.0, 57°C, and 60 min with an extraction yield of 59%. CDRB obtained looked like a fine powder with its colour parameters,  $L^*50.98 \pm 1.40$ ,  $a^* 6.2 \pm 0.54$  and  $b^* 19.88 \pm 0.87$ . Further the effect of ultrasonication (5,10,15,20 min) on Defatted Rice Bran for its protein extraction was also analysed. Results showed that ultrasonic time significantly influenced the extraction yield of protein in Defatted Rice Bran.

## ASSESSMENT OF LETHAL DOSE OF FREQUENTLY USED SYNTHETIC INSECTICIDES ALPHAMETHRIN AND CHLOROPYRIFOS AGAINST THE LARVA OF DIAMONDBACK MOTH (*PLUTELLA XYLOSTELLA*)

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### Abstract

Diamondback moth (DBM), *Plutella xylostella* (Plutellidae; Lepidoptera), is the major pest, inflicting significant losses to cauliflower and cabbage plants. Its late second instar larva feeds on the bottom leaf surface of these cruciferous plants, causing drastic damage to the cultivars. The frequent and unsubstantiated concentrations of these pesticides, including *Bacillus thuringiensis* bio-pesticides, are responsible for the development of resistance DBM generations day by day, including upto 52% yield loss on cauliflower and cabbage in India. We attempted to identify the suitable dilutions of alphamethrin and chloropyrifos for protection of cabbages as well as the necessity to recognise the interaction between pest and pesticides. The larva of DBM was collected from Village Rajahicamp, kushmahi, Gorakhpur. Each disc of 4.8 cm in diameter was made from the cauliflower leaf from unsprayed field and held with upto 10 number of second instars larvae of DBM. We examined four dilutions 0.1%, 0.3%, 0.5%, and 0.6% of pesticides as per assay and repeated each dilution five times, including controls for the period of 24, 48, 72 and 96, hrs; respectively. Larvae were considered dead if they showed no signs of movement. We found that 0.5% and 0.6% dilutions of Alphamethrin (10%) and Chloropyrifos (20%) were showed 100% mortality of DBM larva after the duration of 48 hrs and 96 hrs; respectively. However, 0.3% and 0.1% dilutions were not showed significant results against the survivability of DBM larva. Our study suggests that alphamethrin and chloropyrifos upto 0.5% diluted solution during 48-96 hrs are the sufficient dose against the DBM larva of cruciferous cultivars and helpful for the agriculturist to reduce the cost of insecticide.

## CANDIDATE GENE BASED ALLELE MINING FOR OIL CONTENT IN SAFFLOWER (*CARTHAMUSTINCTORIOUS* L.)

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### Abstract

Candidate genes associated with glycerol lipid metabolism, fatty acid biosynthesis, fatty acid elongation were identified from genome sequencing data and primers were designed for amplification. Initially, genes *CtaccD* (Acetyl CoA carboxylase D), *CtFAD2-1*, *CtFAD2-2*, *CtFAD2-10* (Oleatedesaturases), *CtGAPDH* (Glyceraldehyde3-Phosphate Dehydrogenase), *Oleosin 1*, *2*, *3*, *4*, *5*, *6*, *7*, *8* genes, *CtDGAT-1*, *CtDGAT-2*, *CtDGAT-3* (Diacyl glycerol acyl transferases), *CtFATA* and *CtFATB* (Fatty acid thioesterases), *CtGPAT* (glycerol-3-phosphate acyltransferase), *CtPDAT* (Phospho-diacyl glycerol acyl transferase) have been studied for sequence variation in 40 germplasm lines in which oil content ranged from 23 to 48% oil content which had been phenotyped at four locations for oil content. Out of 20 genes studied, 5 genes (*CtDGAT1*, *CtDGAT2*, *CtPDAT*, *CtFATB* and *CtOleosin4*) showed nucleotide variation between 20 low and 20 high oil lines in safflower. Initially the sequence variation was observed through gene sequencing in all the five genes. Two different haplotypes was observed in sequencing of these genes in safflower germplasm lines studied. An allele specific primers was designed for *CtDGAT-1* and *CtFATB* based on the sequence variation in two haplotypes and screened in safflower germplasm mapping panel developed (192 no.) which was phenotyped across four locations. Strong association with gene *CtDGAT-1* and oil content was observed with  $R^2$  value of 0.76 in the germplasm mapping panel. Allele mining of *CtOleosin4* gene identified single nucleotide change at 77 bp in the CDS





regions leading to amino acid change in the protein from Methionine (M) to Lysine (K) in high and low oil lines. For oleosin 4 gene, KASP assay can be designed for further screening in the germplasm mapping panel.

## BREEDING FOR ENHANCED BIOAVAILABILITY OF NUTRIENTS IN MAIZE

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### Abstract

Micronutrient malnutrition is one of the potential global health issues; and development of micronutrient dense staple crop is underway in a large scale to provide sustainable and cost-effective solution to malnutrition. Several maize genotypes rich in one or more micronutrients viz. lysine, tryptophan, provitamin-A, vitamin-E, iron and zinc are available that are developed through integration of conventional and molecular breeding. However, bioavailability of these micronutrients after consumption inside the human body remains a major concern that need to be critically addressed to achieve the recommended dietary allowance in the diet. Several studies reported that higher concentration of lysine and provitamin-A increase the bioavailability of zinc in maize, hence combining QPM and provitamin-A would offer scope for enhanced bioavailable zinc in the diet. Besides, reduction of kernel phytic acid would enhance the bioavailability of minerals like iron and zinc; and with the low phytic acid (*lpa*) mutants available in crops like maize, development of low phytate based maize would also help in enhancement of bioavailability of iron and zinc in maize-based diet. Oil is reported to have effect in enhancing the bioavailability of vitamins, therefore combining high oil with vitamin-A and vitamin-E would offer scope to develop highly bioavailable vitamins in the diet. Breeding for these bioavailability enhancing factors alone or in combination would offer biofortified maize with enhanced bioavailability towards nutritional security.

## RESPONSE OF SUMMER SESAME TO DIFFERENT SOURCES AND LEVELS OF SULPHUR ON VERTISOLS

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### ABSTRACT

A field experiment was conducted at College of Agriculture, Nagpur during summer season of 2013-2014 in factorial randomized block design with two sources of sulphur viz., elemental sulphur and bentonite sulphur and four levels of sulphur viz., 0, 15, 30 and 45 kg S ha<sup>-1</sup> thereby making eight treatment combinations, replicated four times. Sesame variety AKT-101 was used as a test crop. The soil was clayey in texture with pH 7.66. The study revealed that application of sulphur through elemental sulphur and bentonite sulphur had no significant effect on seed yield (kg ha<sup>-1</sup>), oil content (%) and oil yield (kg ha<sup>-1</sup>), sulphur uptake (kg ha<sup>-1</sup>) by the crop, GMR and NMR (Rs. ha<sup>-1</sup>) as well as residual status of available nitrogen, phosphorus, potassium and sulphur (kg ha<sup>-1</sup>). However, bentonite sulphur recorded higher uptake of S than elemental sulphur. Results also stated that sulphur application at 45 kg ha<sup>-1</sup> recorded significantly highest values of these parameters except residual potassium. However it remained at par with 30 kg S ha<sup>-1</sup>. Application of 30 kg sulphur ha<sup>-1</sup> recorded the highest B:C ratio. Therefore, it was concluded that application of 30 kg sulphur ha<sup>-1</sup> to summer sesame in vertisols, either through elemental sulphur or bentonite sulphur was optimum in increasing the seed and oil yield, its uptake, gross and net monetary returns and was responsible for an increased residual status of nitrogen, phosphorus and sulphur in soil.

## EFFECT OF PLANT GROWTH REGULATORS ON FLOWERING AND FRUITING BEHAVIOR OF ZIZYPHUS MAURITIANA L.

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### Abstract

The plant growth regulators are the organic chemical compounds, other than nutrients and vitamins, which modify or regulate physiological processes in an appreciable measure in the plant when used in small concentration. They are known to influence



fruit set, retention, yield and quality of fruit crops. Fruit trees are considered high-value crops and even small modifications in production efficiency, product quality or enhanced cosmetic appeal have the potential to significantly increase product value. Application of plant growth regulators results in better output as it improves the internal physiology of developing fruits to improve fruit set, reduce fruit drop and to amend various physiological disorders in order to improve quality and yield. In this view, we have discussed about impact of various plant growth regulators on fruit set, retention, quality and yield of ber fruit. Plant growth regulators or phytohormones are organic substances produced naturally in higher plants, controlling growth or other physiological functions at a site remote from its place of production and active in minute amounts. Thimmann proposed the term Phyto hormone as these hormones are synthesized in plants. Plant growth regulators include auxins, gibberellins, cytokinins, ethylene, growth retardants and growth inhibitors. Auxins are the hormones first discovered in plants and later gibberellins and cytokinins were also discovered. During the last 50 years considerable research work has been done in the country on various aspects such as varieties, propagation, irrigation, training and pruning etc. to increase the yield and quality of guava fruits. The production of poor quality fruits is a matter of common experience. It would be therefore worthwhile to improve the yield and quality of fruit crops by foliar application of plant growth regulators. The use of plant growth regulators has assumed an integral part of modern crop husbandry for increasing production of quality fruits. The plant hormones or regulators are the organic chemical compounds, which modify or regulate physiological processes in an appreciable measure in the plant when used in small concentration. They are readily absorbed and move rapidly through the tissues, when applied to different plant parts. These chemicals are specific in their action. In other words, plant growth regulators are organic substances (other than nutrients), which in small amount promote, inhibit or otherwise modify any physiological process in plants. Thus, the use of plant growth regulators has resulted in some outstanding achievements in several fruit crops with respect to growth, yield and quality.

## **PHYSIOLOGICAL CONSIDERATION FOR LONG TERM SEED STORAGE**

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### **Abstract**

Seeds are uniquely equipped to survive as viable regenerative organisms until the time and place are right for the beginning of a new generation. However, like any other form of life, they cannot retain their viability indefinitely and eventually deteriorate and die. Seed survival and their ability to retain viability through storage are key components for successful reproduction. During Seed storage they are several factors which affect the storage such as environmental factors like relative humidity, temperature and oxygen. Storing seeds at proper environmental factors for longer periods increased seed survival and resulted in good germination usually seed moisture content usually being more influential than temperature. The deterioration of the stored seed is a natural phenomenon and the seeds tend to lose viability even under ideal storage conditions. Auto-oxidation of lipids and increase in the content of free fatty acids during storage period are the main reasons for rapid deterioration of seed of oil plants. Accelerated ageing has been recognized as a good predictor of the storability of seed lots. Aged seeds show decreased vigour and produce weak seedlings that are unable to survive. The characteristics of the chemical composition of the crops are related to specific processes occurring in seed during storage. Lipid auto-oxidation and increase of free fatty acid content during storage are the most often mentioned reasons for accelerated damage of seed. Seed vigour testing becomes more important in seeds stored under unknown or adverse storage conditions. In seed deterioration process damage to cellular membranes, decrease in mitochondrial dehydrogenase activities, chromosomal aberration and DNA degradation increases.

## **CHANGE ENVIRONMENT IN AGRICULTURAL SECTOR BY ICT TOOLS**

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### **Abstract**

Agriculture is the backbone of India. ICT in agricultural sector is an emerging fields focusing on the boosting of agricultural and rural development. It involves applications of ways to use ICT in rural domain and agricultural innovation. The



advancement in ICT can be utilised for providing, timely, relevant, accurate, information and services to the Farmers, thereby facilitating an environment for more renovation in agriculture (Mahant *et al.* 2012). Application of Information and Communication Technology in agriculture is increasingly important. In agricultural development e-Agriculture is an emerging field focusing on the enhancement of farming sector and rural development through improved information and communication processes. More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative path to use information and communication technologies (ICT) in the rural sector, with a primary focus on agriculture. All stakeholders of agricultural production system need information and knowledge about these phases to manage them efficiently.

## **FOREST PRODUCTION : A SIGNIFICANT TOOL FOR SUSTAINABILITY**

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### **Abstract**

Forests are rich natural resource that draws thousands of visitors every year for fishing, hunting, camping, and hiking. It helps to regulate ecosystems, protect biodiversity, play an integral part in the carbon cycle, support livelihoods, reduces about 60 billion tons of carbon from the atmosphere every year because they are so effective in sequestering this greenhouse gas they are highly valued as carbon sinks. The productivity and integrity of forest ecosystems is linked to the supply of nutrients. Climate change can influence nutrient dynamics by altering the rate of litter decomposition, the leaching of key nutrients from the soil, and the uptake of nutrients and water by fine roots and symbiotic fungi, affects the distribution and abundance of many wildlife species changes in habitat, food availability, thermal tolerances, species interactions such as competition, and susceptibility to parasites and disease. Deforestation alone can contribute about 12% of the current total anthropogenic emissions of GHGs. Forestry, therefore, plays a significant role in climate change mitigation and adaptation. Changes in the world's climate, due to increases in the concentration of carbon dioxide and other greenhouse gases in the Earth's atmosphere, have the potential to significantly affect forests and the practice of forestry.

## **SOCIAL MEDIA FOR EXTENSION ADVISORY SERVICES**

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### **Abstract**

Social media are web based tools of electronic communication that allow users to personally interact with others individually or in groups for the purpose of exchanging information, sharing thoughts and opinions, influencing and facilitating decision-making by creating, storing, retrieving and exchanging information in any form (text, pictures, video, etc.) by anyone in the virtual world (Suchiradiptra and Saravanan, 2016). These are digital networks that are used to share and discuss user generated information - opinion, video, audio, and multimedia (Andres and Woodard, 2013). Merriam-Webster (2015) defines social media as forms of electronic communication through which users can create online communities to share information, ideas, personal messages and other content. Social media platforms enables quick delivery and wider coverage of agricultural advisory services and could lead to better interaction and knowledge sharing. There are large number of social media platforms used throughout world of which Facebook, WhatsApp and YouTube are more popular among Indian farmers and entrepreneurs. The high level of user engagement in social media also makes it one of the most participatory mediums of extension. On one hand these can be used by them for getting updated and latest information on government agriculture policies and plans, weather update, information about input delivery agencies, latest technology etc. and on the other hand, it has the greater potential in widening marketing horizon of farmers and connecting them directly to the customers or other appropriate users for maximum benefit. Farmers may contact directly with many users and may get information about current prices for their commodities. They can get access to the market sitting at home. Further, it will curtail the profit of middlemen also which will be beneficial for the farmers. This can improve a farmer's source of revenue; empower farmers for making good decisions about appropriate future crops. However low IT Literacy, poor Network connection, lack of confidence in handling the social media platforms etc act as an constraints in using social media among farmers.



## **CRITICAL ROLE OF PLANT BIOTECHNOLOGY FOR THE GENETIC IMPROVEMENT OF FOOD CROPS**

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### **Abstract**

Recombinant DNA technology has played significant and vital important role for the conventional crop improvement, and has a great promise to assist plant breeders want to meet the increased food demand predicted for the 21st century. Biotechnology is making new ground agriculture in the food/agriculture area. Current public debate about BSTC the FlavrSavr™ tomato (produced by transgenic plants engineered by antisense technology to preserve flavor texture and quality) is a new breed of value added foods. Food biotechnology offers valuable and viable alternative to food problems, and a solution to nutritionally influenced diseases such as diabetes, arthritis etc. A transgenic 'Golden rice' has been produced by introducing three genes for the production of vitamin A in 'Taipai rice'. Several insect resistance transgenic Bt gene of *Bacillus thuringiensis* into the desired plants. Huge progress has been made over the past two decades in manipulating genes from diverse and exotic sources, and inserting them into microorganisms and crop plants to confer resistance to insect pests and diseases, tolerance to herbicides, drought, soil salinity and aluminum toxicity; improved post-harvest quality; enhanced nutrient uptake and nutritional quality; increased photosynthetic rate, sugar, and starch production; increased effectiveness of bio control agents; improved understanding of gene action and metabolic pathways; and production of drugs and vaccines in crop plants. Despite the diverse and widespread beneficial applications of biotechnology products, there remains a critical need to present these benefits to the general public in a real and understandable way that stimulates an unbiased and responsible public debate. The development, testing and release of agricultural products generated through biotechnology-based processes should be continuously optimized based on the most recent experiences. This will require a dynamic and streamlined regulatory structure, clearly supportive of the benefits of biotechnology, but highly sensitive to the well being of humans and Environment.

## **HEALTH RISKS OF FOOD OXIDATION**

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### **Abstract**

Dietary patterns, and other environmental factors such as exposure to toxins are playing an important role in the prevention/development of many diseases, like obesity, type 2 diabetes, and consequently on the health status of individuals. A major challenge nowadays is to identify novel biomarkers to detect as early as possible metabolic dysfunction and to predict evolution of health status in order to refine nutritional advices to specific population groups. The impact of dietary habits on our health is indisputable. Consumer's concern on aging and age-related diseases challenges scientists to underline the potential role of food on the extension and guarantee of lifespan and health span. While some dietary components and habits are generally regarded as beneficial for our health, some others are being found to exert potential toxic effects and hence, contribute to the onset of particular health disorders. Among the latter, lipid and protein oxidation products formed during food production, storage, processing, and culinary preparation have been recently identified as potentially harmful to humans. Upon intake, food components are further degraded and oxidized during the subsequent digestion phases and the pool of compounds formed in the lumen is in close contact with the lamina propria of the intestines. Some of these oxidation products have been found to promote inflammatory conditions in the gut (i.e., bowel diseases) and are also reasonably linked to the onset of carcinogenic processes. Upon intestinal uptake, some species are distributed by the bloodstream causing an increase in oxidative stress markers and impairment of certain physiological processes through alteration of specific gene expression pathways. This chapter summarizes the most recent discoveries on this topic with particular stress on challenges that we face in the near future: understanding the molecular basis of disease, the suitability of using living animals vs in vitro model systems and the necessity of using massive genomic techniques and versatile mass spectrometric technology.





## INTEGRATED FARMING SYSTEM

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### Abstract

Integrated farming system is a commonly and broadly used word to explain a more integrated approach to farming as compared to monoculture approaches. It refers to agricultural system that integrates livestock and crop production or integrated fish and livestock and may be sometimes be known as Integrated Bio system. Integrated farming system approach requires involvement of agriculture, horticulture, soil conservation, forestry, fisheries, animal husbandry and allied enterprises. The emergence of integrated farming system has enabled us to develop a framework for the alternative development model to improve the feasibility of small sized farming operations in relation to larger ones. In This system, inter-related set of enterprises is used so that the “waste” from one component become an input for another part of the system, which reduce cost and improves production or income. Since it utilizes waste resources, we not only eliminate waste but we also ensure overall increase in productivity for the whole agricultural system. According to FAO policies, family farming is a means organizing agriculture, forestry, fisheries, pastoral and aquaculture production which managed and operated by a family and predominately reliant on family labour , including both women’s and men’s. Family farming is the predominant form of agriculture in the food production sector for both in developing and developed countries. Thus integrated farming system provide new venture for employment generation and sustainable development of livelihoods for people. The overall results revealed that the improved practices different crop and animals components are excellent approach for the sustainable production, income generation and employment opportunity for the small and marginal rural households.

## PRODUCTIVITY AND NUTRIENT USE EFFICIENCY OF HYBRID RICE (*ORYZA SATIVA* L.) IN RESPONSE TO INTEGRATED USE OF ORGANIC AND INORGANIC SOURCES OF NUTRIENTS

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### Abstract

An experiment was carried out during the kharif 2002 and 2003, to study the productivity and nutrient use efficiency of hybrid rice (*Oryza sativa* L.) in response to integrated use of organic and inorganic sources of nutrients at Research farm, IGAU, Raipur (CG). In all 12 treatments, comprising of different N, P and K levels and its conjunction with organic fertilizers were laid out in randomized block design with 3 replications. The results revealed that application of inorganic fertilizer level of 150:80:60 kg NPK ha<sup>-1</sup> significantly increased number of active leaf, leaf area, leaf area index and dry matter accumulation at later stages as compared to lower level of inorganic fertilizer. The conjunction of 100:60:40 kg NPK ha<sup>-1</sup> along with PM or N blended with CDU found to be equally effective to that of inorganic fertilizer level of 150:80:60 kg NPK ha<sup>-1</sup> for above growth parameters. The chlorophyll content during crop period under above level was the highest under said treatment. The highest crop growth rate was observed between 60-90 DAT followed by 90 DAT-harvest and 30-60 DAT, respectively. The per day accumulation of dry matter during 60-90 DAT period was almost three to four times of that accumulated during 30-60 DAT. Thereafter growth rate almost declined till maturity during both the years. The increased concentration of N at different growth stages and its uptake by plant helped in increasing the yield components and grain yield. The critical analysis of grain yield observations revealed that conjunction of lower levels of inorganic fertilizer (100:60:40 or 50:30:20 kg NPK ha<sup>-1</sup>) along with CDU or PM gave the saving of 50 kg N, 20 kg P and 20 kg K ha<sup>-1</sup> for the cultivation of hybrid rice. Moreover, the higher buildup of available N and K has been also observed under said combination of organic and inorganic fertilizer treatments. The application of 150:80:60 kg NPK ha<sup>-1</sup> along with PSB gave the highest buildup of available phosphorus. Inorganic level of 150:80:60 kg NPK ha<sup>-1</sup> gave the highest production efficiency and productivity rating index, which was followed by application of inorganic fertilizer of 100:60:40 kg NPK ha<sup>-1</sup> along with PM and blending of N with CDU, respectively. The application of inorganic fertilizer of 50:30:20 kg NPK ha<sup>-1</sup> + PM gave the highest nutrient efficiency during both the years. The highest input cost, net profit and per rupee investment was found under 150:80:60 kg NPK ha<sup>-1</sup> followed by application of 100:60:40 kg NPK ha<sup>-1</sup> along with PM.



## QUINOA AS A SUPERFOOD

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### Abstract

Quinoa (*Chenopodium quinoa* Willd.,  $2n=4x=36$ ) is a South American dicotyledonous crop plant whose seed has become an extremely popular food product in the last 30 years, particularly in Europe and North America, but also in the Andean region. This is in part the result of the increased popularity of vegetarian diets and the increasing number of diagnoses of dietary gluten intolerance and increasing socio-political awareness of, and pride in, indigenous Andean culture and heritage in South America. Quinoa seed, when properly handled to remove the bitter saponins in the pericarp, has a mild flavour and can be consumed in many of the same ways as cereal grains—hence, quinoa's classification as a pseudocereal or pseudograin. However, compared with the highest strains of wheat, quinoa seed has a similar protein content, a more favourable amino acid profile and 13 fewer glutinous seed proteins. The importance of quinoa is that the seeds have a high nutritional value. The average percentage of protein in the seeds varies from 7.5% to 22.1% depending on the variety. The quinoa seeds, which contain all the amino acids needed by the human body, are in the full protein category. Another important feature of the quinoa is that it is gluten-free. In this regard, it is an important source of food for celiac patients (gluten allergy) to meet protein and carbohydrate needs. The nutritional profile of gluten-free diets was improved by adding quinoa to meals and snacks. Most notable increases were protein (20.6g vs. 11g) iron (18.4 milligrams vs. 1.4 mg.) calcium (182mg vs. 0 mg) and fiber (12.7g vs. 5g). Its seeds are rich in minerals such as Ca, Mg, K, Fe, Cu and Mn and A, B, C and E vitamins.

## EFFICACY OF SOME BOTANICALS AGAINST PULSE BEETLE (*CALLOSOBRUCHUS CHINENSIS* L.) ON CHICKPEA (*CICERARIETINUL*.) SEEDS UNDER LABORATORY CONDITIONS

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### Abstract

Pulse beetle, (*Callosobruchus chinensis* L.) is an important pest of stored chickpea grain causing substantial loss in the storage. The bio-efficacy of different botanicals against the pulse beetle on chickpea during 2017-18 was studied at Department of Entomology CSAUA&T, Kanpur under laboratory conditions. These botanicals comprising of Neem leaf powder, Dhatura leaf powder, Castor leaf powder, Aak leaf powder, Mustard oil, Linseed oil, and Coconut oil, the dose of treatments are 15g powders and 3ml oils per kg of seeds respectively. The per cent of grain damage was observed viz. 2.51, 10.05, 12.12, 13.02, 5.67, 7.09, and 6.67 respectively. Among the treatments the neem leaf powder @15 g/kg of seeds and mustard oil @ 3ml/kg of seeds was found most effective provided minimum 2.51 and 5.67 per cent damaged grain respectively in comparison to 68.80 per cent grain damaged in untreated control. All the treatments were also observed to be significantly superior over untreated control.

## ROLE OF PLANT GROWTH REGULATORS IN ENHANCING THE PRODUCTION OF VEGETABLES

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### Abstract

Vegetables are one amongst the great sources of vitamins and minerals, and play very important role in ensuring food and the nutritional security. The consumption in sufficient quantities provides taste, palatability, increases appetite, and supply fair amount of fibers. The currently reckoned as important adjunct for maintenance of fine health and beneficial in protecting against some condition and neutralizes the acids produced during digestion of proteinaceous and fatty foods. To reinforce the



productivity of vegetables Indian Agriculture became more mechanized and science based by using inputs, and plant growth regulators. Plant growth regulators have quicker impact on vegetative also as yield of the crops. Because it has various advantages like less time consuming to treat the plant and environment friendly. The utilization of plant bio-regulators at the time of flowering, increases yield and improve production of quality vegetable, the simplest treatment was 1.25 mg/lit 2,4-D with a mean of 52% rooting in regenerated plants, higher concentration of cycocel (250-500 ppm) resulted in early female flower appearance when applied at fourth true leaf stage in bitter melon cv. KH-8. The applying of GA<sub>3</sub> at 25 ppm and NAA at (50 ppm) stimulated the elongation of main vine length in summer squash. Similarly, the applying of GA<sub>3</sub> (25 ppm) at 2-4 true leaf stage resulted within the more vine length as compared to regulate in bitter melon. The applying of NAA at 2 and 4 true leaf stages increased the most vine length of the vine in watermelon cv, Sugar Baby. The physiological activity of vegetable crops regulates and after the application of phytohormone finally enhances the vegetable production.

## PROGRESSIVE ASPECT OF MARKER TECHNOLOGY IN PLANT BREEDING PROGRAMME : FROM RFLPS TO NEXT-GENERATION SEQUENCING

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### Abstract

Molecular markers have prove to be helpful equipment for genetics and molecular breeding programme of crop plants , starting with low-throughput RFLPs (restriction fragment length polymorphisms) in 1980 and culminate in ultra high-throughput SNPs at present. Molecular marker technology has incessantly evolved from hybridization based RFLPs to PCR-based RAPDs, AFLPs, and SSRs, and finally high-throughput SNPs. More newly, ultra high-throughput genotyping by sequencing has been recognized. Among these molecular markers, SSRs were considered the markers of selection for several crop breeding applications because of their various popular attributes, and are still considered cheap for simply inherited traits. However, more newly, SNP markers have become markers of option due to their abundance, standardized distribution throughout genomes and high resolution as well as their amenability to high-throughput approaches. With the advent of next-generation sequencing technologies, new sequencing tools have been create to be precious for the discovery, validation, and application of genetic markers. These ultra high-throughput markers will not only prove helpful for preparation of high-density genetic maps and identification of QTLs for their use in plant breeding but will also assist genome-wide selection and genome-wide association studies.

## IDENTIFICATION AND DETECTION OF QUORAM SENSING AUTOINDUCER II GENES IN MULTIDRUG RESISTANT BACTERIA PATHOGENS

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### Abstract

Quorum sensing (QS) has administered new hope for studying the regulatory mechanism of drug resistance and overcoming drug resistance. QS system regulation shows various cellular processes of micro organism such as pathogenic gene expression, toxin production, extracellular polysaccharide synthesis. Innumerable bacteria can communicate by contributing and responding to a small diffusible molecule that act as signals. These molecules are described as auto inducers (AIs). AIs are produced at initial level and their concentration increases with growth. Because the signals are diffusible through membrane, concentration of environment is approx to the concentration inside. Upon reaching its threshold, concentration the signal molecule can bind and activate the receptor inside the bacterial cell. For activation of behaviour, gene expression can be altered by receptors that are advantageous under particular rendezvous conditions. Keeping these things in mind, the present study was planned to find out the presence of autoinducer genes in multi drug resistance bacteria. The primers were designed to identify the particular genes in *E. coli*, *Pseudomons spp.* and *Kelbsiella spp.* A total of 100 faecal and milk samples were collected for the isolation of *E. coli*, *Pseudomons spp.* and *Kelbsiella spp.* These revealed 36 *E. coli* and 14 *Klebsiellasp* and 7



*Pseudomonas spp.* All the isolates were confirmed by PCR based amplification for genus specific genes. Confirmed isolates were subjected to antibiotic sensitivity assay. All the isolates revealed multi drug resistance against the commonly used antibiotics. These MDR isolates were further subjected to amplification of autoinducer II genes. All the *Kelbsiella* and *Pseudomonas* species revealed the presence of specific autoinducer genes.

## EPIDEMIOLOGY AND ASSOCIATED RISK FACTORS OF BOVINE ANAPLASMOSIS IN DAIRY ANIMALS OF WESTERN UTTAR PRADESH

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### Abstract

Bovine anaplasmosis causes significant economic losses to dairy farming in many parts of the world by reducing the profitability of dairy animals in terms of production, draft power as well as reproduction. The present cross sectional study reports the epidemiology and the risk factors associated with bovine anaplasmosis in dairy animals of western parts of Uttar Pradesh state. Blood examination of seven hundred sixty eight animals (cattle and buffalo) of five districts (Meerut, Muzaffarnagar, Baghpat, Shamli and Hapur) of Uttar Pradesh by giemsa stained thin blood smear revealed 61.58% prevalence of *Anaplasma* spp., showing high endemicity of this hemoprotozoan among dairy animals in the region. Species of dairy animals, place / district and sex were the risk factors significantly associated ( $P < 0.05$ ) with the bovine anaplasmosis in dairy animals. The disease is more prevalent in Baghpat district (69.97%), followed by Hapur (58.57%), Meerut (51.38%), Shamli (45.07%) and Muzaffarnagar (40.98%). The female animals (74.48%) were significantly ( $P < 0.05$ ) more susceptible than male counterparts (32.34%). There was no significant difference in the prevalence of *Anaplasma* infection with respect to age of the animals. A multivariate logistic regression model was built with three risk factors included. Hosmer-Lemeshow test indicates a good fit of the model to the data ( $P = 0.2397$ ) and the area under the ROC curve (AUC) is 0.697 (95%CI: 0.663–0.729). Results of this cross-sectional study on the epidemiology and risk factors for bovine anaplasmosis of dairy animals from western parts of Uttar Pradesh suggest the endemicity of disease in the region and recommend the requirement of better disease surveillance and appropriate control measures to improve the profitability of dairy farming.

## BIOFORTIFICATION FOR GLYCININ RICH RICE

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### Abstract

Biofortification, also known as “biological fortification,” refers to nutritionally enhanced food crops that are designed and grown using current biotechnology techniques, traditional plant breeding, and agronomic approaches to maximize bio availability to the human population. The ultimate goal of biofortification is to produce nutritious and safe foods in a sufficient and sustainable manner. Biofortification of important micro-nutrients into agricultural plants can be accomplished in three ways: transgenic, conventional, and agronomic, which all involve the use of biotechnology, crop breeding, and fertilization tactics. The ultimate goal of biofortification is to produce nutritious and safe foods in a sufficient and sustainable manner. Biofortification of important micro-nutrients into agricultural plants can be accomplished in three ways: transgenic, conventional, and agronomic, which all involve the use of biotechnology, crop breeding, and fertilization tactics. Rice seed endosperm is weak in lysine, as are most of the crops addressed by transgenic, conventional breeding, and agronomical techniques. Glycinin is a globulin protein rich in lysine discovered in soybean seeds. Lysine is an essential amino acid (EAA). Glycinin makes up more than 20% of the dry weight of the seed and serves as a carbon and nitrogen reserve for seed germination. Glycinin1; Glycinin 2; Glycinin 3; Glycinin 4; and Glycinin 5 are the five Glycinin genes. Modifying the higher protein sequence of a main crop protein to contain higher amount of desired EAA is a frequent molecular method. Making a synthetic protein with a high concentration of the desired EAA. Creating a heterologous protein that contains a large amount





of the desired EAA. Manipulation of a homologous protein's expression to achieve desired EAA. By using metabolic engineering to increase the pool of a certain free EAA. The biofortification process entailed inserting four contiguous methionine residues into the 11-S variable sections of the soy protein. The C-terminal portions of acidic and basic polypeptides are represented by the Glycinin gene. Soybean with a high Met content that has been modified Glycinin gene was converted into rice using *Agrobacterium tumefaciens* and expressed under the control of the GluB-1 promoter. A total of 5% glycinin protein was recovered. It was introduced primarily to fill a gap in the rice grain's seed storage protein. Lysine aids normal growth and development, as well as decreasing blood cholesterol and LDL cholesterol, minimising the risk of heart disease.

## ISOLATION AND ANTIBIOGRAM OF PSEUDOMONAS ASSOCIATED WITH BOVINE DIARRHEA

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### Abstract

*Pseudomonas* is a Gram-negative non-fermenting bacterium that inhabit in a wide variety of environments, animals, birds, micromammals and cause diseases in human and animals. It is the most considered as the opportunistic pathogen and in recent pasts, it has been associated with various problems of medical and veterinary importance. The present study was conducted to find out the association of *Pseudomonas* in the clinical cases of bovine diarrhea in Meerut city, Uttar Pradesh. A total of 47 faecal samples were collected from cattle showing diarrhea and subjected to isolation and identification of *Pseudomonas* spp. Out of 47 faecal samples, *Pseudomonas* spp. could be isolated from 06 samples indicating the prevalence of 12.77%. All the six isolates of *Pseudomonas* spp. isolated from the clinical cases of bovine diarrhea were subjected to *in vitro* antibiogram testing using 7 antibiotics and antibacterials viz., Enrofloxacin, gentamicin, streptomycin, amikacin, Oxytetracyclin, ceftriaxone and metronidazole. All the *Pseudomonas* isolates were resistant to streptomycin, oxytetracyclin and metronidazole. Overall, very high percent of isolates were resistant to ceftriaxone and gentamicin (50.00%), followed by enrofloxacin and amikacin (33.33% each). Drug sensitivity analysis of all the 06 *Pseudomonas* isolates revealed 04 different biotypes. The study revealed isolates with resistance against three antibiotics to the isolates with resistance against all the 07 antibacterials used. The study concluded that enrofloxacin and amikacin may be the best drug of choice for the treatment of bovine diarrhea associated with *Pseudomonas* infection and also recommends the regular antibiotic sensitivity before starting the treatment to avoid dissemination of antimicrobial resistant among pathogens.

## GENETIC GAIN IN OILSEED CROPS IN THE ERA OF MOLECULAR BREEDING

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### Abstract

India is the fourth largest oilseed producing country in the world and it has the largest area and production of oilseeds in the world. Oilseeds are rich sources of energy and nutrition. Due to industry interest in the composition of their seed oils, which consist of a wide range of fatty acids with six predominant forms, the adoption of oilseed crops has grown significantly: 16 or 18 carbon palmitic, stearic, oleic, linoleic and linolenic acid, and 12 carbon lauric acid, as well as other unusual fatty acids produced by wild plant species, including those with chain lengths between 8 and 24 carbons. Due to their structure and composition, those oils are used as food/industrial feed and as a range of product applications such as surfactants, soap, detergents, lubricants, solvents, paints, inks, chemical feedstocks and cosmetics. India is a leading importer of vegetable oil so we have to develop some improved varieties so we can able to break all constraints in oilseed production. Although we have wide variability in oilseeds; wild as well as cultivated but we are not able to mitigate the requirement of vegetable oil in our country. So there is a need to create variability in the existing population in the existing crop and for this creation of variability transformation method is the only milestone in the improvement of oil production. The main advances in genetic improvement of oilseed crops, starting with omics to understand metabolic routes and to find out key genes in seed oil production, and also,



getting in use of modern biotechnology including genetic engineering and new breeding techniques , a modern-breeding tool that has allowed the functional study of genes with potential application for breeding in agriculture, focusing on oilseed crop genetic improvement with high precision. Via- Transgenic, various varieties of oilseeds have been produced for various traits and released for commercial cultivation. Genetic engineering provides tremendous potential for crop plant genetic improvement, in particular for resistance to diseases and pests, and improved quality characteristics. The Transgenic technology has great potential to generate new varieties along with the conventional breeding.

## INFLUENCE OF TILLAGE AND WEED MANAGEMENT PRACTICES ON WEED DYNAMICS IN WINTER CHICKPEA

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### Abstract

A field trial was conducted at the Agronomy Research Farm of IGKV, Raipur during the winter season of 2010-11 and 2011-12 to study the influence of tillage and weed management practices on weed dynamics in winter chickpea. Results indicated that the weed density was lowest in conventional tillage during initial period, but, at later stages, weed population was lowest under zero tillage. Hand weeding registered 47.57% and 47.59% higher seed yield over weedy check in crop sown after harvest of soybean and rice respectively. The minimum values of above characters were observed under weedy check plot (W<sub>9</sub>). In the soybean-chickpea experimental field, at harvest stage, infestation percentage of different weed species i.e. *Chenopodium album* (11%), *Medicagodenticulata* (22%), *Brachiariaramosa* (16%), *Echinochloacolona* (16%), *Euphorbia geniculate* (18%) and some other weeds (17%) and in a rice-chickpea experimental field, at harvest, weed infestation percentage of weeds i.e. *Chenopodium album* (17%), *Medicago denticulate* (40%), *Echinochloacolona* (23%) and other weed species (20%) was noted and dominance of above weed species was observed throughout the crop growth period. One hand weeding at 20DAS (W<sub>8</sub>), followed by the treatments of POE application of imazethapyr @ 90 g ha<sup>-1</sup> (W<sub>7</sub>) and POE imazethapyr @ 80 g ha<sup>-1</sup> (W<sub>6</sub>) were most effective in reducing weed density, weed dry matter production, lowest weed index and gave highest weed control efficiency.

## IMPACT OF BIOCHAR LEVELS AND INM PRACTICES ON YIELD AND PROFITABILITY OF FRENCH BEAN (*PHASEOLUS VULGARIS* L.) IN NE, INDIA

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### Abstract

A field experiment was conducted during *pri-rabi* season of 2018-19 at Research Farm of ICAR RC for NEH Region, Umiam, Meghalaya to study the effect of biochar and integrated nutrient management (INM) practices on performance of french bean. The experiment was comprising of twelve treatment combinations and laid out in a Factorial Randomized Block Design (FRBD) with three replications. Results found that, application of biochar @ 15 t/ha has produced maximum number of pod yield 7.57 t/ha of french bean. Among the INM practices treatment 75% RDN + 25% FYM was found significantly highest pod yield 5.86 t/ha during the study period. Among the levels of biochar, application of biochar @ 15 t/ha has resulted in higher haulm yield fresh (16.27 kg/ha) and this was higher by 21.9 per cent. Among the nutrient management practices, application of 75% RDN + 25% FYM has resulted in higher fresh haulm yield (14.26 kg/ha) which was 5.0 and 19.7 percent higher than fresh haulm yield with the application of 100% RDN and 50% RDN+ 50% FYM, respectively. Among the levels of biochar, application of biochar @ 15 t/ha has resulted in higher haulm yield dry (3.12 and 3.19 kg/ha) and this was higher by 27.8 and 44.0 per cent as compared to the application of biochar @ 10 and 15 t/ha. Among the nutrient management practices, application of 75% RDN + 25% FYM has resulted in higher dry haulm yield (2.68 kg/ha) which was 12.6 and 30.7 per cent higher than dry haulm yield with the application of 100% RDN and 50% RDN+ 50% FYM. Application of biochar @ 15 t/ha has resulted in higher biological yield (10.68 kg/ha) and this was higher by 25.0, 46.3 and 101.5 per cent. Application of 75%



RDN + 25% FYM during first year, has resulted in higher biological yield (8.54 kg/ha) which was 6.3 and 16.9 per cent higher than biological yield with the application of 100% RDN and 50% RDN+ 50% FYM, respectively. Application of 50% RDN+ 50% FYM and 100% RDN has resulted in lowest biological yield. Among, the different biochar levels maximum value of gross return, net return and B: C ratio was recorded under biochar@15 t/ha which was significantly higher than control, biochar@5 t/ha, biochar @ 10 t/ha and biochar @ 15 t/ha. Among the INM practices maximum cost of cultivation was involved under 50% RDN + 50% FYM followed by 75% RDN + 25% FYM and lowest cost of cultivation was involved under 100% RDN. However, maximum gross return was obtained under 75% RDN + 25% FYM which was significantly higher than 100% RDN and 50% RDN+ 50% FYM. Whenever, significantly maximum net return was recorded under 75% RDN + 25% FYM as compare to 50% RDN+ 50% FYM and it was remained statistically at par with 100% RDN during the experimentation. The maximum B: C ratio was registered under 100%RDN which was significantly superior over 75% RDN + 25% FYM and 50% RDN+ 50% FYM.

## **ANTIOXIDANT FLAVONOIDS ON PLANT DEFENCE MACHINERY UNDER OSMOTIC STRESS**

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### **Abstract**

Flavonoids are basically variable phenolic compounds that are synthesised in plant contribute in response to the techniques of higher plants to a plethora of environmental stresses. The flavonoids act as screeners of the detrimental short wave solar radiation and as antioxidants under the influence of various abiotic stresses. Flavonoids impersonate as distinctive UV filters, signal molecules, allelopathic components, phytoalexins and detoxifying agents. These are defensive compounds which play a functional role in frost hardiness, drought resistance, heat acclimatization and freezing tolerance. Osmotic stresses drought and salinity causes severe losses in agricultural production due to the effect of climate change. Plants often tend to alleviate oxidative stress by changing the activity of antioxidant enzymes and accumulative non-enzyme antioxidants such as flavonoids. A consummate amount of flavonoids gene expression have been detected during intense drought stress, thus flavonoids play a vital role against water stresses. As a consequence of salt stress, the upregulation of flavonoids biosynthetic genes takes place. The mechanism of defense against osmotic stress is due to the capacity of flavonoids to scavenge reactive oxygen species (ROS) released under the influence of abiotic stress. Phytohormones and key messenger signals regulate the accumulation of flavonols which are involved in guard cell signal transduction and stomatal movement which is hindered under drought stress. The flavonoids being derivatives of quercetins, greatly affect the movement of auxin responsible for plant development. A decrease in carbon assimilation induced under osmotic stresses exacerbates the injurious impact of high solar irradiance. Thus, flavonoids act as developmental regulators and serve as a part of antioxidant machinery of plant to overcome abiotic stress.

## **INTEGRATED AQUACULTURE : AN APPROACH TOWARDS SUSTAINABILITY, PROFITABILITY, LIVELIHOOD AND NUTRITIONAL SECURITY**

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### **Abstract**

The famous Green and White revolutions have made India self-sufficient in cereal and milk production respectively. However, India is still facing some socio-economic problems like sustainability in production, nutritional security, livelihood security etc. day by day, the land availability per capita is decreasing due to exponential population growth of our country. For sustainable production of agricultural crops, judicious use of land and water resources are very essential. Integrated aquaculture systems refer to the production, integrated management and comprehensive use of fish farming, agriculture and livestock, with an emphasis on aquaculture in which, fish is cultured along with paddy, horticulture crops, vegetables flowers, poultry, piggy, cattle or any suitable live stock. In integrated farming system, one can minimize the risk associated with farming and at the same time able to sustainable earning for their livelihood from minimum resources. The details of integration of fish with other various crops are discussed.



## ONE WORLD – ONE HEALTH

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### Abstract

As the population is increasing, industrialization and geopolitical problems are also increasing which is ultimately causing significant damage to biodiversity and ecosystem. These rapid changes in the environment are leading to emergence and re-emergence of infectious, non-infectious and zoonotic diseases. The health of humans, animals and environment is interrelated. The one health concept is therefore an integrated global strategy focusing on holistic and transdisciplinary approach by involving multisector expertise in dealing with the health of humans, animals and environment. This approach is essential for the progress of mankind by prevention, detection and control of diseases which spread between humans and animals. It also emphasizes on tackling with antimicrobial resistance, ensuring food safety and preventing environment related human and animal threats.

## EVALUATION OF FUNGICIDES AND BIO CONTROL AGENTS AS SEED TREATMENT FOR THE MANAGEMENT OF COLLAR ROT IN CHICKPEA

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### Abstract

Collar rot of chickpea caused by *Sclerotium rolfsii* is an important fast spreading soil borne pathogen, which causes 55-95 % mortality of chickpea seedlings. A study was taken up for management of collar rot through combination of fungicides and bio agents at RARS, Nandyal during 2019-20. In the lab experiment total ten *Trichoderma* isolates were tested against virulent *S.rolfsii* isolates by dual culture technique. Among ten isolates, two *Trichoderma* (CPRT-8 and CPRT-10) isolates were found effective. Similarly poison food technique was conducted with different fungicides. Two fungicides i.e. vitavax power and tebuconazole were found most effective for inhibition of collar rot pathogen. Compatibility studies with effective fungicides and potential bio agents were carried out and growth of both *Trichoderma* (CPRT-8 and CPRT-10) isolates was observed with vitavax power at all concentrations. Hence vitavax power was used in combination with *Trichoderma*. A field experiment was also conducted with seven treatments in RBD design during Rabi, 2020-21. Seed treatment with vitavax power @ 1.5g/kg of seed + *Trichoderma* formulation (CPRT-10) @ 10g/kg of seed showed 69.8% disease control which was on par with vitavax power @ 1.5g/kg of seed + *Trichoderma* formulation (CPRT-8) @ 10g/kg of seed (65.7%). The combination of bio-control agent (*Trichoderma*) with fungicide as seed treatment was very effective in the management of collar rot in chickpea.

## INDIGENOUS TECHNICAL KNOWLEDGE IN AGRICULTURE : THE UNIQUE TREASURE

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### Abstract

Indian agriculture is at least 10,000 years old. Farmers devised various ways to effectively cultivate developed crops and raise animals in the highly diversified agro ecological regions of the Indian subcontinent. The last 170 years have brought in new techniques, some useful and some harmful. The development of indigenous technical knowledge (ITK) systems, including management of natural environment, has been a matter of survival to the people who generated these systems long back. The advent of the concept of sustainable agriculture in late eighties in Indian agricultural scenario has evoked interest on indigenous technical knowledge (ITK) that has the element of use of natural products to solve the problems pertaining to agriculture and allied activities. Indian farmers, over centuries, have learnt to grow food and to survive in difficult environments, where the rich tradition of ITK has been interwoven with the agricultural practices followed by them.





Indigenous Knowledge refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area. Indigenous knowledge is the local knowledge - knowledge that is unique to a given culture or society. The traditional knowledge is vital for the well-being and for sustainable development as it has evolved after thousands of years of observation and experience. By linking the indigenous knowledge systems of the people with farmer, research and extension, the output of researches can be made more fertile and usable.

## **SELECTION INDICES FOR YIELD AND RELATED TRAITS IN SORGHUM**

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### **Abstract**

Sorghum (*Sorghum bicolor* L., Moench) is an often cross pollinated and fifth most important crop in the world with chromosome number ( $2n=2x=20$ ). In most crop improvement program there is a need to improve more than one trait at a time and improvement of one trait may cause deterioration in associated traits. For simultaneous improvement selection indices provide one method for improving two or more traits in a breeding program. Selection indices in sorghum is used to select genotypes for resistance or susceptibility to various stress namely functional plant loss index, antibiosis index, tolerance index and mean productivity index that damage by the spotted stem borer as a result of indices based on grain yield reduction combination with associated grain yield response and potential under borer infested and uninfested condition and each index have different biological mechanism. Utilizing the principle of selection indices in sorghum, found that geometric mean productivity, relative efficiency index, Fernandez stress tolerance index provided a better discrimination of the stem borer-tolerant genotypes under borer-infested conditions, and were better predictors of grain yield performance. Selection indices is highly helpful to discriminate desirable genotypes by the discriminant function method for simultaneous selection of field component and their interrelationship between relative weightage given to different yield component to obtain maximum gain because yield is a qualitative character and influenced by environmental fluctuation. Selection applied simultaneously to all the characters which determine the economic value of a plant. Appropriate weights are assigned to each character according to their relative economic importance, carried a study for yield and related traits and concluded that the selection index consisting of plant height at 50 per cent flowering, number of leaves/plant and leaf length are reliable to select biometrical characters in plant breeding programmes for the improvement of fodder yield in forage sorghum. These studies establish the scope of improvement of sorghum using selection indices and need to explore new metric and physiological traits in sorghum.

## **WALNUT PROPAGATION : PROBLEMS AND SOLUTIONS**

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### **Abstract**

The high biological value of the walnut kernel makes it an indispensable food product that is why the walnut is on the FAO plant priority. Walnut is one of the major nut crops in central Asia and is especially important in India. Jammu and Kashmir is a principle walnut growing state in India having 89788 hectare area under walnut cultivation with annual production of 163745 million tones. Even though, scientific and regular orcharding is still limited due to lack of quality planting material and problems in propagation. Generally, it is widely propagated through grafting and budding the major constraints in propagating walnut is poor callus formation in two year old root stocks due to presence of high concentration of phenolic compound like juglone in tissue and their oxidation therefore epicotyl grafting using stock and scion of different ages is techniques worth to be evaluated. Walnut do not produce callus below  $20^{\circ}\text{C}$  because of this walnut is preferably propagated under protected environmental condition having temperature ranging from  $25\pm 2^{\circ}\text{C}$  and relative humidity of 85-90%, where 60-70% graft success has been reported in wedge grafting with hot cable callus system. Defoliating scion 10 to 15 days before budding and treating scion wood and rootstock with Ascorbic acid @500ppm for 5 min respectively has reported more than 80% success rate under protected environment condition. Other growth regulators like 6-BAP and IAA at different concentration has also shown positive result. Thus, for better production scientific and regular orcharding is important and various techniques for propagating walnut according to different agro climatic regions should be standardized.



## ROLE OF ORGANIC FARMING IN PLANT PROTECTION FOR SUSTAINABLE VEGETABLE PRODUCTION

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### Abstract

Crop protection strategies in organic agriculture and horticulture aim to prevent pest, disease and weed problems through optimization of the cropping system as a whole. Plant protection is one of the major issues in organic farming. Organic crop protection (OCP) strategies often rely on a limited number of methods that provide only partial control of pests and that induce lower yields and economic performances. As a result, farmers hesitate to adopt these strategies. This paper focus on how IPM and agro ecological concepts may contribute to OCP. Beyond IPM, agroecology is characterized by a holistic approach and the importance given to the design of a “healthy” agroecosystem. Choice of crops and varieties within the rotation and use of appropriate husbandry practices are critical to the success of the system and direct curative action against pests and diseases is rarely necessary. In practice, all these concepts are subject to various interpretations, and organic farming includes a variety of practices, ranging from intensive inputs substitution to a comprehensive integrated approach. This paper provides key elements for crop protection in OF on the basis of the adaptation of the agroecological crop protection approach and IPM in some locally cultivated vegetables. Finally, in the field of crop protection, this paper shows that organic farming can be both a prototype for designing innovations and a source of practices to be extended to other types of agroecosystems for sustainable vegetable production.

## SCREENING OF WHEAT (*T. AESTIVUM* L.) GENOTYPES FOR RESISTANCE AGAINST CEREAL CYST NEMATODE (*HETERODERA AVENAE*)

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### Abstract

Large number of plant parasitic nematodes are known to cause damage to various cereals such as wheat, barley, etc. One such economically important pest of cereals is the cereal cyst nematode (*Heterodera avenae*) that causes significant yield losses in different cereals including wheat (*T. aestivum*) across the world. Wheat genotypes such as AC KARMA, SC 8021 V2, WH147, WH-542, C-306, Chinese spring, Giza, HUW468, M6 (MARION), OPATA (MARION), PBW 343 and RAJ MR1 were used for screening of this nematode. Screening experiments were conducted successively for two years (2017-18 and 2018-19) in controlled environmental conditions with minimum of five and maximum of seven replicates in different batches. Plants were infected with J2 stage juveniles. Phenotypic data in terms of number of cysts were obtained by counting cysts from the roots and soil of all the infected plants with the help of stereomicroscope. The results showed that the genotypes (Raj MR1, and WH542) were found to be resistant and genotypes such as WH147, OPATA were found to be susceptible or moderately susceptible. Highest cyst count (up to 57) was found in the genotype AC KARMA, showing that it is highly susceptible. These results more or less can be helpful in studying the resistance mechanism and pathogenicity of this nematodes in wheat that can further facilitate the development of resistant wheat line against *H. avenae*.

## GENOME EDITING MEDIATED INDUCTION OF WATER LOGGING STRESS TOLERANCE

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### Abstract

The manipulation of targeted plant genes to enhance stress tolerance is becoming the need of the day. Genome editing techniques can play a significant role in diminishing the adverse effect of water logging stress. Overexpression of AtACO5



(ACC oxidase) gene in Arabidopsis triggered the Ethylene production, and cell expansion activities resulting in enhanced tolerance against waterlogging stress. The ERFs (Ethylene Responsive Transcription factors) are directly involved in the regulation of waterlogging stress. Generation of PhERF2 overexpressed lines resulted in tolerance to waterlogging stress. On the contrary, the RNAi line of PhERF2 showed sensitivity to waterlogging. Constitutive expression of TaERFVII.1 (Ethylene Responsive Transcription factors) gene in wheat alleviated the negative effects of waterlogging stress by boosting the immunity resulting in increased grain weight per plant, improved survival rate, and better chlorophyll content of leaves. On the other hand, the compromised expression of TaERFVII.1 in silenced plants also decreased the transcript of several waterlogging responsive genes. The barley HVERF2.11 when overexpressed in Arabidopsis triggered the expression level of antioxidant enzyme biosynthesis genes (AtSOD1, AtPOD1) and ET biosynthesis gene (AtACO1), conferring resistance to waterlogging stress. The overexpression of CsARN6.1 (Adventitious root number) gene in cucumber facilitates the formation of Axillary roots independent of hormonal generations. Similarly, the induced expression levels of genes involved in alcoholic fermentation process like NtPDC (Pyruvate decarboxylase), NtADH (Alcohol dehydrogenase), NtHB1 (HD-ZIP I subfamily gene), NtHB2, NtPCO1, and NtPCO2 genes in AdRAP2.3 overexpressed tobacco plants presented its association with the enhanced waterlogging stress tolerance. Transgenic Arabidopsis plants having HD-ZIP I subfamily gene HaHB11 induced the tolerance to waterlogging stress and also increased the biomass and yielded more seeds than control by inducing the glucose and sucrose level and increment of expression of genes involved in the alcohol fermentation. Thus using genome editing techniques adverse effect of water logging stress can be diminished in plants.

## HOMEMADE INSECTICIDES A KEY FOR SUSTAINABLE VEGETABLE (OKRA) PRODUCTION

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### Abstract

Now a day's one of the most important global problems is protecting vegetables from insect pest with sudden increased in number and developed resistant for many insecticides. Okra (*Abelmoschus esculentus*) is an important vegetable crop grown throughout the year in India. The crop is attacked by number of pests of which shoot and fruit borer, aphids, jassids, whitefly, red spider mite, solenopsis mealybug and root knot nematode are most serious causing pests which causes substantial reduction in crop growth and yield. The present study was conducted to evaluate some homemade insecticides to control insect pests population in okra. We set up trial with plot size (5\*5m) in random completely block design RCBD with 3 replication at College of Agriculture Balaghatwaraseoni during 2018 and 19 for kharif season. Seven homemade methods were applied viz; garari leaves extract, garari fruit extract, garlic cloves, datura leaves, custard apple leaves, aloe vera leaves extract and control. There were significant reduction in pests population for all the homemade insecticides applied to okra plants as compared to the control. The plants on which these insecticides applied show more healthy vegetables and plants growth. In place of chemical fertilizers we used compost made of garari leaves. The weight of each cultivar was maximum and yield was also more. The homemade insecticides used for these study show good results against sucking type pest of okra. All insecticides reduce the insect population but garari leaves and garlic cloves extract show the best result as compared to other. It was concluded that homemade insecticides are very useful, although it controls the insect pests population with herbal insecticides and also contributes in reducing the pesticides pollution and insecticidal residual problems in vegetables which is good for human health and environment also. So all these homemade traditional methods will act as a boom for sustainable vegetable production.

## EXTRACTION OF PLANT BIO-COLOURS FOR DYEING DRY FLOWER

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### ABSTRACT

Experiment I consisted of fifteen dye sources *Lagurus ovatus* (Beta vulgaris, Bixa orellana, Bougainvillea spp, Capsicum annum, Carthamus tinctorius, Celosia argentea, Cosmos bipinnatus, Curcuma longa, Euphorbia pulcherrima, Lilium hybrids, Peltophorum pterocarpum, Punicagranatum, Rosa hybrida, Tagetes erecta and Woodfordia fruticosa) which were assessed for dye



extraction using two solvents i.e. water and acetone. Out of the two solvents used for extraction of biocolour from fifteen different dye sources acetone was observed to be the best solvent. Maximum score (4.50) for overall acceptability in dry flower *Lagurusovatus* after dyeing was observed for bio colour extracted from rose, marigold, turmeric, cosmos and liliun. Experiment II consisted of suitability of three dye assistants i.e. sodium chloride, acetic acid and hydrochloric with two mordants i.e. alum and ferric chloride for dyeing *Lagurusovatus*. Out of the fifteen dye sources; rose, marigold and turmeric were found to be the best source of biocolour wrt. overall acceptability scores. It was found that the biocolour was successfully extracted using acetone as a solvent, alum as a mordant and sodium chloride or acetic acid as dye assistants in case of turmeric and marigold, whereas; sodium chloride or hydrochloric acid were found to be suitable dye assistants for rose. In experiment III; these best dyed samples (selected from experiment II) were kept under two storage conditions i.e. open and wrapped in cellophane sheets for a period of 90 days. It was found that the dyed flowers of *Lagurusovatus* showed good overall acceptability when stored under wrapped conditions as compared to open conditions even after 90 days of storage. Various value-added products like dry flower arrangements, maize spathe doll, rakhis, greeting card, wall hangings, file covers, dry flower sticks and wall pictures were prepared from lagurus grass after dyeing with the bio-colours.

## **IMMUNE BOOSTING FOOD**

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### **ABSTRACT**

The immune functions in healthy individuals are damaged by several factors and the deprivation of health is related to disruption of immune functions. Nutritional deficiencies cause impairments in immune system development and have a negative effect on immune incompetence that results in susceptibility to infection, allergies and chronic inflammation. Several health conditions that are the result of an impaired immune function like cancer, inflammation processes such as atherosclerosis, rheumatoid arthritis, bronchial asthma, cystic fibrosis, fibromyalgia have been known to be prevented and treated by components present in food. The consumption of foods that provide such nutritional components not only stabilizes immune functions but also reduces the occurrence of pathogenic infection. The Macronutrients (lipids such as n-3 PUFA) and micronutrients (zinc, vitamin D, and vitamin E), in addition to phytochemicals and functional foods (probiotics and green tea), may benefit the immune system when taken in appropriate amounts. Also, nutritional factors modulate metabolic processes which may include the activation or inhibition of key enzymes or immune regulatory mediators that can result in altered cellular immune function, particularly in cells of T lymphocytes lineage. Several trace elements and vitamins have an important role in key metabolic pathways and immune cell functions. Food containing vitamins like C, E and beta-carotene need to be added to our diet as they show defense mechanism against free radicals.

## **DEVELOPMENT OF BAKED AND EXTRUDED PRODUCTS FROM KODO MILLET**

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### **ABSTRACT**

Most of the population rests on a cereal-based diet because cereal grains are good source of carbohydrates, energy and vitamin B complexes but lack in micronutrients and functional compounds. Kodo millet (*Paspalum scrobiculatum*) is gluten-free nutritious grain rich in dietary fibre, polyphenols, antioxidants and phytochemicals but not well utilized by the food industry for development of value added products. The present study was conducted with the prime objectives to develop kodo millet supplemented muffin pre-mix, muffin and pasta to enhance the nutraceutical and functional properties of products. In the present study, kodo millet flour was supplemented with refined wheat flour at different concentrations but 100 per cent kodo millet found highly acceptable by the sensory panel (9 point hedonic scale). Muffin pre-mix prepared from 100 per cent kodo millet flour was recorded with total dietary fibre (12.86%), crude fibre (2.42%), total phenols (85.26mg/100g) and antioxidants (9.65%). Whereas, 100 per cent kodo millet flour muffins observed with high dietary fibre (11.63%) and crude fibre (6.01%). Muffins pre-mix can be stored for six months at ambient conditions with minimum significant changes in quality while muffins can be stored upto 6 days at ambient condition. Pasta is commonly made from durum wheat-derived semolina flour and celiac disease cause due to gluten intolerance is very common now a days. So to overcome that kodo millet





can be utilized for supplementation of pasta to improve its nutritional value and develop kodo millet gluten-free pasta. Different concentration of kodo millet was supplemented and evaluated for various quality characteristics. However, on the basis of cooking, functional properties and sensory analysis 70:30 semolina and kodo millet showed its acceptability higher among all the treatments. While in case of gluten free pasta (rice and kodo millet) 80:20 was found better for sensory and functional properties. For the storage, minimum changes were recorded in pasta for 6 months. Study concluded that incorporation or addition of kodo millet for the development of different food products support the possibility of developing bakery (muffin) and extruded (pasta) products with excellent nutritional profile and desirable quality. It seems to be a viable to utilize kodo millet which is an minor millet to raise farmer's income, apart from providing the population with many health benefits.

## **MICROALGAE NATURAL INGREDIENT AS EMERGING FUNCTIONAL FOODS FOR PROMOTING HUMAN HEALTH**

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### **Abstract**

Algae are a group of microorganisms that can live almost everywhere including deserts, volcanic water, highly acidic and frozen soils. But most part of them are preferentially found in aquatic environment. They are the main producers of oxygen and contribute to about 40% of global photosynthesis. They also form the basic component of food chains in the world's ecosystem. Algae bring together macroalgae (i.e., seaweed) and microalgae which are microscopic organisms commonly found in marine and freshwater. The use of microalgae as a source of food had started more than a thousand years ago by the indigenous population, but the commercial production of microalgae biomass began post 1950s starting first with Germany. Still their use as food source has not been exploited to its potential. Microalgae can ensure the food security of the 1 out of 9 people in the world who are facing the problem of hunger and malnutrition. Besides these, it can meet the requirements of today's consumers who have become more conscious about food preferring natural healthy products rich in secondary metabolites such as PUFAs, proteins, DHA (docosahexaenoic acid), phenolic compounds, tannins, lipids, enzymes, carbohydrates, terpenoids, vitamins and minerals etc. These functional bioactive compounds can be exploited as active ingredients in the manufacturing of pharmaceutical products and help in the prevention of NCDs (non-communicable diseases) like diabetes, chronic respiratory diseases, CVDs (cardiovascular diseases) and cancers. Thus, microalgae are a viable and economical biomass source to produce valuable compounds with potential application in nutraceutical, pharmaceutical, chemical, food, cosmetic, bio-fertilizer and bio-refinery industries due to their biologically active and regenerative properties.

## **KIWIFRUIT PROTEASE ENZYME : AS A SUBSTITUTE OF ANIMAL RENNET FOR THE PRODUCTION OF COTTAGE CHEESE**

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### **Abstract**

The present study was conducted to replace the animal rennet with kiwifruit enzyme for the production of cottage cheese. For this, extraction of enzyme was done at various stages of fruit maturity and maximum enzyme activity ( $200.32 \pm 0.2 \mu\text{g/gm}$ ) was shown at immature stage of fruit maturity. Ammonium sulphate precipitation method @ 40-60 per cent yields 86 per cent enzyme yield of 1.65 purification fold and 0.86 /mg of protein specific activity. Characterization of enzyme through response surface methodology shows that enzyme is stable at high pH (8.00) and temperature ( $45^\circ\text{C}$ ) for 20 min incubation time. Standardization of protease enzyme concentration was done on the basis of milk clotting activity (MCA). Cottage cheese prepared with partially purified kiwifruit enzyme (0.5%) was found better compared to the cheese prepared with rennet (1%)



on the basis of physicochemical and sensory properties. It shows that kiwifruit as a plant protease can be a best alternative to replace animal and microbial origin rennet, as a religious or diet issues and also due to high cost and pathogenicity of microbial one. Henceforth, kiwifruit enzyme can be a boon in dairy industry for production of cottage cheese.

## SPIDER ASSEMBLAGES IN MAJOR CROPS OF RAJENDRANAGAR, TELANGANA

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### Abstract

Spiders are generalist predators that have been widely reported on a variety of crops preying upon crop pests. Class Arachnida is the only class whose members are totally predatory and they play a major role in natural biological control. However, very scant information on spider assemblages and their species composition in various crops of Rajendranagar is available. Hence, a study was planned to be conducted in major crops in the area viz., rice, cotton, maize, vegetables and tomato between 2014-2017 in the College Farm, Rajendranagar to understand the spider assemblages by working out their species diversity using species richness, Pielou's evenness, Shannon-Wiener diversity index, Berger Parker Index, True Diversity and Gini Simpson Index. A study of spider guilds in the crops helped to understand their predatory behaviour and target insects better. A total of 3083 spiders were collected in rice crop, 503 in cotton crop, 250 in maize, 815 in tomato and 298 in vegetable crops. In rice, a total of 12 families were recorded, 8 families in cotton and maize, 10 families in tomato and 7 families in vegetables. Diversity parameters worked out indicated that spider diversity was highest in maize crop ( $H' = 1.99$ ) > vegetables ( $H' = 1.82$ ) > Rice ( $H' = 1.80$ ) > tomatoes ( $H' = 1.74$ ) > cotton ( $H' = 1.08$ ) indicating mediocre diversity in all the crops studied, which needs to be conserved using ecologically safe pest management practices. True diversity also reflected the need to conserve these very useful predators to enhance natural control.

## NUTRIENT UPTAKE BY CROP AND WEEDS IN KHARIF GREEN GRAM (*VIGNA RADIATA*) AS INFLUENCED BY SEQUENTIAL APPLICATION OF PRE AND POST EMERGENCE HERBICIDES

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### Abstract

The experiment was conducted during Kharif season of 2013 to know the nutrient uptake by crop and weeds in Kharif Greengram as influenced by sequential application pre and post-emergence herbicides in clay loam soil under rainfed condition at Main Agricultural Research Station, Dharwad. The experiment comprised of fifteen treatments included three pre-emergence herbicides (Pendimethalin, Alachlor and Oxyfluorfen) and two post-emergence herbicides (Imazethapyr and Fenoxypyr-p-ethyl) and their sequential applications along with cultural practices. These herbicide treatments were compared with farmers' practice, weed free check and weedy check. Experiment was laid out in randomized complete block design with three replications. Among the sequential application of herbicides, pre-emergence application of pendimethalin @ 1.0 kg ha<sup>-1</sup> / post-emergence application of imazethapyr @ 75 g ha<sup>-1</sup> recorded significantly higher nutrient uptake of NPK by crop (24.4, 6.2 and 18.7 and 59.1, 14.5 and 52.3 NPK kg ha<sup>-1</sup> at 30 and 60 DAS, respectively) and reduced weed growth and nutrient uptake by weeds. As a result of effective control of weeds and higher nutrient uptake, the same treatment recorded significantly higher seed yield (1110 kg ha<sup>-1</sup>) with lower weed index of 5.6%. This treatment was statistically comparable with weed free check. This was mainly attributed to higher uptake of nutrients by the crop as a result of effective control of weeds since from sowing to maximum vegetative stage which created conditions similar to weed free environment due to sequential application of pre and post emergence herbicides. The effective reduction in weed growth in the above treatments resulted in reduced competition offered by weeds for precious crop growth resources like nutrient, moisture, space and solar energy. The uncontrolled weed growth caused 57.4% reduction in seed yield of green gram.



## INTEGRATED NUTRIENT MANAGEMENT IN KHARIF SUNFLOWER (*HELIANTHUS ANNUUS* L.).

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### Abstract

A field experiment was conducted during kharif 2019 at Experiment Farm, Agronomy section, Oilseeds Research Station, Latur to study the “Integrated nutrient management in kharif sunflower” (*Helianthus annuus* L.). The soil was clay in texture, alkaline in nature (7.85 pH), very low organic carbon (0.51 %), very low in available N (87.80 kg ha<sup>-1</sup>), medium in P (21.18 kg ha<sup>-1</sup>), and very high in K (413.31 kg ha<sup>-1</sup>). The experiment was laid out in RBD with 8 treatments 3 replication. The treatments were T<sub>1</sub>-RDF only, T<sub>2</sub>-RDF + Fly ash (2.5 t/ha), T<sub>3</sub>-RDF + FYM (5 t/ha), T<sub>4</sub>-RDF + ZnSO<sub>4</sub> (20 kg/ha), T<sub>5</sub>-RDF + FeSO<sub>4</sub> (20 kg/ha), T<sub>6</sub>-RDF + Azotobacter (250 gm/10 kg), T<sub>7</sub>-RDF + Vermicompost (2.5 t/ha), T<sub>8</sub>-RDF + Poultry manure (3 t/ha). FYM was applied before tillage operation and seed sown by dibbling method on 5<sup>th</sup> August, 2019. The RDF 90:45:45 NPK kg ha<sup>-1</sup> was applied as per treatment. The crop was harvested on 7<sup>th</sup> November 2019.

The results of the field experiment indicated that the growth, yield and quality attributes of sunflower were significantly influenced by different treatments. The significantly higher plant height (175.34 cm), number of functional leaves plant<sup>-1</sup> (23.20), leaf area plant<sup>-1</sup> (73.20 dm<sup>2</sup>), stem girth plant<sup>-1</sup> (8.60 cm), head diameter plant<sup>-1</sup> (23.83 cm), dry matter plant<sup>-1</sup> (112.57 g) was found significantly superior with application of treatments (T<sub>3</sub>) i.e. RDF + FYM 5t/ha over the rest of treatments and number of filled seed plant<sup>-1</sup> (847.4), seed yield plant<sup>-1</sup> (36.30 g), seed yield ha<sup>-1</sup> (1833 kg), stalk yield ha<sup>-1</sup> (4227 kg), biological yield ha<sup>-1</sup> (6060 kg) was found significantly superior over rest of treatments. While higher oil content (19.92 %) and also higher gross (?76986) and net monetary return (?40236) with higher benefit cost ratio (2.09) was obtained due to application of treatments (T<sub>3</sub>) i.e. RDF + FYM @ 5t/ha and followed by application of RDF + Vermicompost 2.5 t/ha (T<sub>7</sub>) and RDF + Poultry manure 3 t/ha (T<sub>8</sub>).

## ASSESSMENT OF CROP RESIDUE MANAGEMENT IN MACHINE HARVESTED RICE STRAW USING DECOMPOSING CULTURE BY INSITU DECOMPOSITION

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### Abstract

Rice (*Oryza Sativa*) is a major staple food in Asian countries. Rice straw is the major byproduct of rice cultivation. Rice straw decomposition has important practical significance in sustainable rice production as it improves soil structure and increases the availability of soil nutrients. To address this, an On Farm trial (OFT) was conducted in farmers' fields of West Godavari district of Andhra Pradesh state during Kharif and rabi seasons of 2018-19 and 2019-20 using EM1 microbial culture developed from ARS, Amaravathi. The recommended practice in the OFT was waste decomposer in situ incorporation of rice straw @ 5t/ha along with cellulolytic microorganisms (EM1 culture) @ 1kg/ton of trash + Urea (10 kg/ac) + SSP (1 bag/ac). and in farmer practice, only recommended dose of fertilizers was used without any rice straw decomposition. The two year trial results revealed that an average yields of 7220 and 7221 kg/ha were recorded in OFT and farmers' fields respectively during kharif season, whereas in rabi the mean yields of 9231.5 and 9076.5 kg/ha were recorded in OFT and farmer fields respectively. The farmer benefited an extra amount of 4543/- with the decomposition of paddy straw during rabi season. The highest BC ratio of 2.6 was recorded in rabi and 2.2 was recorded in Kharif.

## MAINTAINING SOIL SUSTAINABILITY AND BUILDING OF SOIL HEALTH IS PRIME MEASURE FOR ENHANCEMENT OF CROP PRODUCTION

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### Abstract

Intensive farming on large scale from last decade has undesirable effects on the soil environment which result in soil



degradation. In fact, it is projected that 95% of our food is straight or indirectly obtained from our system of soils. In Indian context, multiple nutrient deficiencies in major crop production systems is frequent in present scenario that deteriorating or decreasing productivity growth rate in the production of food grain crops. To maintaining the soil health and enhancement of soil fertility for crop production it must have principal concern on soil sustainability. Soil sustainability deals with soil management by keep the needs of the present without negotiating the ability of future generations to meet their own needs from that soil. Thus, emphasis on soil health involving different parameters such as soil physical, chemical and biological required instead of target on a some major plant nutrients. A good soil health is require for sustainable crop productivity with quantity and quality produce under intensive agriculture systems. The major approach for better soil health should be based on integrated plant nutrient supply system, advancement of balanced fertilization and finding the ways for merger of organic matter into the soil. Organic fertilizers now days promoted intensively, giving rise to the concept of organic culture. Soil carbon and nitrogen content enhance by organic amendments which results in improved crop productivity and soil fertility and as well it is cost-effective and eco-friendly. On increasing the content of humus, there will be modification in biological properties of soil which help in flourishing of beneficial macro- and microorganisms. Instead of application of SOM, humus content and bio inoculum legumes (groundnut, soybean, common beans, cowpea, and pigeon pea), small grains (pearl millet, finger millet, and sorghum), roots and tubers (cassava, sweet potato, potato), and other cereals (rice, barley, wheat) have right cultivars for supportive production.

## **POPULATION OF MAJOR INSECT PESTS OF RICE INFLUENCED UNDER DIFFERENT WEATHER PARAMETERS OF EASTERN UTTAR PRADESH CONDITIONS**

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### **Abstract**

An investigation was undertaken to study the population of major insect pests of rice influenced under different weather parameters in rice field ecosystem of Eastern Uttar Pradesh conditions for two consecutive years, 2014 and 2015. The population of major insect pests of rice were observed under particular weather parameters, i.e. temperature maximum, temperature minimum, relative humidity, and rainfall in different growth stages of rice. The influence of weather parameters on population of major insect pests of rice were inferred by correlation coefficient. Of the total observed population of rice insect pests under damaging groups in all growth stages of rice under temperature maximum, temperature minimum, relative humidity, and rainfall, the correlation coefficients were - 0.669, - 0.649, - 0.564, and 0.821 for stem borers; 0.859, 0.846, 0.784, and - 0.953 for leaf feeders; 0.191, 0.217, 0.321, and 0.037 for sap feeders; 0.587, 0.565, 0.474, and - 0.756 for root feeders respectively. The all correlation coefficients were inferred non-significant between damaging groups of rice insect pests and particular weather parameters in all growth stages of rice except between rainfall was inferred significant. The population of most of the major insect pests of rice were highly decreased with highly increasing temperature maximum, temperature minimum, and relative humidity and decreasing rainfall in seedling stage; highly increased with moderately decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in transplanting stage; and moderately decreased with highly decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in flowering stage. The population of Rice cutworm (*Spodoptera mauritia* Boisduval) in nursery stage and Rice earhead bug (*Leptocoris aacuta* Thunberg) in flowering stage were highly increased under influence of weather parameters respectively.

## **SOIL HEALTH MANAGEMENT IN INTENSIVE VEGETABLE CULTIVATION**

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### **Abstract**

Vegetables are very important part of human diet and also considered as protective food because their nutritional and therapeutic properties. As the population of the country as well as the world is raising continuously, the demand is also showing the parallel trend. Therefore, to meet the increasing demand farmers are shifting towards the intensive vegetable cultivation. High-input is prerequisite of intensive vegetable cultivation and generally require large quantities of fertilization,





pesticides, frequent irrigation, and repeated tillage or interculture operations. Consequently, an increase in global vegetable production may have seriously deteriorative impacts on soil health (soil biology, chemistry, and physical dynamics) and ecosystem. Yet, not only maintaining but improving soil health is critical to enhancing the sustainability of food production systems. To improve soil health, we need to modify conventional vegetable production systems by using organic or conservation agriculture or integrated management systems. In general, approaches like soil amendments basically improve soil chemical properties and nutrient availability, soil carbon levels and nitrogen reserves. Incorporation of cover crops to vegetable crop rotations system enhance nitrogen recycling via reduced nitrate leaching risks, increased soil carbon levels, and weed suppression. Incorporation of organic mulch also found efficient in improving overall soil health and weed suppression. Reduced tillage is rarely practiced, presenting an important challenge and opportunity for further improving soil health dynamics in vegetable production. Reportedly, adopting alternative practices generally had no effect or very little effect on crop yields, which implies little risk of yield penalties when agronomic management is carefully planned. Therefore, a blend between organic and conventional ideologies will play a key role to improve overall soil health in future sustainable vegetable production systems.

## URBAN FORESTRY IN ARC CAMPUS, CUTTACK, ODISHA

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### Abstract

The Research was carried out on Urban forestry in ARC campus, Cuttack, Odisha in 2019-20 having the objectives of to bring out the importance and principles of urban forestry in our campus and to make an analysis on growth parameter and standing tree volume. Urban growth parameter machine is an influential thesis of urban plantation that suggests the objective of growth of various species and interests in relation to a city. Various growth parameters of 10 different species were studied in ARC campus, Cuttack and their height and girth measurements are taken and then volume was estimated. It was found that the dominant species were Kadamb, Mango with maximum diameter and volume. Various climatic and Physiographic conditions of the plantation site was found. The vegetation of the site is of tropical climate and humidity is about 80%. It consists of heterogeneous plantation of various species around 20 different species. This area mainly consists of laterite soil, black soil and brown colour soils are present in this block. The species are planted according to the temperature and climate conditions of that area. Here the average temperatures was around 33°C and minimum average temperature is 26°C. The growth factor depends on the soil type of that particular area. But overall there was a good growth of the species and the climate is also favourable. There are about 20 different species planted out of 10 species of them to study their growth parameters. These include Teak, Jamun, Gulmohar, Neem, Sisoo, Radhachuda, Kadamba, Senna, Mango etc. It was found that the dominant species were Kadamb, Mango with maximum diameter and volume. Among all these species Mango (*Mangifera indica*) showing highest total volume (4.2 m<sup>3</sup>) followed by Kadamba (*Anthocephallus cadamba*) (3.29m<sup>3</sup>), Neem (*Azadirachta indica*) 1.71m<sup>3</sup>, Radhachuda (*Peltophorum pterocarpum*) 1.01 m<sup>3</sup> Sisoo (*Dalbergia sisoo*) 0.99 m<sup>3</sup>, Gulmohar (*Delonix regia*) 0.81m<sup>3</sup>, Jamun (*Syzygium cumini*) 0.51m<sup>3</sup>. The species also plays a vital role for the environment also in controlling pollution like air, sound pollution etc. The urban people are also benefited from these types of plantation in various way, they got recreational and aesthetic benefits. The dominant species indicates that high growth rate and pollution are the key attributes considered for species selection by local authorities.

## SOCIO-ECONOMIC PROFILE OF JFMC BASED VILLAGES IN KHORDHA DISTRICT OF ODISHA

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### Abstract

The study was conducted to ascertain the socio-economic profile in the villages practicing Joint forest management (JFM) in



Khordha district of Odisha. For the above study multi stage random sampling method was followed. The caste structure of the JFMC members indicated that the maximum numbers (32.78%) belonged to scheduled tribe followed by OBC, general and scheduled caste having 28.33%, 27.22% and 15% share respectively in the total population of the area. The age distribution of the JFMC members indicated that the maximum number of people (43.89%) were in middle age category, followed by younger generation and people above 55 years having share of 34.44% and 21.67% respectively in total population of the area. The education wise analysis of JFMC members showed majority of population was educated up to primary level (30.56%) followed by illiterate, educated up to +2 and above, high school and middle school having a share of 22.78%, 17.77%, 15.00% and 13.89% respectively in total population of the area. The family size wise analysis showed majority of household was of size upto 5 members (69.44%) followed by above 10 members, 9 to 10 members and 6 to 8 members having 23.33%, 16.67% and 10.56% respectively. The housing pattern wise analysis of JFMC members showed majority of house hold was semipucca (38.89%) followed by pucca, thatched and hut having 30%, 24.44% and 6.67% share respectively of total household. The land holding analysis indicated that the majority was having land holding upto 1 ha (56.11%) followed by landless, 1.1 ha to 2 ha and 2 ha and above having 25%, 13.33% and 5.56% share respectively of total respondent.

## **EFFECT OF NUTRIENT LEVELS ON LINSEED GENOTYPES UNDER RAINED CONDITION**

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### **Abstract**

To find out the yield potential of linseed genotypes the experiment was conducted at AICRP on Linseed, College of Agriculture, Nagpur during the rabi season of 2020-21. The results revealed that the effect of nutrient levels on linseed genotypes under rainfed condition was observed significant on growth and yield parameters. Among the genotypes tested RLC-171 has recorded maximum and significantly superior plant height and number of seeds per capsule. Number of branches was more in JLS-95, whereas maximum number of capsules per plant was recorded in T-397. Seed yield was significantly affected due to genotypes tested and highest seed yield (746 kg/ha) was observed in the genotype RLC-171 as compare to T-397 (708 kg/ha) and JLS-95 (632 kg/ha). The genotype RLC-171 was recorded 15 % more seed yield on zonal check JLS-95 and 5 % more seed yield national check T-397 under rainfed condition. Growth parameters and seed yield of linseed genotypes have been significantly affected due to different nutrient levels under rainfed condition. The 150% recommended dose of fertilizer observed maximum and significantly superior in plant height, number of branches, number of capsules, number of seeds per capsules. Maximum yield was recorded under 150% RDF (652 kg/ha) which was at par with 100% RDF (651 kg/ha). The increase yield in 150% RDF is only 1.7 % than 100% RDF, whereas 100% RDF was recorded 11.4 % higher yield than 50% RDF. Among the interaction effect highest seed yield was recorded in the interaction of RLC-171 with RDF 100% (788 kg/ha) which was at par with 150% RDF in the same entry RLC-171 (751 kg/ha). Therefore, it is concluded that among the genotypes tested RLC-171 was recorded highest seed yield with 100% RDF.

## **PERFORMANCE OF LINSEED GENOTYPES FOR SEED YIELD AND ANCILLARY CHARACTERS UNDER DIFFERENT SEED RATE IN UTERA CONDITION**

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### **Abstract**

Performance of six linseed genotypes for seed yield and ancillary characters under three different seed rate were investigated in utera condition at AICRP on Linseed, College of Agriculture, Nagpur during rabi season of 2020-21. All the ancillary characters and yield parameters of different entries tested under *utera* condition have been significantly affected to each other. The genotype RLC-148 has recorded maximum plant height which was at par with the entry BAUP-101. Number of branches per plant and number of capsules per plant was recorded maximum in the T-397. Number of seeds per capsules was observed maximum in the entry BRCL-107-1 which was at par with T-397. Highest seed yield (710 kg/ha) was observed in T-397 which was at par with the genotype BAUP-101. None of the entry surpass the yield level of national check, whereas the genotype BAUP-101, RLC-153 and BRCL 107-1 has recorded 16.44%, 13.73%, 13.33% more yield on zonal check RLC-143. Ancillary characters of linseed have been significantly affected due to different seed rate under *utera* condition and



observed maximum in seed rate of 30 kg/ha i.e. number of branches and other yield parameters like number of capsules and number of seeds per capsules and yield per plant except plant height which was observed maximum in seed rate of 50 kg/ha. The seed yield was significantly affected due to different seed rate and recorded maximum seed yield at the seed rate of 50 kg/ha (660 kg/ha) which is significantly superior over 30 kg/ha (586 kg/ha) but at par with 40 kg/ha (639 kg/ha) seed rate. This might be due to the more number of plant population per hectare at maximum seed rate. The interaction effect of genotypes and seed rate under *utera* was found significant on seed yield (kg/ha) and recorded highest in T-397 with 40 kg/ha seed rate (764 kg/ha) followed by genotype RLC-153 with seed rate 50 Kg/ha. (763 kg/ha) followed by entry BAUP 101 with seed rate 40 Kg/ha (755 kg/ha).

## PRODUCTIVITY OF SESAME (*SESAMUMINDICUM* L.) AS INFLUENCED BY SOURCES AND LEVELS OF SULPHUR

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### Abstract

Among the oilseed crops, sesame has the highest oil content of 46 to 52 per cent with 25 per cent protein and sesame oil contains important antioxidants (sesamol and sesamolins) which prevent rancidity, hence it is called as “Queen of oilseeds”. Oilseed crops require more amount of sulphur for their growth compared with cereals. Sulphur is the fourth major plant nutrient after nitrogen, phosphorus and potassium. High yield and quality of oilseed crops are possible only when crops have access to the optimum amount of sulphur. Use of high analysis sulphur-free fertilizers, heavy sulphur removal by the crops under intensive cultivation and neglect of sulphur replenishment contributed to widespread sulphur deficiencies. The use of sulphur is very remunerative in many crop sequences involving oil seeds. Hence, the present investigation was conducted to study the effect of sources and levels of sulphur on growth, yield and quality of sesame. Field experiments were carried out during consecutive seasons of summer 2019, 2020 and 2021 at Regional Agricultural Research Station, Tirupati. The experiment was laid out in a randomized block design with factorial concept and replicated thrice. The treatments consisted of two sources viz., gypsum and elemental Sulphur and five sulphur levels viz., 0, 10, 15, 20 and 25 kg ha<sup>-1</sup>. The results of the experiment revealed that the application of the elemental sulphur recorded significantly higher growth parameters, yield attributes, yield (1048 kg/ha) and monetary returns as compared to the gypsum (973 kg/ha) in sesame. With regard to the sulphur levels tried, sesame responded significantly from 0 to 25 kg S ha<sup>-1</sup> (916 kg/ha to 1114 kg/ha) with higher productivity and economic returns. The interaction effect between sources and levels of sulphur could not exert any significant influence on any of the parameters studied. The study concluded that the application of elemental Sulphur @ 25 kg ha<sup>-1</sup> resulted in higher productivity and profitability of sesame under Southern Agro climatic zone of Andhra Pradesh.

## INFLUENCE OF SOCIO-ECONOMICAL VARIABLES ON BACKWARD AND FORWARD LINKAGES DEVELOPED AMONG THE COTTON GROWERS IN ANDHRA PRADESH—AN EX-POST-FACTO STUDY

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### Abstract

In the present study, an attempt was made to find out the activity wise backward linkages followed by cotton growers in information activity, physical inputs, financial requirements and technical guidance. Based on maximum area under cotton cultivation Kurnool and Guntur districts from Andhra Pradesh was purposively selected. An ex-post facto research design was used for the study and the data were collected from 240 respondents. The results showed all the sixteen variables acted as cause to bring 54.50 per cent variation in extent of following backward and forward linkages in cotton cultivation were attributed to educational status, extension contact, Mass media exposure, Innovativeness and Risk orientation were positively and significantly contributed and the F value (3.167) was also found to be significant at 0.01 level of probability. The cotton grower who having more education, extension contact, mass media exposure, innovativeness and risk orientation they may gain more understanding of backward and forward linkages than the average members of the community. These findings draw attention to researchers, and policy makers and other stakeholders for the introduction of innovative methods in better indulgent of backward and forward linkages in cotton cultivation. Since the farming community is proactive, the government has to initiate



block chain technology enabled infrastructure to facilitate them with respect to timely information reach as well as efficient dissemination of technology at the farmer's door steps.

## **IMPACT OF COVID-19 ON FARMING ACTIVITIES IN CHITTOOR DISTRICT OF ANDHRA PRADESH**

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### **Abstract**

Impact of COVID-19 on Farming activities in Chittoor district of Andhra Pradesh revealed that there was an average 6.66 per cent decline in production of agriculture, 26.66 per cent decline in horticulture and 31.66 decline in production of livestock. In agriculture crops 25.00 per cent decline in farm gate prices followed by 85.00 per cent decline in horticulture crops due to disruption in supply chain management and restriction on movement of money, men and closure of APMCs. Impact of Covid-19 on availability of inputs revealed that there was 22.22 per cent decline in availability of inputs like Seeds, fertilizers and pesticides and 21.11 per cent rise in price of inputs. With respect to marketing majority (73.11%) of the farmers faced lack of marketing facilities in agriculture crops, followed by 95.00 per cent in marketing of horticulture produce and 51.66 per cent of the farmers faced problems marketing of livestock produce due to disruption in supply chain management and restriction on movement of money, men and closure of APMCs. In impact of Covid-19 on crop shifting pattern 20.00 per cent of the tomato farmers shifted from tomato to groundnut and 10.00 per cent of the farmers shifted from tomato to paddy. Impact of covid -19 on Post lock down preparedness of farmers in production and marketing aspects revealed that majority (80.00%) shown increase rate of dependence on social media Platforms (Whatsapp, Youtube, Facebook etc.,) and 23.33 per cent shown increased Interaction with ANGRAU Scientists (RARS/KVK/DAATTCs/DOA/ICAR) and 63.33 per cent of farmers shown interest towards formation of FPOs for production and marketing aspects.

## **ASSESSMENT OF WATER STABLE AGGREGATES IN RELATION TO PHYSICO CHEMICAL PROPERTIES OF SOIL OF BABINA WATERSHED IN JHANSI DISTRICT OF BUNDELKHAND REGION**

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### **Abstract**

The studies of water stable soil aggregates (>0.25mm) was carried out in Babina watershed representing typical red (Amarpur and Imilia series) and black soils (Chamraua and Badaura series) of district Jhansi in Bundelkhand region of Uttar Pradesh (India) under Operational Research Project for Resource conservation on sustained basis. Analysis of water stable soil aggregates (>0.25mm) in different soil series of Babin watershed representing typical red (Amarpur and Imilia series) and black soils (Chamraua and Badaura series) of Jhansi district of Bundelkhand region of U.P. revealed that black soils (Vertic Ustochrepts) were rich in water stable aggregates as compared to red soils (Typic and Udic Ustochrepts, Typic Ustifluvents). Water stable aggregates among various soil series ranked in order of Badaura > Chamraua > Imilia > Amarpur. The result represented that erodibility among the project area varies according to soil conservation measures adopted. Reversion lands with conventional up and down cultivated soils are more erodible in comparison to land treated by various soil conservation practices. On the basis of erosion ratio, erosion index and water stable aggregate as principle indices of erodibility, soil under various soil conservation practices may be arranged in the order of: Conventional method > sowing across the slope > Sunken structure > submerged bund with vegetative > check dam > contour bunding > land leveling and field bunding > vegetative barriers. A significant and positive correlation was recorded of water stable aggregates with clay ( $r=0.979^{**}$ ), silt ( $r=0.529^{**}$ ), silt+clay ( $r=0.912^{**}$ ), moisture equivalent ( $r=0.986^{**}$ ), water holding capacity ( $r=0.987^{**}$ ), organic carbon ( $r=0.937^{**}$ ), total N ( $r=0.963^{**}$ ), available  $P_2O_5$  ( $r=0.933^{**}$ ), available  $K_2O$  ( $r=0.920^{**}$ ), Exch.  $Ca^{++}$  ( $r=0.746^{**}$ ), Exch.  $Mg^{++}$  ( $r=0.881^{**}$ ) and clay/ moisture equivalent ( $r=0.822^{**}$ ) negatively correlated with sand ( $r=-0.912$ ), easily dispersible silt+clay ( $r=-0.0259$ ), bulk density ( $r=-0.986^{**}$ ), particle density ( $r=-0.876^{**}$ ), hydraulic conductivity ( $r=-0.936^{**}$ ), pH ( $r=-0.839^{**}$ ), EC ( $r=-0.976^{**}$ ), dispersion ratio ( $r=-0.983^{**}$ ), erosion ratio ( $r=-0.962^{**}$ ), erosion index ( $r=0.962^{**}$ ), clay ratio ( $r=-0.501^{*}$ ) and silt/clay ratio ( $r=-0.499^{**}$ ). Among adopted eight soil conservation practices, soil erodibility decreased with increasing clay content. Soils of Babina watershed are erosive in nature and require warrant and prompt attention for implementing intensive soil conservation measures in the





entire watershed in order to subside the havoc of soil erosion with in safe limits because adopted soil conservation measures are variably effective to controlling the erosion.

## SUSTAINABLE MEMBRANE FILTRATION TECHNOLOGY FOR WASTEWATER TREATMENT FOR AGRICULTURE PRODUCTION

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### Abstract

Nowadays, membrane filtration technology is used for wastewater treatment for agriculture field in which wastewater is reused for irrigation. For sustainable agricultural production and safe groundwater recharge the effluent is further polished by a combined two-stage membrane pilot system. The pilot membrane system consists of two main in row stages: Ultrafiltration and Reverse Osmosis. The ultrafiltration stage is efficient in the removal of the bacteria and suspended organic-inorganic matter while the successive reverse osmosis stage provides safe removal of the dissolved solids. Effluents of different qualities were applied for agricultural irrigation along with continuous monitoring of the membrane system performance. Best agricultural yields were obtained when applying effluent having minimal content of dissolved solids (after the Reverse Osmosis stage) as compared with effluent without any further treatment and extended storage. In regions with shallow groundwater reduced soil salinity in the upper productive layers, maintained by extra membrane treatment, will guarantee minimal dissolved solids migration to the aquifers and minimize salinization processes.

## EFFECT OF SITE SPECIFIC NUTRIENT MANAGEMENT ON GROWTH PARAMETERS AND YIELD OF SOYBEAN [*GLYCINE MAX* (L.)]

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### Abstracts

The field experiment was conducted to study the effect of omission of N, P and K fertilization and balanced NPK under it specific nutrient management in akola district in Vertisols. N omission with ample PK, omission of P with ample NK, omission of K with ample NP, and Ample NPK. The experiments comprised of four treatments as per the omission plot technique in randomized block design replicated on fifteen farmers' fields and each farmer's field considered as one replication. Balanced application of NPK recorded higher plant height, number of pod per plant and number of seeds per pod. The seed yield of soybean was most influenced by omission of phosphorus indicating that phosphorus is most crucial element in soybean production. The treatment wise yield of seed and straw was recorded significantly highest with balanced application of NPK.

## CULTURAL AND PHYSIOLOGICAL VARIABILITY STUDIES ON FUSARIUM STALK ROT OF MAIZE (*FUSARIUM VERTICILLOIDES*)

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### Abstract

Investigations on Cultural and Physiological studies on Fusarium stalk rot of maize incited by *Fusarium verticilloides* was studied under in vitro conditions in maize pathology laboratory at ZARS, VC farm, Mandya. The growth of *Fusarium verticilloides* was studied on 6 different synthetic media viz ; Potato Dextrose Agar , Oat meal Agar, Czapekdox Agar , Corn Meal Agar, Potato Carrot Agar and Richard's Synthetic Agar. The result revealed that among the different culture media tested, Richard's synthetic agar (RSA) and Czapekdox agar (CA) shows the growth of 50.9 mm & 47.5 mm. Hence these media were more favourable for the growth of Fusarium species. Potato dextrose agar (PDA) and Potato carrot agar (PCA) shows the growth of 30.6 mm & 33.4 mm. Among 5 different PH were used to study the growth of *Fusarium verticilloides*, PH 7 is more favourable for the growth of *Fusarium verticilloides* and it shows the maximum growth



of 49.9mm followed by 43.2mm at PH 6. The minimum growth was observed at PH 4 (27.8mm) and PH 8 (37mm). Among five different carbon source(sucrose, lactose, dextrose, cellulose, starch)used to observe the growth of *Fusariumverticilloides*,all the carbon source shows almost same colony diameter. The maximum diameter was observed in sucrose (70.5mm) and in the dextrose medium (66.5mm) and the minimum diameter was observed in lactose (62mm). The result concludes that sucrose is more favourable for the growth of *Fusarium* species. Among five different nitrogen source(control, sodium nitrate, ammonium nitrite, ammonium sulphate, ammonium chloride, maximum colony diameter in the medium containing sodium nitrate(41mm) as a nitrogen source and the minimum diameter was observed in the medium containing ammonium chloride (30 mm).

## **SURVEY FOR THE TURCICUM LEAF BLIGHT (*EXSEROHILUMTURCICUM*) ON MAIZE (*ZEA MAYS L.*)IN MAIZE GROWING AGRO ECOLOGIES OF SOUTHERN KARNATAKA.**

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### **Abstract**

Maize is an important food and feed crop which ranks third after wheat and rice in India and in the world. It is cultivated under diverse environmental conditions. Turcicum leaf blight is a major disease in Karnataka and in India which caused severe reduction in the grain yield up to the tune of 40 per cent. Hence to know its damage and the extent of severity, survey was carried out in six(Hassan, Chamarajanagar, Mandya, Mysore, Bengaluru and Ramanagara) major maize growing districts of southern Karnataka. Highest disease index was noticed in Hassan district which is having mean per cent index (PDI) of 66.17 succeeded by Chamarajanagar and Mandya districts with the mean PDI of 57.68 and 50.40 respectively. However, the least per cent disease Index was recorded in Mysore district with the mean PDI of 48.04 followed by Bengaluru and Ramanagar districts with the mean PDI of 49.95 and 48.25 respectively.

## **CHARACTER ASSOCIATION AND PATH ANALYSIS IN GROUNDNUT (*ARACHISHYPOGAEA L.*)**

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### **Abstract**

The present investigation entitled “Character Association and Path Analysis in Groundnut (*ArachishypogaeaL.*)” was conducted during *kharif*,2020. In the experiment thirty diverse genotypes including four checks namely UG-5 (Pratap Raj Munghali), TG37A, GG-7, JL-501 of groundnut, were grown at the instructional farm, CTAE, MPUAT, Udaipur. This experiment was conducted in RBD with three replications. All Observations recorded for thirteen characters viz., days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, sound mature kernels (%), dry pod yield per plant (g), kernel weight per plant (g), 100-kernel weight (g), shelling percentage (%), biological yield per plant (g), harvest index (%), duration between flowering to pegging and oil content. The data so obtained were subjected to analysis of variance, estimation of different variability parameters, correlation and path analysis for all thirteen characters. Analysis of variance revealed that genotypes were highly significant for all the thirteen characters, indicated the presence of ample genetic variability available in the experimental material under study that can be further exploited for groundnut improvement.

Highest GCV was found for number of branches per plant (12.69%), harvest index (12.41%), plant height (12.23%), duration between flowering to pegging (11.97%), kernel weight per plant (11.82%) and dry pod yield per plant (10.12%) where as lowest GCV was observed in the character Days to maturity (3.27%). Highest PCV was found for harvest index (15.61%), dry pod yield per plant (13.78%), kernel weight per plant (13.78%), number of branches per plant (13.47%), plant height (13.08%), duration between flowering to pegging (13.01%) and biological yield per plant (11.17%) where as lowest PCV was observed in days to maturity (3.51%). The high estimates of heritability values noticed in characters like 100-kernel weight (92.00%), oil content (91.53%), number of branches per plant (88.78%). High GCV coupled with high heritability and expected genetic gain were recorded for duration between flowering to pegging, kernel weight per plant, number of branches per plant, plant height, and harvest index in the experiment.

Dry pod yield per plant exhibited positive and significant correlations coefficient with harvest index at both genotypic and



phenotypic levels. On the basis of this study the genotype UG-197, UG-229, UG-232, UG-229, UG-234, UG-228, UG-234, UG-192, UG-234, UG-192 and UG-236 were found to have considerably high mean values for traits like dry pod yield per plant, plant height, sound mature kernels, number of branches per plant, 100-kernel weight, kernel weight per plant, shelling percentage, biological yield per plant, harvest index, duration between flowering to pegging, oil content while genotypes UG-199 and UG-198 have considerably low mean values for traits like days to 50 per cent flowering and days to maturity respectively. So above genotypes can be further used in breeding programme. An ideal plant of groundnut is one which should have higher value of harvest index, duration between flowering to pegging, kernel weight per plant, number of branches per plant and plant height.

## GENETIC VARIABILITY AND PATH ANALYSIS IN CHICKPEA (*CICERARIETINUM* L.)

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### Abstract

The present investigation entitled “Genetic Variability and Path Analysis in Chickpea [*Cicerarietinum* L.]” was conducted during *rabi*, 2019-20. In the experiment twenty five diverse genotypes including three checks *viz.*, PC-1, JG-16 and JG-315 of chickpea, were grown at the instructional farm, CTAE, MPUAT, Udaipur. This experiment was conducted in RBD with three replications. All Observations recorded for twelve characters *viz.*, Days to 50 per cent flowering, Days to maturity, Plant height (cm), Number of primary branches per plant, Number of secondary branches per plant, Number of pods per plant, Number of seeds per pod, 100-seed weight (g), Biological yield per plant (g), Harvest index (%), Protein content (%) and Seed yield per plant (g).

The data so obtained were subjected to analysis of variance, estimation of different variability parameters, correlation and path analysis for all twelve characters. Analysis of variance revealed that genotypes were highly significant for all the twelve characters, indicated the presence of ample genetic variability available in the experimental material under study that can be further exploited for chickpea improvement. High GCV coupled with high heritability and expected genetic gain were recorded for 100-Seed weight, seed yield per plant, number of primary branches per plant, plant height, number of secondary branches per plant, biological yield per plant and harvest index in the experiment. Association study indicated that seed yield per plant at genotypic as well as at phenotypic levels was strongly and significantly correlated with harvest index, biological yield per plant and number of secondary branches per plant.

Path analysis study revealed that harvest index (%) had the maximum direct effect followed by plant height (cm), number of seeds per pod, number of primary branches per plant, protein content and number of secondary branches per plant were the main direct effect attributes for increasing the seed yield in chickpea. On the basis of this study the genotype PBC-515, PBC-512, PBC-514, PBC-503, PBC-512, PBC-502, PBC-530, PBC-515, PBC-99 and PBC-531 were found to have considerably high mean values for traits like seed yield per plant, plant height, number of primary branches per plant, number of secondary branches per plant, number of pods per plant, number of seeds per pod, 100-seed weight, biological yield per plant, harvest index and protein content while genotypes PBC-502 and PBC-503 have considerably low mean values for traits like days to 50 per cent flowering and days to maturity respectively. So above genotypes can be further used in breeding programme. An ideal plant of chickpea is one which should have higher value of harvest index, number of seeds per pod, number of primary branches per plant, number of secondary branches per plant, biological yield per plant, number of pods per plant and 100-seed weight.

## EFFICACY OF SELECTIVE INSECTICIDES FOR THE MANAGEMENT OF FALL ARMY WORM IN MAIZE UNDER SATPURA PLATEAU

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### Abstract

An experiment was carried on efficacy of selective insecticides for the management of fall army worm in maize under Satpura Plateau at Krishi Vigyan Kendra, Chhindwara (M.P.) during kharif 2020. Fall army worm, *Spodoptera frugiperda* (J.E. Smith)



(Lepidoptera: Noctuidae), is an insect showing polyphagous nature, with more than 80 host species that causes severe damage to cereals and vegetable crops. On late 2016, occurrence of FAW was reported in West Africa for the first time and it was firstly collected and reported in India at Shivgoma, Karnataka, on May 2018. Both migratory habit and a more localized dispersal habit are performed by the moths. The insect causes heavy damage on corn and yield losses of 39% to over 70% has been recorded. Use of chemicals like, Emamectine benzoate 5 SG, Cholorantraniliprole 18.5 SC, Flubendamide 20 WG and Sipnosad 45 SC. Among chemical treatment Emamectine benzoate were found best at ETL whereas Azadirachtin 1500 ppm and *Beauveria bassiana* were found best at early stage of maize.

## **EMBRYO RESCUE TECHNIQUE : A NOVEL TECHNOLOGY FOR CROP IMPROVEMENT**

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### **Abstract**

The term “embryo rescue” refers to in vitro techniques whose purpose is to promote the development of an inherently weak, immature or hybrid embryos into a viable plant. Depending on the organ cultured, embryo rescue is referred to as embryo, ovule, or ovary culture. It is most often used to rescue embryos from interspecific and intergeneric crosses and from embryos that do not fully develop naturally. Wide hybridization involving crossing of two different species of plants from the same genus or different genera often results in failure, due to failure of zygote formation, zygote development and hybrid seedling development. Failure of zygote formation occurs due to the inability of the pollen tube to reach the embryo sac (pre-fertilization barrier) and failure of zygote development (postfertilization barrier) may take place due to lethal genes, genotypic disharmony between genomes of the two parental species, chromosome elimination, incompatible cytoplasm and endosperm abortion. Endosperm abortion occurs due to inability of the young endosperm to continue development and provide nutrition to developing young embryo. The endosperm may abort during early embryo development preventing further development of the embryo or it may abort at a later stage allowing an almost complete development of the embryo. For example, in the cross between *Triticum* and *Secale*, endosperm aborts at such a late stage that a small frequency of viable seeds is also obtained. Endosperm abortion can be overcome by embryo rescue technique by culturing young hybrid embryo on a suitable culture medium.

## **DOUBLING FARMERS INCOME THROUGH PROCESSING AND VALUE ADDITION OF PULSES**

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### **Abstract**

Processing and value addition of pulses becomes an important function in the present-day marketing as pulses play a very important role in providing food and nutritional security especially during COVID pandemic. It is a cheaper source of protein than milk, fish, meat, nuts etc. At present consumers depend upon processed food for most of their requirements. Consumer awareness of health, quality of food and healthy nutrition option, and convenience and ready to eat food product is growing. Value addition of pulses can be more fruitful in the market, motivated by the consumer demand, there is a need for development of short cooking time, microbial safety and high quality foods. In addition to daily consumption as dhal, pulses are processed in different nutritive blended value added products like nutri papad for increasing the nutritional status and also for increasing the income of the farmer. Papad is one of the Indian traditional food items that can be prepared in advance and served as when needed. They are staple in every Indian home with most families consuming it daily. It is a traditional food which is manufactured on a cottage scale. Nutri papad is mainly designed to enhance the quality and nutritional value of papad by mixing different ingredients of pulses and medicinal herbs like Chinese chives, allium hookeri and spices. The product has been evaluated for sensory attributes i.e. colour, flavour, texture, taste and overall acceptability. Papad are traditional and very popular snack primarily made from black gram flour with salt, oil and spices. Papad are now experimented for value addition with different ratio 1:1, 3:2, 7:3, 4:1 of moong dal and black gram with common salt, spices, sodium bicarbonate, medicinal herbs allium hookeri, Chinese chives are added at the same ratios. The results showed that the ratio of 7:3 of black gram and moong dal are the excellent product without any significant change in quality attributes of the papad. This nutritive product could facilitate sustainable livelihood through entrepreneurship development and enhance the socio-economic status which helped to double the income of the farmer.





## MUTAGENIC EFFECTIVENESS AND EFFICIENCY IN M<sub>2</sub> GENERATION FOR CHICKPEA (BG-1053)

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### Abstract

A mutation breeding programme in chickpea was started in 1978-79 for induction of desirable mutants. The emasculation and pollination process used in recombination breeding is a different task in chickpea due to the presence of tiny and delicious flowering parts, which are major preventing, rapid & successful hybridization in chickpea. Mutation breeding is different type of approach for improvement in this crop. Induced mutations can be used with advantage over conventional breeding procedures to rectify simple, specific undesirable traits in otherwise well adopted varieties without grossly disturbing its genetic constitution. Mutation breeding methodology needs to be sufficiently standardized for improvement of polygenic traits to gain general confidence and wide acceptance of its usefulness among the breeders so that experiments could be planned with reasonable expectations of success. Mutagenic effectiveness and efficiency have been estimated based on M<sub>2</sub> progenies. Mutagenic effectiveness is an index genotypic response to various doses of a mutagen. The estimates of mutagenic effectiveness of various treatments generally, it was observed that the effectiveness decreased with increasing doses of different treatments. The highest (0.95) mutagenic effectiveness was observed under 20 kR gamma-rays treatments followed by (0.89) under 0.10 EMS while the lowest (0.16) recorded under the 60 kR gamma-rays. The mutagenic efficiency increases with decrease of gamma-rays, chemical (EMS%) and combined (kR+ EMS%) treatments (3.68%) maximum mutagenic efficiency was seen in the treatment of 20 kR gamma-rays, While the (0.80%) mutagenic efficiency was recorded under the treatments of (0.30% EMS). Among the mutagens tested Gamma-rays (20 kR) most efficient then chemical and combined treatments.

## ROLE OF HELICASES IN ABIOTIC STRESS TOLERANCE

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### Abstract

To cope up with the stressed conditions in crop plants, nucleic acids are always been focused for better alterations and repair. One of the enzyme that can be used to protect the organism from genetic damage by the process of repairing DNA is helicase. Helicases are ubiquitous enzymes and responsible for unwinding of double helical DNA structure and remodel them. There are two types of helicases i.e. DNA and RNA helicases. Helicases are motor proteins which unzip two strands of DNA double helix by attaching itself to the area (a point, called the "origin") and disorganize the hydrogen bonds between complementary bases on DNA strands, hence pulling the two strands apart. Activity of helicase plays a crucial role in regulation of gene expression under stressed conditions. Transgenic plants carrying helicases showed enhanced stress tolerance. Genes encoding helicases have been incorporated in crop plants for abiotic stress tolerance. It has been found that various DNA helicases are involved in stress tolerance in crop plants. So many helicases are known to work in stress tolerance during stressed conditions. There are reports that helicases are upregulated in response to abiotic stress in plants and help in survival under stressed conditions. Some of the examples of helicases which are activated under abiotic stresses are PDH45, STRS1, PDH47, STRS2, MCM6, p68, OsRuvB etc.

## QUANTIFICATION OF DRUDGERY AND ITS MITIGATION IN CROP PRODUCTION SYSTEM: A CASE OF HILL WOMEN IN NORTH WESTERN HIMALAYAN REGION

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### Abstract

Gender analysis of hill rural women's livelihood identifies a 'triple burden' of work in the productive, reproductive and social



spheres due to out migration of male counterparts for search of jobs. In this study quantification of women's drudgery in crop production activities has been the issue of concern for providing technological interventions benefits among them. In the attempt to obtain and analyze the prioritized drudgery experiences in crop production activities through drudgery assessment and reduction, various ergonomically sound farm tools and implements were provided for crop cultivation and intercultural operations. The study was conducted in North Western Himalayan Region and physiological ergonomics evaluation was done for traditional method and with improved technological support with three replications of fifteen minutes work cycle without rest pause. Various postural ergonomics techniques were used for quantification of musculoskeletal issues with traditional method and postural evaluation of farm women while performing various agricultural activities. Data for indicating musculoskeletal disorders were analysed by android based mobile applications available for ergonomics assessment of postural and biomechanical assessments viz. Rapid Entire Body assessment (REBA), Rapid Upper Limb Assessment (RULA) and Human Physical Drudgery Index (HPDI). After quantification, gender friendly agricultural tools were demonstrated for weeding activities done by women in nutri-gardens. Weeding efficiency was evaluated using traditional and improved agricultural tools developed for women. Different types of weeding tools were evaluated in vegetables crops (Brinjal, Tomato, Capsicum, cauliflower and Okra). The weeding operation with improved technology was observed advantageous in terms of time, quality and weeding efficiency for all the crops.

## **IMPACT OF CLIMATE CHANGE TOWARDS GLOBAL FOOD SECURITY**

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### **Abstract**

Agriculture is not only a source of the commodities food but importantly also a source of income. In a world where trade is possible at reasonably low cost, the crucial issue for food security is not the availability of food but monetary and nonmonetary resources at the disruption of the population are sufficient for everyone to access the adequate quantities of food. Food security is one of the leading concerns associated with climate change. Climate change affects food security in complex ways. Its impacts on crops, livestock, forestry, fisheries and aquaculture also cause grave social and economic consequences as reduced income decreasing livelihoods, trade and adverse health impact. While, net impact of climate change depends not only on the extent of climatic shocks but also on underlying vulnerabilities. As per study of Food and Agriculture Organization (2016), both biophysical and social weakness determines the overall impact of climate change on food security. The magnitude of impacts of extreme events on agriculture is already high. FAO's recent analysis 25 percent of all economic losses and damages inflicted by medium- and large-scale climate hazards such as droughts, floods and storms in developing countries affect the agriculture sectors. Towards this provide opportunity to integrate food security and nutrition as key objective as well as need to better planning. Keeping this in mind effort made in agriculture food security is the priority.

## **SOCIAL-ECONOMIC CONSTRAINTS TOWARDS WOMEN ENTERPRISES GROWTH IN UTTAR PRADESH**

**Priya Vashishtha<sup>1</sup>, Vinita Singh<sup>2</sup> and Netrapal Malik<sup>3</sup>**

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### **Abstract**

Women entrepreneurs can play powerful role in confidence building and creating awareness in other women to promote self-reliance. On the other hand, women entrepreneurs have to face more problems than men entrepreneurs. Their risk taking ability is less. They have to devote more time to the family and maintain a balance between their family responsibility and business. Other obstacles faced by women entrepreneurs include being accepted as a women in business, lack of role model, lack of professional interaction, difficulties in gaining the confidence of their clients and suppliers, lack of adequate training and lack of related experience the primary objective of this study was to examine the problems faced by women entrepreneurs. The present study was carried in district Hardoi. District Hardoi was divided 18 blocks. One block 52 was selected in this study area. From this selected block, three villages Tatyora, Rukmanapur and Mujahidpur were selected and Thus, three namely Tatyora Rukmanapur and Mujahidpur were selected and 50 respondents were selected purposively from each village. Thus total 150 respondents were selected for the study. The data were analyzed and tabulated according to statistically.



Further after studying it was found that the rank order of economic constraints viz; lack of family income restrict the women not for doing any extra/other enterprises was ranked I with mean score value of 2.78 and the rank order of social constraints viz., negative social attitude about women role outside the home was ranked-I with mean score value of 2.64.

## **ADDRESSING THE IMPACTS OF CLIMATE CHANGE ON SOIL HEALTH AND ITS MANAGEMENT**

**Priyanka Kumari<sup>1</sup>, Sunil Kumar<sup>1</sup>, Ragini Kumari<sup>1</sup>, Shailja Kumari<sup>1</sup> and Gopal Kumar<sup>1</sup>**

<sup>1</sup>*Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Sabour, Bhagalpur-813210, Bihar*

### **Abstract**

Climate change threatens to build the potential for soil degradation, soil erosion, reduce soil quality, decreases agricultural productivity and adversely impact on food security as world wide and it quite possible in the 21<sup>st</sup> century there will be extreme serious problems. Now, questions are arising, how to mitigate the impact of climate change on various soil properties. Soil health is declining day to day due to injudiciousness used of numerous chemical likes' fertilizer, pesticides, weedicides, rodenticides and fungicides which is direct effects the physical, chemical and biological properties of soil. The soil health is known as the ability of soils to perform agronomic functions including sustainable production of crops and animals along with maintaining and improving the environment of locality. Key indicators of soil health are texture, structure, colour of soil, tilth, biodiversity of microbes, infiltration rate, draughtiness, internal drainage and resilience against perturbation. We will be introducing of different approaches or techniques to manage soil health depend upon soil capacities and its functions. The objective to improving of soil health in agricultural and forestry ecosystems to upgrade and support biomass production while further developing soil water quality with mitigating and adapting to changing environment. Soil natural matter (SOM) is a vital indicator of agricultural productivity and overall soil health and strongly impacts on quality, function and health of soil. It can improve by soil management practices likes crop diversity, minimum disturbance of soil, application of organic amendments and agronomic practices include organic fertilization, incorporation of residues. Improvements in soil health, along with increase in availability of water and nutrients, builds soil adaptability against hostile climate change and promoting or supporting of soil health is additionally appropriate to progressing Sustainable Development Goals of the U.N. like alleviating poverty, reducing hunger, improving health, and promoting economic development. Conclusion that, it is major challenge of soil management to support agricultural productivity without hampering the others ecosystem services.

## **TLC AND OIL PERCENTAGE ANALYSIS OF INDIAN MUSTARD (*BRASSICA JUNCEA*) SEEDS**

**Purnima Sogarwal<sup>1</sup>, Anubhuti Sharma<sup>2\*</sup>, Shoor Vir singh<sup>1</sup> and Meghna Garg<sup>1</sup>**

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### **Abstract**

Thin layer chromatography is an easy and efficient technique to evaluate the pharmacological properties and quality of the oil. The extraction (with Soxhlet apparatus) and TLC analysis of 2 varieties of mustard i.e. PM21 and PM30 was carried out. TLC was performed on silica gel plate (stationary phase). The solvent used as mobile phase for TLC was n-propanol: ethyl acetate: H<sub>2</sub>O (7:1:2). Folin Ciocalteu's was used as the spraying agent. It revealed a blue color spot at R<sub>f</sub>: 0.40. Under UV light blue green spots were also observed. This confirmed the presence of phenolics in the oil. Oil percentage for both the varieties was also calculated. The oil percentage for PM30 seeds was 35.4% and for PM 21 seeds, it was 32%. The above result is an indicator of good quality of oil.

## **INSECT PROOF NET TUNNEL—AN EFFECTIVE TECHNIQUE FOR HEALTHY AND DISEASE FREE VEGETABLE SEEDLING PRODUCTION**

**R.K. Jhade, P.L. Ambulkar, D.C. Shrivastava and Surendra Pannase**

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### **Abstract**

A vegetable nursery is a place or an establishment for raising or handling of young vegetable seedlings until they are ready for more permanent planting. The seeds of some vegetable are first sown in the nursery beds and the seedlings from these beds are later transplanted in the main field. Vegetable seedling production under protected structures is an improved technology. The



seedlings are protected from abiotic (temperature, rain, wind, humidity, etc.) and biotic (diseases and insect-pests) stresses. The vegetable seedlings grown under open condition are always affected by several diseases and pests, resulting in diseased, virus infected and poor-quality plants. Hence, the vegetable seedlings are grown under Insect-proof net tunnel (40 -50 mesh) an effective technique for healthy and disease free vegetable seedling production. It is a farmer feasible and can be made as temporary or permanent. The structure is clad with 40-50 mesh UV stabilized insect proof nylon or rust proof metal net. The net effectively provide barrier for the entry of harmful insect-pest and vectors of diseases. Insect proof net tunnel in vegetable seedling production is minimizes the seedling production costs. This technology used for raising the seedlings like tomato, chilli, capsicum, cabbage, cauliflower, broccoli, Cucurbits, etc. It is prerequisite to raise virus free healthy seedlings of the vegetable crops by covering the nursery beds with insect proof net (40-50 mesh). These structures checked the pests and other vector population effectively. Reduce the healthy and virus free seedling production cost. The production of healthy and quality seedlings are of paramount importance for increasing the yield potentials and meeting the ever increasing demands of vegetables at reasonable prices, generating additional income, creating more employment opportunities for both rural and urban youth and women folk.

## **EFFECT OF LONG TERM FERTILIZATION ON DIFFERENT FORMS OF SULPHUR IN SOYBEAN-SAFFLOWER CROPPING SEQUENCE UNDER VERTISOL**

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*AICRP on Long Term Fertilizer Experiments*

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### **Abstract**

Long term effects of chemical fertilizers and manuring in soybean - safflower cropping sequence were monitored after 14<sup>th</sup> years of rotation on different forms of sulphur in Vertisols. Soil sulphur forms viz. Organic sulphur, Non Sulphur, Water Sulphur, Heat Soluble Sulphur, Total Sulphur as influenced by application of long term use of different inorganic and organic fertilizers differed significantly among each other in soybean-safflower cropping sequence. However, results obtained from 14<sup>th</sup> years of experimentation indicated that the maximum Sulphur forms Organic sulphur (37.13 kg ha<sup>-1</sup>), Non Sulphur (118.28 kg ha<sup>-1</sup>), Water Sulphur (12.28 kg ha<sup>-1</sup>), Heat Soluble Sulphur (1.459 kg ha<sup>-1</sup>), Total Sulphur (153.65 kg ha<sup>-1</sup>) were observed in the treatment 100% NPK+FYM @ 5t ha<sup>-1</sup> followed by only application of organic manuring as Only FYM @ 10 t ha<sup>-1</sup> Organic sulphur (35.28 kg ha<sup>-1</sup>), Non Sulphur (117.63 kg ha<sup>-1</sup>), Water Sulphur (11.33 kg ha<sup>-1</sup>), Heat Soluble Sulphur (1.454 kg ha<sup>-1</sup>), Total Sulphur (152.43 kg ha<sup>-1</sup>). Lowest soil sulphur forms were recorded in absolute control treatment, fallow treatment and application of without sulphur fertilizer treatment 100% NPK-Sulphur. The different forms of sulphur were increasing with increasing inorganic fertilizers dose, results showed that 150% NPK fertilizer dose recorded higher sulphur forms as compare to 50% NPK and 100% NPK fertilizer dose in soybean-safflower cropping sequence.

## **MANAGEMENT OF CROP RESIDUES IN THE CONTEXT OF CONSERVATION AGRICULTURE**

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### **Abstract**

The amount of surplus crop residue available in India is about 141 million tons a year, out of which 92 mt is burned each year. The two crops as rice and wheat are produced large amount of residues in India. Processing of agricultural produce through milling and packaging also produces substantial amount of residues. Crop residues are natural resources with tremendous value to farmers. These residues are used as animal feed, composting, thatching for rural homes and fuel for domestic and industrial use. About 25% of nitrogen, 25% phosphorus, 50% of sulphur and 75% of potassium uptake by cereal crops are retained in residues, making them valuable sources of nutrients (NPMCR, 2014). However, a large portion of the residues, about 141 Mt, is burned in field primarily to clear the field from straw and stubble after the harvest of the preceding crop. The problem is severe in irrigated agriculture, particularly in the mechanized rice-wheat system. The main reasons for burning crop residues in field include unavailability of labour, high cost in removing the residues and use of combines in rice-wheat cropping system especially in the Indo-Gangetic plains (IGP). Primary crop





types whose residues are typically burned include rice, wheat, cotton, maize, millet, sugarcane, jute, rapeseed-mustard and groundnut. Farmers in northwest India dispose a large part of rice straw by burning *in situ*.

## **CHALLENGES AND OPPORTUNITIES IN AGRI-ENTREPRENEURSHIP IN INDIA**

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### **Abstract**

The agriculture sector provides food for 1.3 million people in India as well as supports over 60 % of the population for their livelihood and plays a crucial role in the sustainable growth of the country's economy. Traditionally, agriculture has been seen as a low-tech industry with limited dynamics, largely controlled by a huge number of small families, which over the years paid attention to improving crop yield rather than looking at it as a money-making module. Many farmers are forced to migrate to cities for their livelihood in the wake of lower remuneration or unbearable crop losses on accounts of volatile market dynamics or unpredictable weather conditions. There is a need to bring about transformational changes in the agriculture sector by making farmers as agri entrepreneur. They need to consider their activities as businesses. Entrepreneurship should be encouraged in agriculture as innovation would not just help farmers improve crop productivity, more profit but create new avenues of employment generation for rural youth as well. Entrepreneurship helps in developing nation's economy, improves production and labour market, builds job opportunities and finally increases employment rate which influence most of the developing countries including India to encourage and support entrepreneurship for their economic development and reduced unemployment. India focused on entrepreneurial development which is nothing but an organized and regulated growth of an individual towards an entrepreneur employing cultivating entrepreneurial skills in terms of knowledge, financial support, marketing and other approaches. There is ample scope in different sectors of Agri business like agri inputs, farm mechanization, agri clinic, processing, trading, value addition, retail marketing, micro financing, logistics etc. In spite of unlimited growth potential in this field there are several challenges also. The most important is dependency on favorable weather conditions. In the absence of local entrepreneurship, the opportunities in agriculture are high jacked by outsiders, particularly the urban businessmen and traders, leading to misuse and lack of employment for the farmers. Although it is very difficult to change the mind set of farmers towards Agri Entrepreneurship but some progressive farmers may be attracted for establishing start-ups in this field.

## **PERFORMANCE EVALUATION OF DIFFERENT WHEAT CULTIVARS UNDER IRRIGATED CONDITION OF JAMMU (JAMMU AND KASHMIR)**

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### **Abstract**

A field trial was conducted during the year 2014-16 to evaluate the performance of different wheat cultivars under irrigated conditions of Jammu. The experiment was laid out in Randomized Complete Block Design with three replication having a plot size of 4 x 3 m (12 m<sup>2</sup>) at the experimental fields of KVK Jammu, R.S.Pura, SKUAST-Jammu. Six promising wheat cultivars (HD 3086, WH-1105, WH-1080, WH-1021, HD-2967 and PBW-550) were evaluated for their growth and yield performance under recommended package of practices. Cultivar HD-3086 surpassed all the cultivars in this study for growth and yield performance followed by HD-2967, WH-1105 and PBW-550. HD 3086 produced highest grain yield (48.2 q ha<sup>-1</sup>), followed by HD-2967 (46.4q ha<sup>-1</sup>), WH-1105 (43.5 q ha<sup>-1</sup>), PBW-550 (42.1 q ha<sup>-1</sup>) and WH-1021 (38.5q ha<sup>-1</sup>) while lowest grain yield (34.3q ha<sup>-1</sup>) was recorded in WH-1080. Hence, cultivar HD 3086, HD-2967, WH-1105 and PBW-550 were the most promising cultivars, while WH-1021 also showed promising performance.

## **THERAPEUTIC MANAGEMENT OF CANINE LICK GRANULOMA**

**Satish Kumar, Mrigakshi Yadav and Kavita**

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### **Abstract**

Canine acral lick dermatitis or lick granuloma is characterized by firm, raised, ulcerative skin plaques resulting from a



compulsion to lick caused due to dermatologic or psychogenic affections. A 6 year-old, Labrador was presented to Teaching Veterinary Hospital, Pantnagar, with a history of a nonhealing wound located on the left foot over the lateral aspect of the metatarsal bone due to vigorous licking. Dog was treated with cefixime @ 10 mg/Kg B.W, antifungal fluconazol @ 10 mg/Kg B/W and omega-3 supplementation along with open wound healing with topical antifungal-antibacterial ointment. Dog showed significant improvement following one week of treatment.

## THERAPEUTIC EFFICACY OF BERENIL AGAINST BABESIA CANIS IN GERMAN SHEPHERD DOG-A CASE STUDY

Aakanksha Harit, Deepesh Sharma, Stuti Vatsya, Rajeev Ranjan Kumar and Sudhir Kumar

Department of Veterinary Parasitology, College of Veterinary and Animal Sciences, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar

### Abstract

Canine babesiosis is a tick borne disease distributed worldwide including India. It is caused by *Babesia gibsoni* or *Babesia canis*. A 5 years old male German Shepherd dog from Unchapul region of Haldwani, District Nainital, Uttarakhand presented with tachypnea, tachycardia, anorexia, haematuria and lethargy. It was suspected for haemoprotozoan infection. Blood sample was collected and brought to the Department of Veterinary Parasitology, Pantnagar for further examination. The microscopic examination was performed using thin blood smear stained with Giemsa Stain. Peripheral blood smear examination revealed the presence of the proplasms of *Babesiacanis* in RBC. The dog was treated with intramuscular injection of diminazine acturate @ 3.5mg/kg body weight in divided doses. The clinical signs start to disappeared 3 days post treatment and completely disappeared 7days post-treatment. Blood sample examined on 7<sup>th</sup> day was found negative for the piroplasmic stage.

## HEMATOLOGICAL ALTERATIONS DUE TO THEILERIOSIS IN BUFFALO: A CASE REPORT

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### Abstract

Theileriosis is a tick borne haemoprotozoan disease and is one of the economically important diseases of tropical countries like India. The *Theileria* species is an obligate parasite which infects wide range of livestock as well as wild animals and is transmitted by Ixodid tick of genera *Hyalomma anatolicum anatolicum* in India. A 7 year old female buffalo was presented to Teaching Veterinary Hospital, College of Veterinary and Animal Science, Pantnagar with a history of pyrexia, frothy discharge from nose and mouth, anorexia and less water intake since last 3 days. Blood sample of cattle brought to the Department of Veterinary Parasitology, CVA and Sc, Pantnagar for the microscopic examination and haematological alteration. Confirmatory clinical diagnosis was made using blood smear examination stain with Giemsa Stain. Microscopic examination revealed the presence of annular form of piroplasmic stage of *Theileria* sp. in RBC. The hematological findings in the present case are Hb (6.2gm%), PCV (22%), TEC ( $4.6 \times 10^6/\mu\text{l}$ ) and TLC ( $6.8 \times 10^3/\mu\text{l}$ ). The findings revealed normocytic hypochromic anemia with leucopenia. Hematological alterations should be considered in initiation of therapeutic treatment for the favorable outcome of the disease.

## DEVELOPING ARTIFICIAL INOCULATION TECHNIQUES FOR FOOT ROT OF FINGER MILLET CAUSED BY *SCLEROTIUM ROLFSSII* SACC

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### Abstract

*Sclerotium rolfsii* is most destructive, soil-borne, polyphagous and a facultative parasitic fungus causes foot rot in finger millet (*Eleusine coracana*), which is an emerging threat to finger millet production in irrigated and high rain fall areas of southern



parts of Karnataka. However, data concerning the artificial inoculation techniques of pathogen is not comprehensive. In the present investigation, ten different artificial inoculation techniques were tried to identify the best artificial inoculation technique. Among them insertion of a toothpick at collar region of plant was found significantly effective in inducing foot rot disease with minimum incubation period (6th DAI), less number of days was taken for production of sclerotial bodies (11th DAI), faster rate of infection (0.12) with highest mean AUDPC value (250.00) followed by clipping wooden clip at basal portion of plant and the root dip for 30 minutes in *Sclerotium* suspension was found to be the least effective to induce the disease. When compared to the check (incorporation of giant culture into soil) and control (without inoculation) under greenhouse condition.

## EVALUATION OF BOTANICALS AGAINST *SCLEROTIUM ROLFSII* SACC. CAUSING FOOT ROT IN FINGER MILLET UNDER *IN VITRO*

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### Abstract

Finger millet is one of the major nutria millet of the India, it ranks third among after sorghum and pearl millet. It has high nutritional quality and one of the hardiest crop. Among the different fungal diseases, foot rot of finger millet caused by *Sclerotium rolfsii* is one of the important emerging disease in heavy rainfall area. Under adverse condition dormant sclerotial bodies are formed and act as main source of primary inoculum. The present investigation was carried out to evaluate the efficacy of botanicals at AICRP on Small Millets Plant Pathology laboratory by using *Agave americana* leaf, *Curcuma longa* rhizome, *Parthenium hysterophorus* leaf, *Azadirachta indica* leaf, *Daturastramonium* leaf, *zingiber officinale* rhizome, *Aloe barbadensis miller* leaf, *Allium sativum* bulb, *Eucalyptus globulus* leaf, and *Gliricidia sepium* leaf extracts and these were evaluated at 3 different concentrations (5, 15, and 25%). Among the botanicals tested against *Sclerotium rolfsii*, *Agave americana* leaf extract showed maximum inhibition of the sclerotium mycelia growth (53.3%, 63.8%, 86.6% at 5, 15, 25% concentration respectively), followed by *Curcuma longa* (51.1%, 61.1%, 67.2% at 5, 15, 25% concentration respectively). While least inhibition of mycelium was observed (13.3%, 22.2%, 26.6% at 5, 15, 25% concentration respectively) in *Gliricidia sepium* leaf extract.

## BIOREMEDIATION OF THIAMETHOXAM BY *BACILLUS SAFENSIS* ISOLATED FROM SOIL

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### Abstract

Pesticides persist in the environment resulting in severe toxicity to animals as well as humans. The outcome of their persistent behaviour is biomagnification, contamination of water resources, destruction of soil, loss of biodiversity etc. Thiamethoxam, a neonicotinoid insecticide has been found to be effective for the control of various insect pests. Bioremediation of thiamethoxam is a promising approach to degrade the pesticide from soil. Isolation and identification of soil microbes was conducted for bioremediation of thiamethoxam contaminated soils. Soil samples collected from different wheat growing fields in Punjab with extensive use of pesticide history served as a source of pesticide degrading microbes. Enrichment of microbial biomass obtained from thiamethoxam contaminated soil, in Dorn's broth containing thiamethoxam as sole source of carbon, resulted in growth of bacterium. The bacterium isolated was identified as *Bacillus safensis*, on the basis of morphological characteristics, biochemical characteristics and 16S ribosomal DNA sequence homology. Clay loam soil samples were fortified with thiamethoxam @ 50, 100 and 150 mg kg<sup>-1</sup> along with 45 × 10<sup>7</sup> microbe cells. Each treatment was replicated thrice and from each fortified (insecticide + microbes) sample, 15 g soil sample was taken at 3, 7, 14, 28, 35, 42 and 49 days after inoculation. The soil samples were evaluated for total thiamethoxam degradation using LC-MS/MS. Among metabolites, clothianidin was found to be the main metabolite followed by nitroguanidine and 1-methyl-3-nitroguanidine. N-desmethyl-thiamethoxam was not produced in any of the samples. Total thiamethoxam residues were not found to follow the first order kinetics. From the



present study, we concluded that inoculation of *Bacillus safensis* isolated from in situ contaminated soil could result in most effective bioremediation, thus, relieving soils from thiamethoxam residues.

## FLUFENACET AS A NEW HERBICIDE AGAINST LITTLESEED CANARY GRASS IN WHEAT

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<sup>1</sup>Assistant Floriculture Officer, Department of Floriculture, Kashmir; <sup>2</sup> Professor Cum Senior Scientist, Department of Agronomy, Punjab Agricultural University, Ludhiana

### Abstract

A field experiment was carried out at Student's Research Farm, Department of Agronomy, Punjab Agricultural University, Ludhiana, during 2013-14 and 2014-15. Flufenacet at 200, 250 and 300 g ha<sup>-1</sup> each as pre-emergence (Zadoks 00), at 21 [(early-POST) (before first irrigation) (Zadoks 13)], 28 [(POST) (Zadoks 21)] and 35 days after sowing (DAS) [(POST) (Zadoks 23)], pendimethalin at 750 g ha<sup>-1</sup> (Pre-emergence) (Zadoks 00), clodinafop at 60 g ha<sup>-1</sup> at 35 DAS (Zadoks 23) (Zadoks *et al* 1974), weed free check (hand hoeings) and weedy check. The experiment was established in randomized complete block design with three replications. Pendimethalin and clodinafop were included as standard checks for comparing with efficacy of flufenacet. Flufenacet 250-300 g ha<sup>-1</sup> application as PRE (Z00) and early-POST (Z13) and recommended pendimethalin 750 g ha<sup>-1</sup> as PRE reduced *P. minor* panicle density to 17-37 m<sup>-2</sup> and 18-24 m<sup>-2</sup>, respectively, compared to clodinafop 60 g ha<sup>-1</sup> at 35 DAS (105-106 m<sup>-2</sup>) and weedy check (132-144 m<sup>-2</sup>). These herbicides reduced the *P. minor* biomass to 18-52 g m<sup>-2</sup> compared to 151-164 g m<sup>-2</sup> in clodinafop and 217-228 g m<sup>-2</sup> in the weedy check. Delaying application of flufenacet to Z21 and Z23 stages recorded poor weed control. In 2013-14, all the treatments provided excellent crop safety. While as, in 2014-15, flufenacet 250 g ha<sup>-1</sup> applied at Z00, Z13 and 300 g ha<sup>-1</sup> at Z00, Z13 and Z21 stage caused injury to wheat plants. The extent of crop injury increased with increase in dose of flufenacet from 250 to 300 g ha<sup>-1</sup> when application was made at same crop stage. The injury symptoms persisted for a longer period at 300 g ha<sup>-1</sup> and fully recovered at 250 g ha<sup>-1</sup>. In 2014-15, flufenacet 250 g ha<sup>-1</sup> as PRE and at 21 DAS (before first irrigation) reduced wheat plant height by 2-13% at 45 DAS but the crop recovered later on; flufenacet 300 g ha<sup>-1</sup> reduced wheat plant height by 31-44%. Flufenacet application at 250 g ha<sup>-1</sup> as PRE and at 21 DAS provided wheat grain yield (4.2-4.5 t ha<sup>-1</sup>) similar to recommended pendimethalin 750 g ha<sup>-1</sup> (4.5 t ha<sup>-1</sup>) and was significantly higher yield than clodinafop 60 g ha<sup>-1</sup> in both years; its residues in soil and wheat grain at harvest were below the detection limit.

## PATHOGENICITY AND BIOEFFICACY OF TWO MOST PROMISING WP FORMULATIONS OF *METARHIZIUM ANISOPLIAE* (METSCHNIKOFF) SOROKIN AGAINST *S. LITURA*

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### Abstract

The use of entomopathogenic fungi due to their amenability to mass production has emerging future in insect pest management. The green muscardine fungus, *Metarhizium anisopliae* (Metschnikoff) Sorokin, Moniliales, Moniliaceae is potential entomopathogenic candidates for biological control. Metschnikoff (1879) was first to isolate fungus *M. anisopliae* from the larvae of grain weevil and also first to demonstrate entomopathogenic nature of the fungus against chrysomelid, curculonid and scarabaeid beetles. *M. anisopliae* capable of infecting more than 100 different insect pests belonging to a variety of insect orders viz., Orthoptera (Grasshopper and Cockroaches), Homoptera (Spittle bug, *Nilaparvata lugens*) and Lepidoptera (*Helicoverpa armigera*, *S. litura*). *M. anisopliae* is characterized as green muscardine fungus due to green colour of the sporulating colonies. It forms a mycelia mat on cuticle of insects. The infective unit is conidia or blastospores which germinate and forms short germ tube bearing appresoria with infective peg attach to cuticle. The infective peg penetrates in layer of integument by enzymatic dissolution of chitin and protein. It reaches the haemocoel and internal organs and insect is filled with fungus. The death of insects occurs due to obliteration of tissues, also production of toxins (destruxin A,B,C,D,E) and proteolytic enzymes secreted by the fungus. Infected insects show symptoms like loss of appetite, decreased irritability, general or partial paralysis, loss of mobility, discolouration and mummification. Laboratory studies with two promising WP formulations by spraying the dilution series (2.0, 3.0, 4.0, 5.0, 6.0 and 8.0 g/l of water or at concentrations 0.01, 0.015, 0.02,





0.025, 0.03 and 0.04%, respectively) of each of the formulations and formulation without adjuvants having three replications in completely randomized design were carried out in the biological control laboratory, Dept. of Entomology, MPKV, Rahuri with an object to evaluate the pathogenicity and bio-efficacy of promising WP formulations *Metarhizium anisopliae* (Metschnikoff) Sorokin. The results revealed that the  $LC_{50}$  values of formulation A1( $M_{30}S_{1/1}C_{1/2}$ ) were 0.0174% and 0.0180% for II and III instar larvae of *S.litura*, respectively. The  $LC_{50}$  values of formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) were 0.0149% and 0.0163% against II and III instar larvae of *S.litura*, respectively.  $LC_{90}$  values of formulation A1( $M_{30}S_{1/1}C_{1/2}$ ) were 0.0940% and 0.1088% for II and III instar larvae of *S.litura*, respectively. The  $LC_{90}$  values of formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) were 0.0928% and 0.1006% against II and III instar larvae of *S.litura*, respectively. It indicated that among two larval instar of *S.litura* tested, II instar of larvae was most susceptible to *M.anisopliae* WP formulation A1( $M_{30}S_{1/1}C_{1/2}$ ) and B1( $M_{30}S_{1/1}H_{1/1}$ ). The data indicated that  $LT_{50}$  values of formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) at concentration 0.02 per cent was 7.78 days and it was the lowest time registered for 50 per cent kill of II instar larvae compared to formulation A1( $M_{30}S_{1/1}C_{1/2}$ ). The formulation A1( $M_{30}S_{1/1}C_{1/2}$ ) recorded 8.12 days for 50 per cent kill of second instar larvae of *S.litura*. In case of III instar larvae of *S.litura* formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) registered 8.68 days while formulation A1( $M_{30}S_{1/1}C_{1/2}$ ) recorded 9.22 days for 50 per cent mortality of larvae of *S.litura*. Thus, it was established from the results that formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) taken minimum time to kill 50 per cent population and was most virulent. The mortality at 10 DAT was higher in the formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) registered highest (85.0%) mortality of II instar larvae. However, it was at par with formulation B1 0.03% (82.50%), A1( $M_{30}S_{1/1}C_{1/2}$ ) 0.04% (82.50%) and A1( $M_{30}S_{1/1}C_{1/2}$ ) 0.03% (77.50%). The next promising treatments were formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) and A1( $M_{30}S_{1/1}C_{1/2}$ ) both 0.025% (72.50 and 70.0%). The concentration 0.01% of both formulations showed up to 50.0 per cent mortality. In case of third instar larvae the highest (82.50%) per cent mortality in formulation B1( $M_{30}S_{1/1}H_{1/1}$ ) 0.04% was recorded which was on par to formulation A1( $M_{30}S_{1/1}C_{1/2}$ ) 0.04% (80.0%), B1 0.03% (77.50%), and A1 0.03% (77.50%).

## EFFECT OF WEATHER PARAMETERS ON POPULATION FLUCTUATION OF SAPOTA FRUIT FLIES, BACTROCERA SPP.

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### Abstract

Studies on population dynamics of fruit flies (*Bactrocera* spp.), infesting sapota were conducted at N.M.College of Agriculture, Navsari (Gujarat) by using methyl eugenol trap and per cent infested fruits. The study revealed that, fruit fly population prevailed throughout the year. The maximum population of *Bactrocera* spp. was observed during the last week of March to last week of August month which coinciding with fruiting period of sapota. The fly population decreased during September to February. The trap catch study carried out for two years was correlated with abiotic factors and it was found that, it showed positive correlation with temperature (maximum, minimum and average), relative humidity (maximum, minimum and average), rainfall and wind velocity.

## PATHOGENICITY AND BIOEFFICACY OF AS FORMULATIONS OF *BEAUVERIA BASSIANA* AGAINST MEALY BUG

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### Abstract

The entomopathogenic fungi causing diseases to the insects and are practically more significant as they are epizootic in nature. Also they have the advantage of ease of production and contact action which allow direct penetration of the host cuticle



without ingestion. Agastino Bassi, 1835 was the first to demonstrate that entomopathogenic fungus, *B. bassiana* could cause an infectious disease in silkworm and suggested the concept that, an infectious micro-organism might be used to control insect pests. More than 750 species of entomopathogenic fungi, representing 100 genera are currently known. *Beauveria bassiana* (Balsamo) Vuillemin is cosmopolitan fungus useful for the control of various insect pests of different crops. *B. bassiana* causes mycosis in 175 host insects from order Lepidoptera, Coleoptera and Hemiptera. This fungus also found useful for the control of various sucking pests of important field crops. *B. bassiana* was pathogenic to mango mealy bug, *Drosicha mangiferae*. Laboratory studies with two promising AS formulations of *B. bassiana* by spraying the dilution series (2.0, 3.0, 4.0, 5.0, 6.0 and 8.0 g/l of water or at concentrations 0.014, 0.021, 0.028, 0.035, 0.042 and 0.056%, respectively) of each of the formulations and formulation without adjuvants having three replications in completely randomized design were carried out in the biological control laboratory, Dept. of Entomology, MPKV, Rahuri with an object to evaluate the pathogenicity and bio-efficacy of two promising AS formulations of *B. bassiana* against mealy bug (*M. hirsutus*). The results revealed that the  $LC_{50}$  value for formulation A was 0.030% ( $11.9 \times 10^6$  cfu  $ml^{-1}$ ) when it was 0.023% ( $9.72 \times 10^6$  cfu  $ml^{-1}$ ) for formulation B against mealy bug. It indicated that the formulation B was more virulent than formulation A against the mealy bug. The data elucidated that the  $LT_{50}$  values of formulation A and formulation B were 10.47 days and 9.74 days, respectively. Thus it was evident from this results that formulation B was more virulent than formulation A as it taken slightly less time to kill 50 per cent test population of mealy bug. At 10 DAT, the cumulative mortality was highest (80.00 %) in the formulation B 0.056 % which was on par with formulation A 0.056 % (76.67 %), 0.042 % (73.00 %), 0.035 % (70.00 %) and 0.028 % (66.67 %) and formulation B 0.042 % (76.67 %), 0.035 % (73.33 %) and 0.028 % (70.00 %). The lowest (56.67 %) kill was noticed in control (*B.b.* alone). At 14 DAT, the highest (86.67 %) mortality of the pest was observed in formulation A 0.056 % and formulation B 0.042 and 0.056 %. However, these were at par with formulation A 0.028 % (80.00 %), 0.035% (83.33 %) and 0.042 % (83.33 %) and formulation B 0.028 % and 0.035 % (83.33%). Control (*B.b.* alone) caused the lowest (63.33 %) mortality.

## SUPPLEMENTATION IN MUSHROOM (*PLEUROTUS FLORIDA*) CROPS AND ITS IMPACT ON YIELD POTENTIAL AND BIOLOGICAL EFFICIENCY

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### Abstract

Mushroom supplementation is an agronomic practice which consists of the appliance of nutritional amendments to the substrates employed for mushroom cultivation. Diversenutrients (Nitrogen and Carbohydrate etc) rich supplements like Lentil husk, Pigeon pea husk, Pea husk and Gram husk individually and proportionally have been evaluated in crops with a substantial impact on mushroom yield and biological efficiency; on the other hand, there is still controversy regarding the nutritional requirements of mushrooms and the necessity for the development of new commercial additives. The adding of external nutrients increases the productivity of some low-yielding mushroom varieties. We have conducted our experiment and find that, the maximum yield in first, second and third flush was obtained from mushroom bed supplemented with pigeon pea husk with lentil husk (1:1) treated bags (401.33g, 400.33g and 401.33g respectively). The maximum total yield was also obtained from pigeon pea husk with lentil husk (1:1) treated bags (1203.00 g) followed by lentil husk, gram husk, pea + pigeon pea + gram + lentil husk (1:1:1:1), gram husk with pigeon pea husk (1:1), pigeon pea husk, gram husk with lentil husk (1:1), pea husk with pigeon pea husk (1:1), lentil husk with pea husk (1:1) and pea husk which was 1179.33 g, 1133.67 g, 1128.67 g, 1069.00 g, 1029.00 g, 970.33 g, 966.33 g, 917.67 g and 903.67 g respectively. All supplemented mushroom bags were performed significantly better yield and biological efficiency (BE) as compared to unsupplemented mushroom bags (896.67 g).

## EFFECT OF COMBINATION AND ALONE APPLICATION OF BIO AGENT, FUNGICIDE AND NITROGEN FOR THE MANAGEMENT OF SPOT BLOTCH AND ROOT ROT OF WHEAT

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### Abstract

A trial was conducted to determine combination and alone effect of *Trichoderma harzianum*, fungicide and Nitrogen



application. Number of diseases occurs in wheat in northern region of India however soil borne and foliar pathogens significantly reduced wheat (*Triticum aestivum* L.) yield. The aim of this work was to evaluate the combined and alone effect of *T. harzianum*, fungicides and N fertilization, A study including combinations of (i) *T. harzianum* (ii) N fertilization rates 80, kg ha<sup>-1</sup> (iii) fungicide treatments ( Bavistin, 0.5 % foliar spray ) . The most common foliar disease in the trial was spot blotch of wheat caused by *Bipolaris oryzae* and root rot of wheat caused by *Polymyxagruminis*. Alone application of *T. harzianum* significantly reduced root rot of wheat disease severity and incidence which recorded as 36.78% and 35% for each season, respectively compared to combinations . Among the all treatment Fungicide + N application significantly reduced disease severity and incidence of spot blotch of wheat were recorded as 65% and 53% respectively, on average over both years compared to alone application of fungicide followed by disease was less severe in combination of fungicide + Bio agent 54% and 43% respectively application plots which compared to among the all treatments. Among the all treatments were greater yield was recorded in combination of *T. harzianum* + N fertilization treated plots with 160 kg ha<sup>-1</sup> over control followed by *T. harzianum* + fungicide application treated plots were recorded as 120 kg/ ha finally concluded that the combination treatment is better than alone application of bio agent, fungicide and N fertilizer application.

## INDUCED SYSTEMIC RESISTANCE IN TOMATO AGAINST FUSARIUM WILT CAUSED BY *FUSARIUM OXYSPORUM* F. SP. *LYCOPERSICI*

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### Abstract

Tomato [*(Solanum lycopersicum* L.) Krust] also known as “Love apple” ranked third among vegetables next to potato and onion in terms of production but ranks first among canned vegetables. The crop is cultivated across all countries in the field as well as in protected conditions. It is one of the most valued vegetable crops of the world owing to its high nutritive value as well as its antioxidant curative properties. The crop is attacked by number of diseases caused by fungi, bacteria, virus, mycoplasma, nematodes etc. and causes huge amount of crop loss across the world. Among the diseases, Fusarium wilt caused by *Fusarium oxysporum* f. sp. *lycopersici* is one of the world's most important disease of tomato. The pathogen survives for a long time in the diseased plant parts, soil and on some other hosts. The management of disease can be done through the cultural practices, biological control, chemical measures and use of resistance variety. However, there is a search of a new and innovative method to manage various diseases is induced resistance. The minimum wilt incidence was recorded in calcium chloride treated plants which was 4.40, 7.24 and 9.12% at 5, 10 and 15 days of pathogenic inoculation which was followed by ferric chloride, hydrogen peroxide and DPHP treated plants. The result indicates that the maximum amount of soluble protein contents was found in calcium chloride treated leaves which were 35.06 mg/gm, 35.96 mg/gm and 33.20 mg/gm of fresh leaves at 5, 10 and 15 days of pathogen inoculation. The soluble protein contents of control-1 were 16.40 mg/g, 17.88 mg/g and 19.12 mg/g at 5, 10 and 15 days after pathogen inoculation. Similarly the maximum amount of phenol content was found in calcium chloride treatment with a value of 2.29 mg/gm, 2.72 mg/gm and 2.60 mg/g of leaves against 1.20 mg/gm, 1.46 mg/gm and 1.3 mg/g in case of control 2 at 5th, 10th and 15th days of pathogen inoculation. The result indicated that highest germination percentage was noted in calcium chloride treated seed (85%) followed by hydrogen peroxide (82%) and DPHP (81%), which are significantly higher than control-1 (72%) and Control-2 (68.5%). Similarly, maximum shoot and root length were found in calcium chloride treated seeds showing 26.5 cm and 11.66 cm against 19.75 cm and 7.55 cm in case of control 1 and 13.55 cm and 6.31 cm in case of control 2. The hydrogen Peroxide, DPHP and Metalaxyl treated plants were showing 25 cm, 23.15 cm and 22.53 cm in case of shoot length whereas, in case of root length it was 10.46, 9.63 and 8.23 cm respectively.

## EMPOWERING RURAL YOUTH THROUGH ICT

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### Abstract

Agriculture plays an important role for our nation in providing food security and removing unemployment in rural youth for the



increasing population. ICT in agriculture is an emerging field focusing on the enhancement of agricultural and rural development in India. Information and Communication Technologies have been for a long time and its initiatives have promoted development in deficient areas by providing an avenue to increase youth's participation in agriculture and make it a more profitable and sound career path. But, at present situations because of lack of information the farmers and rural youth were forced to leave rural areas and move towards urban life. As information is the key to development, power and civilization. ICT (Information and Communications Technology) is an umbrella term that includes any communication device or application, encompassing radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. By creating awareness among rural youth with the help of extension agencies, professionals from various disciplines and other organization the usage of ICT tools had made to share a lot of practical information among the rural and farmers and ultimately results in increase in outreach for development work. Thus, ICT's could make agriculture a more promising career path for millions of rural young people by increasing their potentiality in market access, agricultural mechanization, provide weather forecasts and link farmers to information networks. Involvement of rural youth in agriculture would be helpful for making appropriate policies to make agriculture attractive for the next generation and to eradicate poverty in India.

## **EFFECT OF DATE OF SOWING ON GROWTH AND YIELD OF MAIZE (VAR. SMC 7) UNDER KASHMIR CONDITIONS**

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### **Abstract**

A field demonstration was conducted at KVK Budgam farm to study the effect of date of sowing on SMC 7 variety of maize on plant height, dry matter accumulation, heat units (GDD), yield and yield attributes of the crop. The results revealed that, days taken to different phenological stages, yield components, seed and biological yield were affected significantly by treatments. Early sowing on 10<sup>th</sup> April has taken more number of days and growing degree days to reach maturity as compared to 20<sup>th</sup> and 30<sup>th</sup> April. Highest yield components (cob length, cob girth, grains/cob and 100 seed weight) and seed yield were recorded in early sowing. Greater returns and highest B:C ratio was observed in 10<sup>th</sup> April as compared to other two treatments.

## **AGRIPRENEURSHIP : A TOOL FOR ECONOMIC DEVELOPMENT**

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### **Abstract**

India is an agrarian country with a vast availability of land for agricultural activities and its allied enterprises. Agriculture all over the world is going through a phase of transition. In this ever-changing scenario, agriculture is taking a new shape and expanding its scope beyond the limits of mere crop cultivation and animal husbandry for the livelihood of the rural population. Activities like diversification, value addition, precision farming, high-tech agriculture, agripreneurship, global marketing, organic farming, etc. are gradually getting due attention of people involved in redefining agriculture. Therefore, it is the time to create awareness among the people about new technologies for adoption in the field of Agriculture and economic development. The Agripreneurship is the concept of the Entrepreneurship in agricultural sector, brought in by the people with innovative ideas to develop the existing practices for a better productivity in various businesses to support the existing farmers and other individuals depending on the agriculture. It is all about supplying them with various latest technologies, giving awareness on the incentives available and upgrading the agricultural process from their old techniques to increase yield from crops. This concept has a great scope especially in a country that is blessed with a natural resource for farming and conducting agricultural activities. Being an agrarian economy, we are still not well developed in the technological aspects of this sector. This is leading to a lot of losses, indebtedness of farmers, many other social problems as a great no. of the population is dependent on the agricultural and its allied activities. So, for better development, the technology should go hand by hand without which this sector remains the same as always. Agripreneurship Development will help the economy to leverage





the identified strengths and to achieve tremendous growth in primary sector and to contribute for rural and urban development. It also helps in achieving balanced economic growth in India. The government has to make policies for focused Agripreneurship Development and establish developmental organizations to support the process. Agripreneurship Development is going to give excellent results at rural level and macro level also. Agripreneurship Development is going to give excellent results at rural level. In this context, it is widely believed that sustainable agribusiness ventures can promote job-led economic growth in rural areas Agri-preneurship in sustainable agriculture like natural farming, organic farming, eco-friendly agriculture *etc.* has the potential to transform the face of rural India.

## EFFECT OF DIFFERENT MEDIA SOURCES ON *SCLEROTIUMROLFSII* MYCELIAL GROWTH CAUSING FOOT ROT DISEASE IN FINGER MILLET

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### Abstract

*Sclerotiumrolfsii* is the most devastating pathogen causing foot rot of finger millet especially in tropical and sun-tropical countries, where high temperature prevails during monsoons. An attempt was made to study the best suitable medium and physiological factors such as pH, Nitrogen source and Carbon source on the growth of pathogen. Among the eight different media tested OMA, RSA, CDA medium were found to be highly supportive for the pathogen growth resulting full growth (90mm) in 72 hours and least growth was observed on SDA (40mm). Among different pH studied, maximum growth was reported at pH 4.0 and pH 5.0 and least growth was observed at pH 8.0. Maximum fungal growth was found on yeast extract (63.5) and on urea no growth was found, by applying urea disease can be controlled. Among Carbon source fungal growth was found to be vigorous on mannitol where radial growth was observed maximum (82mm) within 72 hours and least growth was observed on lactose (24 mm)

## EVALUATION OF PARAQUAT DICHLORIDE 24% SL FOR TOTAL WEED CONTROL IN SUGARCANE

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### Abstract

Sugarcane is an important cash crop of India and plays major role to boost farmers' economy in Indo-gangetic plains of Uttarakhand. In sugarcane crops weeds are major constraints which directly and indirectly effect the sugarcane growth as well as production. Due to more spacing between rows and delay in germination provides favourable conditions which promote weed population and density. For controlling all types of weed in spring planted sugarcane, a field experiment was conducted for two years in 2016-17 and 2017-18 at Sugarcane Research Centre (GBPUAandT), Kashipur, Uttarakhand. Mixed population of grassy, broad leaf weeds and sedges were observed in the experimental plot. Among grasses, *Echinochloa spp.*, *Digitaria sanguinalis* and *Eleusine indica* were found. *Physalis minima*, *Portulaca oleracea* and *Commelina benghalensis* were recorded under broad leaf weeds. Population of others weed such as *Dactyloctenium aegyptium*, *Celosia argentia*, *Cleome viscosa*, *Euphorbia spp.* and *Phyllanthus spp.* was observed in less number in the experimental plots. *Cyperus rotundus* was the only sedge in experimental area with maximum density. Different weedicides and their doses were tested to control the weeds. The experiment comprised of nine treatments was evaluated in randomized block design keeping three replications. The treatments were T<sub>1</sub>: Untreated check, T<sub>2</sub>: Paraquat dichloride 24% SL @ 240 g a.i./ha, T<sub>3</sub>: Paraquat dichloride 24% SL @ 360 g a.i./ha, T<sub>4</sub>: Paraquat dichloride 24% SL @ 480 g a.i./ha, T<sub>5</sub>: Paraquat dichloride 24% SL @ 960 g a.i./ha, T<sub>6</sub>: 2, 4-D Dimethyl Amine salt 58% SL @ 3500 g a.i./ha, T<sub>7</sub>: Atrazine 50% WP @ 2000 g a.i./ha, T<sub>8</sub>: Halosulfuron methyl 75% WG @ 67.5 g a.i./ha and T<sub>9</sub>: Manual hand weeding (weed free). Treatments were applied as inter-row application at 2-3 leaf stage of weeds using hoods. The pooled results revealed that highest population of weed species was observed in the treatment of untreated check followed by Halosulfuron methyl 75% WG. Paraquat dichloride 24% SL @ 480 g a.i./ha



registered minimum weed population and it was found significantly superior over rest of herbicidal treatments. Significantly lowest total weed dry matter (43.5 and 53.6 g/m<sup>2</sup> at 30 and 45 days after planting) and highest weed control efficiency (83.0 and 81.4 g/m<sup>2</sup> at 30 and 45 DAP) was recorded in Paraquat dichloride 24% SL @ 480 g a.i./ha treated plots and it was followed by its lower dose rate i.e. Paraquat dichloride 24% SL @ 360 g a.i./ha i.e. 57.4 and 62.3 g/m<sup>2</sup> weed dry matter and 77.5 and 78.3 % WCE at 30 and 45 days after planting. Highest cane yield (82.66 t/ha) was recorded in the treatment of hand weeding (weed free) which was significantly higher over rest of the treatments. Among the herbicidal treatments, significantly higher cane yield (80.44 t/ha) was found in the treatment Paraquat dichloride 24% SL @ 480 g a.i./ha over rest of the treatments and it was followed by Paraquat dichloride 24% SL (@ 360 g a.i./ha i.e. 76.81 t/ha. Hence, it is concluded that Paraquat dichloride 24% SL @ 480 g a.i./ha applied as post emergence is very effective to control total weeds in spring sugarcane crop.

## SCREENING OF WHEAT (*T. AESTIVUM* L.) GENOTYPES FOR RESISTANCE AGAINST CEREAL CYST NEMATODE (*HETERODERA AVENAE*)

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### Abstract

Large number of plant parasitic nematodes are known to cause damage to various cereals such as wheat, barley, etc. One such economically important pests of cereals is the cereal cyst nematode (*Heterodera avenae*) that causes significant yield losses in different cereals including wheat (*T. aestivum*) across the world. Wheat genotypes such as AC KARMA, SC 8021 V2, WH147, WH-542, C-306, Chinese spring, Giza, HUW468, M6 (MARION), OPATA (MARION), PBW 343 and RAJ MR1 were used for screening of this nematode. Screening experiments were conducted successively for two years (2017-18 and 2018-19) in controlled environmental conditions with minimum of five and maximum of seven replicates in different batches. Plants were infected with J2 stage juveniles. Phenotypic data in terms of number of cysts were obtained by counting cysts from the roots and soil of all the infected plants with the help of stereomicroscope. The results showed that the genotypes (Raj MR1, and WH 542) were found to be resistant and genotypes such as WH147, OPATA were found to be susceptible or moderately susceptible. Highest cyst count (up to 57) was found in the genotype AC KARMA, showing that it is highly susceptible. These results more or less can be helpful in studying the resistance mechanism and pathogenicity of this nematodes in wheat that can further facilitate the development of resistant wheat line against *H.avenae*.

## STUDY OF TOTAL PHENOLIC CONTENT IN THE ROOTS OF RESISTANT AND SUSCEPTIBLE WHEAT GENOTYPES INFECTED WITH *PRATYLENCHUS THORNEI*

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### Abstract

*Pratylenchus thornei*, a root-lesion nematode is a migratory, polyphagous endoparasite that feeds on a wide range of crops including cereals, legumes, vegetables, coffee, etc. This nematode is distributed worldwide, and cause significant damages in wheat crop. Yield loss caused by *P. thornei* has been reported up to 62%. In India, *P. thornei* as reported in the fields of chickpea, rice and it may be an emerging pathogen of wheat. Besides, using nematicides and crop rotation, growing resistant or tolerant cultivars would be a more effective, economic and eco-friendly method to control this nematode. After nematode infection, plants activate their defence system and secrete phenols as secondary metabolites that have been considered as an important biochemical compound that protects plants from pathogens. In the present study, we used RAJ MR1 as resistant and WH147 as susceptible genotype and estimated the total phenolic contents in roots of both wheat genotypes. The total phenolic content was estimated at two time points i.e 4 dpi (days post-infection) and 8 dpi. Although, phenolic content was recorded very less in each genotype, it may be due to a very less time period after infection. The difference in phenolic content between resistant and susceptible was observed non-significant. But the values of phenolic content was observed slightly higher in the infected roots of wheat genotypes as compared to the non-infected roots of the same genotypes. These results suggest that the infected plants activate their defence system and secrete more phenols to protect them from nematodes.



## APPROACH TOWARDS FINDING THE RESISTANCE IN WHEAT FOR THE CEREAL CYST NEMATODE (*HETERODERA AVENAE*)

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### Abstract

Wheat is an important crop for human nutrition in the world, and is grown on 218.4 million hectares. Wheat is also one of the major and strategic crops in India in terms of economy, nutrition and employment. Cereal cyst nematode (CCN; *Heterodera avenae* Wollen weber) is one of several important soil borne pathogens of wheat, which causes severe economic damage to its production. In India, *H. avenae* causes 'Molya disease' in wheat, and distributed in many states such as Rajasthan, Haryana, Punjab, western Uttar Pradesh, Himachal Pradesh and Jammu and Kashmir. There is a critical and unmet need for strong host plant resistance for this nematode in wheat to effectively inhibit or decrease its reproduction. Besides, using nematicides and crop rotation, growing resistant or tolerant cultivars is a more effective, economic and eco-friendly method to control the nematodes. It is possible to develop resistant cultivar through conventional breeding however, it is time taking process. With recent advancement in molecular biology and genomics, it could be done in lesser time. Genome-wide association study (GWAS) has become a tool to identify the marker-trait associations (MTAs), like CCN resistance. Single locus and multi locus methods (CMLM, FarmCPU, MLM, BLINK, etc.) are available for GWAS. The associated markers with important MTAs can be further utilized for wheat improvement through various molecular breeding approaches.

## IMPACTS OF CLIMATE CHANGE AND NUTRIENTS AVAILABILITY ON FOOD SECURITY

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### Abstract

The two vital challenges to food security are climate change and nutrient availability. Climate change affects the variation in the length of crop growing season and also increases the incidences of extreme events which results in slowdown of output. It can also drastically affect incomes of farmers and thus impeding their access to food. These diversifications in climate not only affect soil directly but can also be a source of green house gases and ultimately affect our food security. Studies shows that these green house gas emissions can be reduced by the approaches like effective use of fertilizer, adoption of zero tillage and management of water used for irrigation purpose. Climate change has an impact on water shortage too which can be mitigated by effective management of water. Making nutrient availability more prompt to plants can ensure food security. The moisture content in soil proved to be an essential factor in making available the nutrients for plants. Soil water plays a major role in acquisition of mineral nutrients by plant roots from soil. Therefore, applying nutrients and irrigation after considering the available moisture status of the soil can help in better performance of the crop. As India's grain production is vulnerable to climate change, diversifying the crops that a country grows can be an effective way to adapt its food production systems. To ensure food security, better management of available resources is required. One such measure for water and soil management can be the use of wastewater as an irrigation source. Wastewater from rural and urban agricultural sources are great source of irrigation, nutrients and organic matter. It has potential of fertilizer cost saving and minimum soil pollution. Thus, keeping these viewpoints, these studies can help in coping the problem of food insecurity due to climate change.

## ROLE OF FARM WOMEN IN PADDY CULTIVATION IN UTTARA KANNADA DISTRICT OF KARNATAKA

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### Abstract

Agriculture plays a vital role in living life. Agriculture contributing 16.38 per cent GDP to the Indian economy. Almost 70 percent of Indian population depends on agriculture. Paddy is one of the major growing crops in India. India is the second largest agricultural producer of paddy in the world. Paddy cultivation is the most important agriculture operation in the



country not only in terms of food security but also in the diet, economy, Employment, culture and history of India. Women's work in paddy cultivation has become more visible. Women are actively participating in paddy cultivation -operations. The present study on "Role of cultivation has been conducted in two taluks of Uttara Kannada district (Mundgod and Siddapur taluk)" during 2020. From each taluk 60 farm women were purposively selected and making a Sample of 120. The personal interview method was used to collect the data. The study revealed that, most of the farm women were aged between 35-50 years (81.50%), were completed primary education level, from nuclear medium sized families (51.66%), and had a medium level of farming experience. And medium level of social contact (73-33%), regarding participation of farm. Women in paddy cultivation operation, it could be seen that most of the farm women actively involved in weed management (100%) followed by transplanting (91.66%), harvesting (86.70%), seed treatment (76.66%), marketing (19.10.1). Family size farming experience, age and social contact had a positive significantly correlated with participation of farm women in paddy with cultivation operations.

## OPTIMIZATION OF NUTRIENTS FOR PRODUCTIVITY ENHANCEMENT OF GROUNDNUT (*ARACHISHYPOGAEA* L.) IN NORTHERN DRY ZONE OF KARNATAKA

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### Abstract

Groundnut (*Arachishypogaea* L.) is an important legume used as oilseed as well as a food crop in India and grown in most of the states on all soil types, under tropical to subtropical climates. It is unpredictable, heavy feeder legume and is cultivated worldwide on almost all types of soil. For "optimization of nutrients for productivity enhancement of groundnut (*Arachishypogaea* L.) in northern dry zone of Karnataka" field experiment was conducted during rabi 2013-14 and 2014-15 at Agriculture Extension Education Centre, Lingsugur under University of Agricultural Sciences, Raichur, Karnataka. Experiment was laid out in randomized block design with seven treatments replicated thrice. Among the different nutrient combinations, application of PoP + MgSO<sub>4</sub> @ 20 kg ha<sup>-1</sup> + Boron 2.5 @ kg ha<sup>-1</sup> + Multinutrient spray (3 ml per litre of water) recorded significantly higher pod yield of groundnut (1855 kg ha<sup>-1</sup>) when compared with all the treatments except application of PoP + MgSO<sub>4</sub> @ kg ha<sup>-1</sup> + Boron 2.5 @ kg ha<sup>-1</sup> + Multinutrient spray (1828 kg ha<sup>-1</sup>) and PoP + MgSO<sub>4</sub> @ 20 kg ha<sup>-1</sup> + Boron 2.5 @ kg ha<sup>-1</sup> (1765 kg ha<sup>-1</sup>). Application of package of practice alone recorded significantly lower pod yield of groundnut (1586 kg ha<sup>-1</sup>) which was on par with application of PoP + MgSO<sub>4</sub> @ 15 kg ha<sup>-1</sup> (1602 kg ha<sup>-1</sup>), PoP + MgSO<sub>4</sub> @ 20 kg ha<sup>-1</sup> (1639 kg ha<sup>-1</sup>) and PoP + MgSO<sub>4</sub> @ 15 kg ha<sup>-1</sup> + Boron @ 2.5 kg ha<sup>-1</sup> (1698 kg ha<sup>-1</sup>). Pod weight, kernel weight and haulm yield were followed similar trend. Maximum gross returns, net returns and benefit cost ratio was realized with application of PoP + MgSO<sub>4</sub> @ 20 kg ha<sup>-1</sup> + Boron 2.5 @ kg ha<sup>-1</sup> + Multinutrient spray (3 ml per litre of water) followed by PoP + MgSO<sub>4</sub> @ kg ha<sup>-1</sup> + Boron 2.5 @ kg ha<sup>-1</sup> + Multinutrient spray (1828 kg ha<sup>-1</sup>). Balanced application of combinations of macro, secondary and micronutrients is very much essential to boost the productivity and profitability of groundnut cultivation in red soil in northern dry zone of Karnataka.

## PRE-SOWING TREATMENTS FOR ENHANCEMENT OF GERMINATION INTAMARIND (*TAMARINDUSINDICA*) SEEDS

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### Abstract

Tamarind (*Tamarindusindica*) is often quoted as a dry ecosystem species but also suitable for less drought conditions. It has high nutritional, medicinal, industrial and cultural importance for rural communities. The abundance of the species is declining in our country whereas Juveniles' introduction into farmlands may be needed to ensure conservation. For propagation purpose fast germination of seeds is very much necessary. To fasten germination of tamarind seeds, experiment was conducted at College of Agriculture, Bheemaryanagudi during 2019-20. The experiment was laid out in completely randomized design with three replications. All the pretreatment applied in the tray experiment proved effective, and concentration of KNO<sub>3</sub> treatment gave the highest germination percentage, early germination, root length and shoot length is





long, high vigour index, high fresh and dry weight compared to all other treatments like control, cold water treatment, hot water treatment, KNO<sub>3</sub> treatment, GA<sub>3</sub> treatment, cowdung slurry treatment and biodigester treatment. This was due to easy movement of water and nutrients as well as the absorption by the root system.

## DESIRABLE PROVEN PARENTS FOR EARLY MATURITY AND HIGH SUGAR CONTENT IN SUGARCANE

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### Abstract

The selection of potential parents in hybridization plays an important role in crop improvement. In sugarcane crop improvement programme evolving superior plant types with improved cane and sugar yield along with their all fitness. There is urgent need to increase the sugar production per unit area. In recent past early and high sugar varieties have plays important role in increasing sugar yield and recovery and therefore, drawing attention of cane growers and sugar. The genotypes of first clonal generation (C1) planted at Sugarcane Research Station, Kashipur were screened out for earliness and sugar content during two consecutive years 2016-17 and 2017-18. In this experiment genotypes were selected and planted in 6 meters long rows spaced at 90 cm under recommended fertility level. During 2016-17 and 2017-18 out of total 2560 and 720 seedlings, 1024 and 468 genotypes were selected and tested respectively against four standards viz. Co 0238, Co J 64, Co S 767, Co Pant 97222. Total 1492 genotypes were derived from bi-parental crosses made at Sugarcane Breeding Institute, Coimbatore. H.R brix of all the genotypes was recorded in the month of October and also compared with standard. The pooled result showed that out of total 25 genotypes had H.R brix more than 19% in the month of October. Genotypes showing characters of earliness were shortlisted cross wise for further studies. A perusal of parentage of these shortlisted genotypes revealed that they were derived from the cross combination such as BO 91 X Co1148, LG 99183 X BO 130, CoS 8436 X Co 89003, BO 91 X Co Pant 97222, Co 98010 X Co 775, Co LK 8102 X Co 62198, Co 0238 X Co1148. There is a need of an hour to incorporate wide/contrast parents in future breeding programmes for combining early maturity with high sugar yield and also for broadening the genetic base.

## ASSESSMENT OF INTEGRATED PEST MANAGEMENT (IPM) MODULES ON CONTROL OF FALL ARMYWORM, *SPODOPTERA FRUGIPERDA*, AGAINST MAIZE CROP

S.S. Sarangdevot, Shilpi Verma, P.S. Naruka, C.P. Pachauri and J.P. Singh

KrishiVgyan Kendra, Neemuch (M.P)

### Abstract

Fall Army Worm (FAW) emerged in India as a major threat to maize production in the country. Considering that maize is the staple crop of the country, any major shock in its production can have negative consequences on the food security of the entire country. *Spodoptera frugiperda*, commonly known as Fall Armyworm (FAW), is amongst the most terrifying pests of which unexpectedly appeared and spread expeditiously. Estimates of maize crop losses due to this pest are vital in order to compare the effect of these losses with the convenient of controlling FAW and suggest pertinent controlling technology and methods. India is predominantly an agrarian nation thus, maize is grown substantially. A field experiment was conducted at Farmers' field during Kharif 2020-21 on hybrid Maize. Module 1 - Chloretranilprole 19.8 % + seed treatment (4 gm/kg seed) with thiomethoxam 19.8% + 28 bird percher/ha + 37 frugiperda pheromone trap/ha + spray of emactin benzoate 5% SC 200gm/ha along with Module 2- Chloretranilprole 19.8 % + seed treatment (4 gm/kg seed) with thiomethoxam 19.8% + 28 bird percher/ha + 37 frugiperda pheromone trap/ha + spray of *bacillus thuringiensis* 1000gm/ha were evaluated and compared with untreated control plot against the Fall army worm, *Spodoptera frugiperda* for their efficacy. IPM Module -1 was found most effective followed by Module -2. Maximum seed yield (45.45 q/ha) was recorded in the plot treated with with IPM Module-1 followed by Module - 2. The lowest yield of 40.40 q/ha was recorded in untreated control. The marginal higher net return (Rs. 37092/ha) was found with IPM Module - 1 followed by IPM Module -2. The C: B ratio of various insecticide treatments was calculated and the maximum C:B ratio (1:0.97) was recorded from IPM Module - 1 treatment followed by IPM Module - 2 (1:0.90).



## DOSE OPTIMISATION AND EFFICACY OF THIACLOPRID AGAINST SOYBEAN GIRDLE BEETLE (*OBEREOPSIS BREVIS*)

S.S. Sarangdevot, Shilpi Verma, P.S. Naruka, J.P. Singh and C.P. Pachauri

Krishi Vigyan Kendra, Neemuch (M.P)

### Abstract

Soybean [*Glycine max* (L.) Merrill] has established its recognition as both a pulse and an oilseed crop and ranks third among oilseed crops grown in India. Nationally it occupies an area of 110.65 lakh ha and its production is 69.29 lakh MT. Madhya Pradesh ranks first in soybean production in India. Area and production of soybean in Madhya Pradesh are 56.12 lakh ha and 34.12 lakh MT, respectively. Soybean is mostly grown for oil (20%) and protein (40%) around the world. The crop is infested by more than 275 insect pests on different plant parts throughout its growth stage and about a dozen of them have been reported causing serious damage to soybean from sowing to harvesting. The low productivity of soybean is attributed to abiotic and biotic stress like drought and insect pests attack. A field experiment was conducted at Farmers' field during Kharif 2020-21 on Soybean variety JS-20 34. Thiacloprid 21.75% SC @ 750 ml/ha along with chlorantraniliprole 18.5% SC @ 150 ml/ha and Triazophos 1.5 l/ha were evaluated and compared with untreated control plot against the Girdle Beetle, *Obereopsis brevis* Swed. for their efficacy. Thiacloprid 21.75% SC @ 750 ml/ha was found most effective followed by chlorantraniliprole 18.5% SC. Maximum seed yield (13.40 q/ha) was recorded in the plot treated with thiacloprid 21.75% SC @ 750 ml/ha followed by chlorantraniliprole 18.5% SC. The lowest yield of 11.85 q/ha was recorded in untreated control. The marginal higher net return (Rs. 33000/ha) was found with thiacloprid 21.75% SC @ 750 ml/ha followed by chlorantraniliprole 18.5% SC. The C:B ratio of various insecticide treatments was calculated and the maximum C:B ratio (1:1.6) was recorded from Thiacloprid treatment followed by chlorantraniliprole (1:1.5).

## FORMULATION OF MULTIGRAIN IDLI-MIX FOR COMBATING HIDDEN HUNGER AMONG PRESCHOOL CHILDREN

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### Abstract

The scenario of hidden hunger or deficiency of micronutrients among the children aged between 6 and 59 months including anaemic situation is more pathetic and infant mortality rate is higher. Another alarming condition is Vitamin D deficiency, despite receiving plentiful sunshine, at least 70% of Indian population suffering from Vitamin D deficiency which could lead to calcium deficiency, bone diseases, and even cardiovascular diseases. Among other factors infant and young child feeding practices have a greater effect on the current grave situation. The supplementary food provided to the child is generally cereal-based with or without small quantities of other nutrients. Now a day another trend of fast food like chips, wafers, biscuits, sweetened fruit and non-fruit drinks are easily available which play a great role in protein and other micronutrient deficiency among children. Several strategies may be used to improve the nutritive value of the food to be given to the children below five years of age. Multi-grain approach is a most common and convenient way of formulating the desired quality of nutrients. Food and Agriculture Organization (FAO) in its food guidelines for under-five children suggested developing homemade weaning and supplementary foods based on local food resources as an essential driver of food system sustainability ensuring good health. In this context idli premixes were formulated with an aim to provide calcium-iron rich food options with other nutrients for preschool children combating dual burden of malnutrition. Three types of idli premixes were formulated from different proportion of grains especially rich in calcium and iron. Finger millet, Grain amaranth, Black gram and Garden cress seed flour were blended in different proportion viz. 60:10:20:10 (T<sub>1</sub>), 40:25:30:5 (T<sub>2</sub>) and 40:30:20:10 (T<sub>3</sub>) to provide about 1/3<sup>rd</sup> of the Recommended Daily Allowance (RDA) of the particular nutrient for preschool children. These premixes were evaluated for organoleptic parameters and the selected premix was evaluated for nutritional composition as well as shelf life. Results of organoleptic evaluation showed that all the idli mixes were found to be well accepted and T<sub>2</sub> was found to be the best and the values differ significantly (p<0.05) in all the parameters. Calcium and iron content of the idli mix was estimated to be 256.41 mg and 10.10 mg per 100g respectively and was rich in other vital nutrients. Organoleptic evaluation of the formulated premix showed good acceptability scores across the storage period. Moisture content of developed idli premix was increased from 8.69 to 8.89 percent and peroxide value was increased



from 0.58 to 1.78 meq/kg of fat from 30 days to 90 days of storage and was within the permissible limit led by ISI. i.e. peroxide value should not exceed 10 meq/kg of extracted fat even after storage period of three months.

## A TINY MOLECULE $\gamma$ -AMINO BUTYRIC ACID (GABA) IN ABIOTIC STRESS TOLERANCE

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### Abstract

$\gamma$ -amino butyric acid (GABA), a four carbon non protein amino acid is a significant component of the free amino acid pool in most prokaryotic and eukaryotic organisms. The stressed plants recorded increased GABA synthesis and it plays multiple functions under non-stressed and stressed conditions. GABA is a well recognized protein and was reported in potato tuber and after one year it was identified in mammalian brain. It is synthesized *in vivo* by a metabolic pathway known as GABA shunt pathway and it is a crucial metabolite intermediate of nitrogen and amino acid biosynthesis, it stimulates plant growth and alleviates stress *via* up regulating antioxidant defense system. Therefore it contributes to enhancing shelf life due to higher antioxidant activity and quality of the crop during storage and it also significantly increases the germination of the seeds, fresh weight and biomass of the seedlings. The total fatty acid content including saturated and unsaturated fatty acid content also enhanced due to the application of exogenous GABA. The crop yield and quality of the crop were also increased by applying GABA to the crops. The intracellular GABA can induce the expression of signaling and metabolism associated genes involved in the regulation of plant growth, plant vigor and increased stress tolerance. The positive effects finally may also influence the quality and quantity of yield. Exogenously applied GABA can enhance endogenous GABA, thus providing beneficial effects on plant development and plant growth. The positive impact on plants and the ability to induce stress tolerance in plants suggests that GABA could be considered as a tool to improve the quality of agricultural crops. However, for a better understanding of the potential of GABA more work in a broad range of crops and especially under field conditions is necessary.

## USE OF MOBILE APPLICATION IN MITIGATING DRUDGERY IN AGRICULTURAL ACTIVITIES: DESIGNING AND VALIDATION

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### Abstract

In the era of technological advancement, use of mobile phones is increasing at a greater pace. In the pandemic situation, people are benefiting with these technological networks and the use of smart phones in facilitating the agriculture is a great decision. Following this pathway different mobile applications are being developed by various research institutes for helping the farmers. Farmers and the agricultural workers always face difficulty and stress in their working environment due to the less availability of improved farming equipments. These causes the farmers to undergo physical stress and health hazards relating to agricultural based occupational risks. The agricultural operations require intensive muscular force including human energy which affects their work efficiency. Besides these the drudgery experienced by them in their daily work life causes to lowering their working efficiency. The present study deals with the development and validation of mobile application to mitigate the drudgery encountered and recommend adequate postural support for reducing biomechanical load of the body. To serve the decision support system a mobile application named “HPDI Ergon” has been developed with the aim to make the farmers comfortable in their working environment. In this app farmers are assessed based on different physiological parameters and conclusion is drawn regarding their efficiency and constraints. The app is developed using Android Studio and Java programming language. The data generated by different analysis is stored in the database which is implemented using SQLite database. Based on the results of all the ergonomic analysis and drudgery analysis, recommendation on improvement of physiological and postural load is provided to mitigate drudgery.



## **SAMPOORNA KAU MULTIMIX AS AN INNOVATIVE TECHNOLOGY FOR IMPROVING CROP PRODUCTIVITY IN DIFFERENT CROPS**

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### **Abstract**

Crop specific multi-nutrient mixtures were developed at Regional Agricultural Research Station, Pattambi, Kerala Agricultural University for foliar application in different crops to address the micronutrient deficiencies observed commonly in Kerala Fields. Experiments were conducted to evaluate their suitability for improving yield by correcting nutrient deficiencies. The multi-nutrient mixtures developed for rice, banana and vegetables (Sampoorna KAU multimix) contain potassium, magnesium, sulphur, zinc, copper, boron and molybdenum. The field experiments conducted at RARS Pattambi and fields of farmers with different schedules of application indicated that the foliar application of Sampoorna KAU Multimix (rice) 0.5% at two days before pulling out in the nursery and 1.0% twice at tillering and panicle initiation (PI) stages emerged as the most effective schedule in increasing yield in rice. The recommendation for Sampoorna KAU multimix (banana) is: foliar application @10 g per litre at 2, 4, 6 and 8 months after planting in banana and foliar application @0.5% at 30, 45 and 60 DAS (days after sowing) in direct sown vegetables and at 15, 30 and 45 DAP (days after planting) in transplanted vegetables. The Front line demonstrations conducted in different locations in the state indicated that the foliar application of the mixtures could increase the productivity by more than 20%. As foliar application decreases the nutrient load in to the environment, multi nutrient mixtures offer a sustainable option for management of nutrient deficiencies.

## **EFFECT OF CHEMICAL FERTILISERS, NATURAL FARMING AND ORGANIC FARMING ON PADDY IN GODAVARI DELTA IN KHARIF**

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### **Abstract**

A field experiment was conducted at RARS, Maruteru on Nutrient management practices in paddy from 2017-2019 during kharif season with the variety MTU 1075. The treatments included are 7 treatments replicated thrice with randomised block design. The treatments are T1 : Control, T2 : 100% RDF, T3: 50% RDF + Organic farming, T4 : 100% Organic farming, T5 : 100% natural farming, T6 : 50% RDF + natural farming, T7 : 100% RDF + 100% organic farming + 100% natural farming. The recommended dose of fertilisers for kharif season are 90:60: 60 N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg/ha. The results indicated that the highest grain yield and straw yield during kharif season recorded with the application of 100% RDF along with organic farming and natural farming. The nutrient content did not show any significant difference among the treatments but the maximum nutrient uptake was with the application of 100% RDF along with organic farming and natural farming. The available nitrogen, phosphorus, potassium and micronutrients also with the same treatment. pH, EC did not show any significant difference among the treatments.

## **LIGHT EMITTING DIODE (LED) TECHNOLOGY FOR CROP PRODUCTION**

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### **Abstract**

Since the beginning of time, plants have relied on the sun to feed and grow through the method known as photosynthesis. Now, plants can be commercially grown without any sun light. LED lighting is replacing the sun due to advanced





technological innovations Light emitting diode (LED) technology has become widespread in all areas where lighting is important as a light source for agricultural crops in controlled environment facilities (greenhouses and indoor production). The monochromatic nature of LEDs can help prevent physiological disorders that are common in indoor environments, and help reduce incidence of pest and disease pressure in agriculture, which could ultimately increase crop production efficiency by preventing crop losses. This innovative farming model allows them to harvest 20-25 times a year by using “light recipe” optimized for their produce, using 85 percent less energy. The result will be an increase in crop yields and reduced operating costs while providing consumers with fresh vegetables throughout the year. The advent of LED technology has enabled the fine tuning of light recipes optimized to the needs of specific crops. Plants’ sensitivity to light is very different from the human eye, so plants use certain wavelengths of light more efficiently and respond in a different way to different sets of wavelengths.

## **ADVANCED BREEDING TECHNIQUES FOR ABIOTIC AND BIOTIC STRESS IN CHILLI**

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### **Abstract**

Capsicum crop is highly affected by biotic/abiotic stresses. Beside abiotic stresses, several pathogens also damage crop by causing several diseases that damage Capsicum plants severely. To overcome these stresses, plants adapted several mechanisms such as the production of osmoprotectant, proline, galactinol and raffinose, and the reduction of reactive oxygen species. In the last decades, most of the pepper breeding programs have been addressed to the development of cultivars or hybrids against a wide range of pathogens and pests. Despite the efforts made, the exploitation of Capsicum germplasm (pre-breeding materials, landraces, wild relatives and closed related species) and its use in breeding programs for biotic stress resistance still represent challenging tasks. Approach like gene pyramiding strategies can allow the accumulation of resistance genes in a single genotype and creates more durable and broad-spectrum mechanisms. Genomics for the understanding of the molecular basis of resistance. Next-generation sequencing technologies can be applied to provide whole-genome sequencing of pathogens and to develop high-throughput molecular markers for QTL mapping and gene discovery helps in dissecting the complex issue of plant stress tolerance. Now a day’s advanced breeding approaches are used rather than conventional because they are laborious and time-consuming. A number of genes and quantitative trait loci (QTLs) involved in stress tolerance mechanism have been identified. The epigenetic mechanism has also been reported to control biotic and abiotic stresses which should also be explored by Capsicum researchers. To better understand the genetic mechanism of correlated stresses, multiparental population like NAM and MAGIC population should be developed and used. Capsicum genetic material for biotic and abiotic stress resistance/tolerance, biochemical composition, and other traits would greatly enhance the understanding of genetic mechanism regulating those traits besides improving Capsicum varieties for sustainable production in addition to fulfilling the worldwide demand and increase the income of the farmers.

## **EFFECT OF MICRO IRRIGATION ON WATER USE EFFICIENCY AND YIELD OF BITTER GOURD IN SUMMER SEASON**

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### **Abstract**

Field experiment was conducted to study the effect of water use efficiency and yield of micro irrigation systems in sandy loam soil. The experiment consisted of three treatments namely drip irrigation, pitcher irrigation and basin irrigation methods (farmer’s practice) for bitter gourd crop in 100m<sup>2</sup> plot size each with seven replication. For pitcher irrigation methods, earthen pitcher of 30 liter capacity. (4000 pitcher/ha) was taken. Four hole size 3mm diameter has been made at 1/4<sup>th</sup> height from bottom of the pitcher and Cotton thread was fixed was in the hole. The pitcher was buried 1/3<sup>rd</sup> of its height in the soil and placed between four plants of bitter gourd in the alternate row. For drip irrigation methods a tank having capacity of 200 liter and dripper discharge of 2 lit/hr. Size for each plant was taken. For surface irrigation method, basin size of 100m<sup>2</sup> was used.



The result revealed that pitcher irrigation gave higher water use efficiency, yield and net profit in comparisons with drip and basin methods of irrigation in summer season of bitter gourd. Thus, it may be concluded that there was a considerable saving of water and increase in the yield of bitter gourd in case of pitcher irrigated crop as compared to drip surface irrigation.

## IMPACT OF MULCHING ON AGRICULTURE

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### Abstract

As the population of India is continuously rising we have to adopt some means of sustaining our agricultural growth and it can be done through conservation farming. The best way out is the adoptions of the age old practice of Mulching in our agricultural fields. Mulching has become an important practice in modern field production due to benefits such as increase in soil temperature, reduced weed pressure, moisture conservation, reduction of certain insect pests, higher crop yields, and more efficient use of soil nutrients. Mulching is a soil and water conserving and weed management practice through soil solarisation also in which any suitable material is used to spread over the ground between rows of crops or around the tree trunks. This practice helps to retain soil moisture, prevents weed growth and enhances soil structure. There are various types of mulching such as surface mulching, vertical mulching, polythene mulching, pebble mulching, dust mulching live vegetative barriers, straw mulching etc. Mulching proves to be beneficiary though increment in soil moisture, reduction in soil erosion, maintenance of soil temperature etc. It helps in improvise in soil structure, soil fertility and soil biological regime. Though also mulching is having many advantages it shows some limitations as it may harbour some pests and diseases. Mulching has many strategic effects on soil ecosystem, crop growth, and climate. Mulch insulates the soil, helping to provide a buffer from cold and hot temperatures that have a crucial activity in creating beautiful and protected landscapes.

## PREVALENCE AND IN-VITRO MANAGEMENT OF ALTERNARIA BLIGHT OF CARNATION

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### Abstract

The studies on nature and extent of most prevalent diseases in carnation in Kashmir revealed blight of carnation caused by *Alternariadanthi* as the major disease. The mean incidence of *Alternariadanthi* was 43.13-47.33% and the disease intensity varied from 30.33 to 34.10%. The disease progressed during warm and humid condition from late spring till the end of growing season. The invitro evaluation of various fungicides against the pathogen revealed that the systemic fungicide stubenconazole followed by hexaconazole proved superior over others in inhibiting 50 percent of conidial germination at a concentration of 100 µg/ml. Among the non-systemic fungitoxicants mancozeb followed by captan proved superior at 1500 µg/ml in inhibiting more than 95 percent conidial germination.

## INDUCING HOST RESISTANCE : AN ETHNIC APPROACH AGAINST PLANT DISEASES

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### Abstract

Plant disease has been a major factor influencing food production and human societal development over thousands of years. Climate change, agricultural intensification and monocultures had increased disease incidences and disease epidemics. Plant disease management faces ever growing changes due to increased food demands, reduction in production potential, deterioration of agro-ecosystems and disease epidemics. Due to increased disease incidences in agriculture industry application of chemicals to control disease had increased over time which has resulted in pesticide resistance and residuals of chemicals in environment and humans which poses serious threat to ecosystem and human health. Inducing host response against plant disease is an ethnic and eco-friendly approach to control of diseases. Host defence mechanism is the ability of plants to defend against plant diseases. Systemic acquired resistance and induced systemic resistance are two forms of induced



resistance that have been characterised based on distinctions in signalling pathways and efficacy spectra. Plants can be induced to develop resistance to a number of biotic and abiotic stimuli. The ensuing resistance is usually broad-spectrum and long-lasting, although it is rarely comprehensive, with most inducing drugs only lowering illness by 20% to 85%. Because induced resistance is a host response, it is likely to be influenced by a variety of factors in the field, including the environment, genotype, crop nutrition, and the degree to which plants have already been induced. Treatment of plants with various agents, including cell wall fragments, plant extracts and synthetic chemicals, can induce resistance to subsequent pathogen attack both locally and systemically. Acibenzolar-S-methyl (ASM),  $\alpha$ -Aminobutyric acid (BABA), Probenazole, Thiamine, Silicon and Biochar are chemical activators and plant growth promoting rhizobacteria and biocontrol fungi are the biological inducers of host resistance. Despite the fact that research in this field has grown in recent years, our understanding of the impact of these variables on the manifestation of induced resistance remains limited. In recent years, a lot of research have been conducted to better understand how to apply induced resistance in practical crop protection. However, such trials are uncommon, and further study is needed to determine whether or not induced resistance should be included in disease management programmes.

## INFLUENCE OF DIFFERENT AGROCHEMICALS ON MORPHOLOGICAL AND YIELD TRAITS OF RICE (*ORYZA SATIVA* L.) GROWN UNDER NORTHERN DRY ZONE OF KARNATAKA

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### Abstract

A field experiment was conducted at Agricultural Research Station, Gangavathi, UAS, Raichur, to study the influence of different agrochemicals on morphological parameters and yield and yield components of rice variety GNV10-89. The experiment was laid out in RCBD with 3 replications during *Kharif* season, 2017. The experiment consisting of 10 treatment and a control *i.e.*, T<sub>1</sub>: 25 % extra nitrogen soil application, T<sub>2</sub>: NPK (19:19:19) @ 1.0 %, T<sub>3</sub>: triacontanol (2.0 ml l<sup>-1</sup>), T<sub>4</sub>: GA<sub>3</sub> (50 ppm), T<sub>5</sub>: nitrobenzene (20 ppm), T<sub>6</sub>: salicylic acid (500 ppm), T<sub>7</sub>: 6-BAP (20 ppm), T<sub>8</sub>: borax (0.2 %), T<sub>9</sub>: T<sub>3</sub> + T<sub>8</sub> foliar applications and T<sub>10</sub>: control. The results indicated that the analysis of variance was significant for all the morphological characters except unproductive tillers by foliar as well as soil application of different agrochemicals at 65 and 85 days after transplanting. The treatment T<sub>2</sub> (NPK- 19:19:19 @ 1.0 %) recorded the significantly higher number of productive tillers per hill (17.4), more number of green leaves per hill (69.8), less number of senescent leaves per hill (7.7) and higher flag leaf length (43.7 cm). The significantly higher plant height (130.5 cm) was recorded by foliar spray of T<sub>4</sub> (GA<sub>3</sub>-50 ppm) as compared to other treatment. T<sub>2</sub> (NPK -19:19:19 @ 1.0 %), recorded the significantly higher grain yield (8709.8 kg ha<sup>-1</sup>) than rest of the treatment.

## IDENTIFICATION OF EARLY MATURING BTCOTTON (*G. HIRSUTUM*) GENOTYPES HAVING HIGH YIELD POTENTIAL UNDER HIGH DENSITY PLANTING SYSTEM

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### Abstract

Cotton (*Gossypium* spp.) is an important commercial crop of India and the world. India (with ~13million ha) has more than one third of the World's area (~33 million ha) under cotton with a productivity of ~470-490 kg/ha, which is far below than the World's productivity of ~770 kg/ha. The manipulation of plant density and crop geometry is considered as a time-tested agronomic technique for achieving high crop yield. Many countries like Brazil, China, Turkey, Australia have achieved productivity of more than 1500 kg/ha with high density planting system (HDPS). The BGII hybrids grown commercially over 90% of the area under cotton in India put forth enormous biomass owing to spreading or bushy growth habit and hence, are not suitable for high density planting. Due to high vigour and vegetative growth, they take more time to mature due to which they suffer severe yield losses from late season pest like pink bollworm (*Pectinophora gossypiella*). In this regard, short duration Bt varieties amenable to HDPS were considered most crucial in cotton productivity enhancement in India. A total of 23Bt cotton



genotypes including entries under advanced stage of testing in ICAR-AICRP on Cotton were evaluated in high density spacing of 60x15cm in a replicated trial during *khari* 2020-21 at ICAR-CICR, Nagpur along with released Bt varieties (Suraj Bt, PKV081 Bt), non-Bt variety (NH615) and BGII hybrid check (Ankur 3028 BGII) as checks. The BGII check was sown in both recommended (90x60cm) and HDPS (60x15cm) spacing. Difference among the treatments were significant for plant height, number of monopodia, maturity (% boll bursting) and seed cotton yield. More than 15 genotypes recorded higher yield under HDPS than the BGII check (27q/ha) at recommended spacing. Two genotypes viz., CICR Bt 19-31 and CICR Bt 191165 out yielded BGII hybrid check which was sown at HDPS spacing. Though BGII hybrids recorded appreciable yields in HDPS, they took more time for boll bursting and to achieve higher Bartlett's Index. Some of the promising lines had Bartlett's Index up to 0.93 against 0.69 and 0.80 for BGII hybrid check under HDPS and recommended spacing, respectively. The early maturing Bt genotypes identified in the present study can provide higher yields under HDPS and can also escape the late season pest like pink bollworm thereby bringing economic benefits to cotton farmers, especially under rainfed conditions and marginal soils.

## IMPACT OF *BT* COTTON ON SOIL BIOLOGICAL FUNCTIONING UNDER COTTON-LEGUME BASED INTERCROPPING SYSTEM IN DEEP VERTISOLS

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### Abstract

Though most studies have shown that Bt cotton cultivation had nil or neutral effects on environment, a few studies have reported ill effects of growing Bt cotton on soil biology. However, information related to cultivation of Bt cotton on soil biology under various cotton-based cropping systems, especially the leguminous crops are scarce. Hence, our study focused on deciphering the effects of growing Bt cotton along with legumes (soybean and pigeon pea) as intercrop on soil biology under field conditions. A replicated field experiment with Bt cotton (RCH II, carrying *cry1Ac* and *cry2Ab*) and its Non-Bt (Isogenic line) as the main crop, and pigeonpea and soybean intercrop was laid out in a strip plot design along with respective controls in deep vertisols at ICAR-CICR, Panjari Farm, Nagpur (21° 04' 71" N and 79° 04' 40" E) in Central India. Rhizosphere samples were analyzed at different cotton growth stages such as sowing (0d), flowering (60d), boll formation (90d) and at harvest (120d) for selected soil biological attributes such as soil respiration, microbial biomass carbon, total glomalin content, fluorescein di-acetate hydrolysis, and soil enzyme activities (dehydrogenase, urease, acid and alkaline phosphatase), in addition to the enumeration of N-fixers population and total available nitrogen content in soil. Our study revealed that there were no significant ( $P < 0.01$ ) differences in soil biological activities including N-fixers population (*Azotobacter* spp.) between Bt and non-Bt cotton cultivation under cotton-soybean and cotton-pigeonpea intercropping systems. All biological attributes studied were found to reach their maximum activity at flowering and boll formation stages. However, temporal variations in soil biological activities were observed between Bt and non-Bt cotton based leguminous intercropping systems. Based on our study, we conclude that the cultivation of Bt cotton expressing *cry1Ac* and *cry2Ab* genes may not pose any ecological or environmental risk under cotton-soybean and cotton-pigeonpea based intercropping systems in deep vertisols.

## TRANSPONABLE ELEMENTS AND THEIR ROLE IN RACES EVOLVEMENT IN *FUSARIUM UDUM*, AWILT DISEASE CAUSING PATHOGEN IN PIGEONPEA

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### Abstract

Miniature inverted-repeat transposable elements (MITEs) are short non-autonomous class II transposable element (TE) and defective of transposase coding gene. MIMP (miniature impala), a MITE class TE are about 180-220 bp in size and appear to have originated from full-length impala elements. MIMP TE has been found in many *Fusarium oxysporum* pathogenic strains which causes major wilt disease in many solanaceous and leguminous crops such as tomato, pea, medicago, pigeonpea, lentil and chickpea. Genomes of many *F. oxysporum* strains consists of conserved 'core' chromosomes which is responsible for housekeeping and vegetative growth, and one or several accessory chromosomes which harbors MIMPs and





other TEs. These accessory chromosomes are directly linked to virulence of the isolate since many virulence (effector) determining genes such as Secreted in Xylem (SIX) and NIP are present on these accessory chromosomes. Interestingly these MIMP TEs are present on the promoter regions of the effector coding genes such as SIX and other genes which are essential for plant infection. The horizontal transfer of these accessory chromosomes along with different MIMPs and their associated effector genes helps non-pathogenic strain to become pathogenic strains and also conferring the host-specific pathogenicity of races. We could identify such MIMP TEs and their associated effector genes from genome assembly of *Fusarium udum*, a wilt causing pathogen in pigeonpea. This study will help to differentiate races of *F. udum* pathogen based on presence/absence of various effector coding genes as well as variations present on effector coding genes.

## THE GENETICS OF *FUSARIUM* WILT RESISTANCE IN PIGEONPEA

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### Abstract

To study the genetics of *Fusarium* wilt resistance in the genotype ICP 8863 which is a wilt resistant genotype, F<sub>2</sub> population of the cross between ICP 2376 and ICP 8863, BC<sub>1</sub>F<sub>1</sub> (F<sub>1</sub> X ICP 8863) and BC<sub>1</sub>F<sub>1</sub> (F<sub>1</sub> X ICP 2376) were phenotyped at Zonal Agricultural Research station, Kalaburagi, Gulbarga (UAS, Raichur). The parents ICP 8863 and ICP 2376 were found to be 100 percent resistant and 100 percent susceptible respectively. All the F<sub>1</sub>s resulting from the cross, ICP2376 × ICP8863 were found to be resistant. The F<sub>2</sub> population segregated into 3R:1S genetic ratio with 91 resistant plants and 31 susceptible plants indicating a single dominant resistance gene controlling the resistance to Gulbarga isolate of *Fusarium* wilt in this cross ( $\chi^2 = 0.098$ ; P = 0.75381). The disease reactions observed in the BC<sub>1</sub>F<sub>1</sub> populations with ICP 2376 as a recurrent parent confirmed the single dominant gene model detected in the F<sub>2</sub> populations with the genetic ratio of 1R:1S having segregated into 33 resistant plants and 35 susceptible plants ( $\chi^2 = 0.059$ ; P = 0.80837). All the F<sub>2</sub>s of the BC<sub>1</sub>F<sub>1</sub> populations with ICP 8863 as a recurrent parent were found to be resistant. It becomes evident that the resistant parent ICP8863 possessed a single dominant gene for *Fusarium* wilt resistance against the Gulbarga isolate.

## HYDROLYTIC REACTION DURING SPROUTING ENHANCED SWEET PERCEPTION, NUTRITIONAL QUALITY AS WELL AS SHELF LIFE OF THE PEARL MILLET FLOUR

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### Abstract

The aim of this study was to utilize most nutritious pearl millet flour as routinely as wheat flour by improving its shelf life through most inexpensive methodology of “sprouting”. The soaked pearl millet grains were subjected to a process of sprouting at different duration of time period and optimized the sprouting period of 48 hrs based on highest hydrolytic activities of  $\alpha$ -amylase, protease and lipase. Activities of hydrolases such as  $\alpha$ -amylases and proteases which acts on starch and proteins respectively were increased and lead to increased levels of free glucose and amino acid contents. Breakdown of S-L (starch-lipid) and P-L (protein-lipid) complexes due to higher hydrolytic reaction resulted in release of free lipids into flour matrix. Increased lipase activity catalyzed the lipids, as a result the free fatty acids levels were increased. The released glucose, amino acids and fatty acids into the flour matrix were used for the process of germination. As a consequence of higher utilization of free fatty acids during the process of germination is suggested to be linked with reduced activities of oxidative enzymes like LOX, POX, PPO. Further thermal treatment of hydrothermal and near infrared rays was found to be highly effective in enhancing the shelf life of the sprouted flour through reduction of rancid causing oxidative enzymes. Hydrolytic reaction in the sprouted flour matrix enhanced the taste of the end product by improved sweet perception also helped in increased nutritional enhancement in terms of starch and protein digestibility.



## OPTIMIZATION OF OPERATIONAL PARAMETERS OF PONGAMIA DECORTICATOR

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### Abstract

The operational parameters of pongamia decorticator developed by University of Agricultural Sciences, Bangalore were optimised. The major components of the Pongamia decorticator were decorticating unit having a rotating fluted drum and a fixed ribbed concave. The other components were feeding unit (hopper with rotary feeder), separation unit (blower) and driving unit (motor and pulley assembly). Prior to the experimental trials, the volumetric air flow rate of blower and angle of separating screen were adjusted. The main operational parameters like dehulling speed (250, 300 and 350 rpm) and concave clearance (3, 5 and 7 mm) were optimized at constant feed rate (250 kg/h). Three dependent parameters (decortication efficiency, total kernel yield and Whole kernel yield) were measured and the experiment was replicated thrice. The decortication efficiency was found between 83.29 -95.09%. The total kernel yield was found between 26.56 – 35.96%, whereas wholeness kernel was found to be only 37.93-55.86%. The results of decortication trials of pongamia showed that the combination of 3 mm concave clearance and decorticating drum speed of 300 rpm had maximum decortication efficiency (95.09%). The operation cost of Mechanical decorticator was found to be 11.15 times cheaper than manual method.

## INSECTICIDE INDUCED FEEDING INHIBITION IN COTTON WHITEFLY *BEMISIA TABACI*: EXEMPLIFIED BY THE REDUCED HONEYDEW EXCRETION

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### Abstract

Cotton whitefly *Bemisia tabaci* Gennadius – an important sucking insect-pest of many commercial crops, is a phloem feeder. In the present study two populations of *B. tabaci* namely, New Delhi and Ludhiana were selected to study honey dew excretion post insecticide treatment to understand the feeding inhibition caused by the sublethal doses of insecticides. Results revealed that Ludhiana population produced more honey dew in general with 3.60 mm<sup>2</sup> per female, whereas New Delhi population recorded 2.92 mm<sup>2</sup> per female in control. Flonicamid was the most efficient in causing feeding inhibition with LC<sub>10</sub>, LC<sub>20</sub> and LC<sub>40</sub> concentrations causing 70.99, 83.33, 95.37 per cent and 86.31, 94.68 and 98.48 percent reduction in Ludhiana and New Delhi populations respectively. Fipronil caused relatively less percent reduction with LC<sub>10</sub>, LC<sub>20</sub>, LC<sub>40</sub> causing 37.96, 63.27, 89.81 percent and 21.29, 39.92, 86.31 percent reduction in Ludhiana and New Delhi populations respectively. Pyriproxyfen, spiromesifen and buprofezin field recommended doses were used to assess the sublethal effects, because at this concentration the insecticides caused little mortality in adult individuals (<20 percent mortality). Among these insecticides pyriproxyfen (Ludhiana=54.63%, New Delhi=83.27%) caused highest percent reduction followed by buprofezin (Ludhiana=39.20%, New Delhi=44.11%) and spiromesifen (Ludhiana=27.47%, New Delhi=38.02%).

## RAPID GENERATION ADVANCEMENT FOR CROP IMPROVEMENT

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### Abstract

Breeding for new and advanced-cultivars in most of the crop-plants needs several years. Hybridization of selected parental-lines thereby 4-6 generations of inbreeding are typically required to develop genetically stable-lines for evaluation of agronomic-traits and yield. This is particularly time-consuming for field-grown crops that are often-limited to only 1-2 generations year<sup>-1</sup>. In order to reduce the generation period, the methods like utilization of off-season nurseries, single-seed-descent method of breeding, shuttle-breeding, use of double-haploids, marker-assisted selection,



genomic-selection etc., could reduce the time-required to develop variety by reducing number of generations. On the contrary, there are some methods which reduce the time-required to complete one-generation thereby automatically more generations annum-1. A revolutionary development in rapid-generation-advancement, the biotron-breeding-system in rice, which can greatly shorten generation-cycle of 'Nipponbare' for about two-months under controlled-conditions. Recently, an innovative strategy 'speed breeding' has been developed that use of prolonged-photoperiods to accelerate the developmental-rate of plants; harvesting and germination of immature-seeds, thereby reducing generation-time. Speed breeding can be used to achieve up to six-generations year-1 for spring-wheat, durum-wheat, barley, chickpea and pea and four-generations for canola, instead of 2-3 under normal glasshouse-conditions. Recent advances in genomic-tools and resources, decreasing cost of sequencing have enabled plant researchers to shift their focus from model to crop-plants. Despite such advances, the slow generation times of many crop-plants continue to impose a high entry-barrier. Therefore, combining these tools and resources with rapid-generation-advance methods will provide a strong incentive for plant-scientists to perform research on crop-plants directly; thus further accelerates crop improvement research.

## **MICROPROTEINS : VERSATILE TOOLS FOR POST-TRANSLATIONAL REGULATION OF TARGET PROTEINS**

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### **Abstract**

The demand for crop-based products is increasing proportional to the increase in population. Major goals of modern agriculture are optimization and improvement of crops to sustain high productivity with minimal environmental impact. A variety of molecular methods have been developed for regulation of trait-specific genes at the transcriptional and translational level. RNA interference (RNAi) is a method for targeted gene knockdown; however, off-target effects are major disadvantages of this method. Genome engineering technologies, such as zinc-finger nucleases (ZNF), transcription activator like effector nucleases (TALEN), and CRISPR-Cas9, have been enabled site-specific genome modifications. Disadvantages of technologies are also off-target effects and the complete loss of gene function, which could be detrimental or lethal to the organism. Targeted post-translational modification for trait regulation may overcome these problems by precisely fine-tuning protein activity without altering overall plant structure and metabolism. MicroProteins are usually single-domain proteins that contain a protein-protein interaction domain. They have the ability to disturb the formation of protein complexes by sequestering their target proteins. Several microProteins have been identified in plants and animals, most of which negatively regulate transcription factors. MicroProtein candidates that potentially target a wide range of different protein classes were recently identified in a computational approach. These findings reveal that microProteins can be used to influence different physiological processes, which makes them useful tools for post-translational regulation in plants and potentially also in animals.

## **EVALUATION OF INTEGRATED WEED MANAGEMENT FOR SUNFLOWER UNDER IRRIGATED CONDITION**

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### **Abstract**

Sunflower (*Helianthus annuus* L.) placing important role in global vegetable oil production, which contributes up to 12 per cent. The oilseeds scenario in the country had undergone a big change in the last fifteen years while India changed from not importer in the 1980s to a net exporter status during the early 1990s. To increase the productivity of sunflower and reduce the cost of cultivation, use of pre and post-emergence herbicides with hand weeding may be the useful option. The field experiments were conducted at Tamil Nadu Agricultural University, Coimbatore. The experiment consists eight treatments viz. T1 - PE pendimethalin @ 0.75 kg a.i./ha (38.7% CS), T2 - PE pendimethalin @ 1.0 kg a.i./ha + hand weeding (HW) on 30 DAS, T3 - PE pendimethalin @ 1.0 kg a.i./ha + quizalofop Ethyl 10 EC @ 37.5 g a.i./ha on 15-20 DAS as EPoE, T4 - PE pendimethalin @ 1.0 kg a.i./ha + propaquizofop ethyl @ 62 g a.i./ha on 15-20 DAS as EPoE, T5 - PE pendimethalin @ 1.0 kg a.i./ha + fenoxypop ethyl @ 37.5 g a.i./ha on 15-20 DAS as EPoE, T6 - farmers practice (two hand weeding at 20 and 40



DAS), T7- weed free check and T8- unweeded control with three replications and laid out in randomized block design. The crop was irrigated as per the requirement and recommended dose of fertilizers were applied for better growth and development. Pre emergence application of pendimethalin @ 1.0 kg ai/ha followed by one hand weeding at 30 DAS is the best IWM practice for getting effective and economical weed control in irrigated sunflower. Higher gross return of ₹77,140/ha was obtained by weed free check and it was followed by pendimethalin @ 1.0 kg/ha as pre emergence + HW on 30 DAS (₹76,580/ha) [Table-3]. Among the treatments pendimethalin @ 1.0 kg/ha as pre emergence + HW on 30 DAS (T2) gave the highest net return of Rs. 40,324/ha. Application of pendimethalin @ 1.0 kg/ha as pre emergence + HW on 30 DAS (T2) registered higher B: C ratio of 2.11. It was followed by pendimethalin @ 1.0 kg/ha as pre emergence + Quizalofop Ethyl 10 EC @ 37.5 g a.i/ha as early post emergence (T5) and weed free control (1.90).

## IMPACT OF VEGETABLE CLUSTER BEAN GENOTYPES ON *MELIA DUBIA* BASED AGROFORESTRY MODEL

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### Abstract

The main objective of the project is to explore the possibilities of integrating cluster bean under *Melia dubia* based agroforestry model to provide small and marginal farmers a new potential vegetable crop to diversify cropping and achieve sustainability. The experiment was carried out at Department of Agroforestry, Forest College and Research Institute, Mettupalayam during 2020-2021 with three vegetable cluster bean varieties viz., MDU 1, Pusa Navbahar and Sonali under three different ecosystems viz., open field conditions, under 3 years old *Melia dubia* and 6 years old *Melia dubia*. The morphological parameters viz., plant height (46.1%) and leaf area index (1.53) were recorded highest by cluster bean variety MDU 1 under 6 years old *Melia dubia* ecosystem. The pod yield (6.895 t/ha) and quality parameters viz., crude protein (17.04%), ash (3.43%) and dry matter (21.08%) content were recorded higher in MDU 1 variety under open condition. The cost benefit ratio (2.36) was obviously higher in cluster bean variety MDU 1 under 6 years old *Melia dubia* ecosystem followed by cluster bean variety MDU 1 under 3 years old *Melia dubia* ecosystem (2.08). Under all the ecosystems, the soil nutrient status was stable without much decline after harvest of cluster bean crop indicating the compatibility of intercrops and their role in maintaining the soil fertility status. The result of the experiment clearly depicts the possibility of including cluster bean under *Melia dubia* based Agroforestry model.

## CATALOGUING OF CASSAVA GERMPLASM FOR TUBER YIELD AND STARCH CONTENT

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### Abstract

Cassava is one the important tuber crop cultivated in India. India is leading in the productivity of cassava. This crop is highly remunerative and suited for cultivated in dry land conditions. An ideal cassava plant should have optimum plant height with sufficient canopy for tuber production, non branching habit for easy harvesting of the crop and tubers should be distributed uniformly in all the sides of the plant. In this regard, cataloguing is necessary for evaluating the germplasm accessions and commercial varieties. This experiment is conducted at Tapioca and Castor Research Station, Yethapur. There are about 369 germplasm accessions are being maintained at the station and the trial was laid out in Augmented Block Design (ABD). The germplasm accessions are categorized for major yield contributing traits viz., plant height, stem girth, branching habit, number of tubers per plant, length of tuber, girth of tuber and starch content and etc. Among the accessions, 20 numbers of accessions recorded maximum plant height of >300 cm, 84 accessions with stem girth of >10 cm, 16 accessions with tuber yield of >7 kg plant<sup>-1</sup> and 28 accessions with the starch content of >28%. Considering the feasibility of cultivation with better performance, the accession Me 681 recorded the plant height (162.76 cm), stem girth (9.61 cm), number of tuber (7.74), weight of tuber (7.46 kg plant<sup>-1</sup>) and starch content of (31%) and highly suited for commercial cultivation. The same accession was much preferred by the sago and starch manufacturing industries.





## YRCH 2-A PROMISING WILT RESISTANT CASTOR HYBRID FOR TAMIL NADU

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### Abstract

Castor (*Ricinus communis* L.) is an important industrial oilseed crop augurs to rainfed, and areas with limited irrigation. The crop is suitable for resource poor small and marginal farmers. This hybrid was derived from the crosses of M 619-1 x SKI 215 (M 619 is mutant of pistillate line VP1. M 619 -1 is selection made by TCRS, Yethapur from the Population of M 619. The variety was tested under the culture number YRCH-1116, in 145 trials viz., Station Trials (5 numbers), Multi Location trials (MLT) (5 numbers), Adoptive Research Trials (ART) (83 numbers), On Farm Trials (OFTs) (40 numbers), AICRP –Coordinated Trials (12 locations) along with national check DCH 519 and local check YRCH 1. The entry YRCH1116 is tested for wilt reaction in National screening nursery at ICAR-IIOR, Hyderabad and SDAU, SK Nagar, Gujarat. Agronomic features are Semi-dwarf and high basal branching; proportion of female flowers (95%); Resistant to lodging; Non-shattering; suitable for rainfed and areas of limited irrigation. Compact plant type suitable for Intercropping with oil content per centage of 49. Highly fertilizer responsive with semi dwarf plant ideotype. The plant type is compact and augurs well for intercropping system also in addition to pure cropping system with duration of 180 days. Castor Hybrid YRCH-2 suitable for intercropping, mixed cropping systems.

## EVALUATION OF PEPPER ACCESSION FOR YIELD PARAMETERS UNDER SHEVAROYS CONDITION

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### Abstract

The present investigation was carried out at Horticultural Research Station, Tamil Nadu Agricultural University, Yercaud during 2016-17. The experiment was laid out in a Randomized Block Design with three replication. The yield characters viz., spike length, number of berries per spike, 100 green berry weight, 100 dry berry weight, green berry yield and dry berry yield were recorded. Among the 28 accessions, the significant difference was observed for the characters spike length, number of berries per spike, 100 green berry weight, 100 dry berry weight, green berry yield and dry berry yield. Spike length was observed to be the highest in PN 54 (13.9 cm) and lowest in PN 5 (8.2 cm). The accession PN 60 had more number of berries per spike (79.3) where as only 28.1 berries were observed in the accession PN 6. Green berry weight for 100 berries was the highest in the accession PN 46 (13.10 g) followed by PN 79 (13.15 g) and the lowest in the accession PN 74 (12.34g). Dry berry weight for 100 berries was the highest in the accession PN 46 (3.85 g) followed by PN 55 (3.81 g) and the lowest in the accession PN 80 (2.89 g). The accession PN 51 recorded the highest green berry yield per vine (2.86 kg) followed by PN 55 (2.72 kg) and the lowest in PN 58 (1.65 kg) and the accession PN 5 recorded the highest dry berry yield per vine (1.06 kg) followed by PN 11 (0.92 kg) and the lowest in PN 33 (0.49kg).

## CONTINUOUS CULTIVATION OF FODDER MAIZE AND ITS EFFECT ON FODDER YIELD AND ECONOMICS

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### Abstract

A field experiment was carried out at the Department of Farm Management, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu for three years from 2016-17 to 2018-19 with an objective to assess the fodder yield and economics of continuous cultivation of fodder maize (var. African Tall). The experimental location falls under Western agroclimatic zone of Tamil Nadu with the geographical coordinates of 11° N latitude, 77°E longitude and altitude of 426 m above MSL. The research experiment comprised of six treatments on three types of fodder maize cropping sequences annually with and without FYM



Viz., T<sub>1</sub>: Fodder maize - Fodder maize- Fodder maize - Fodder maize with FYM; T<sub>2</sub>: Fodder maize- Fodder maize - Fodder maize- Fodder cowpea (var. CO(FC)8) with FYM; T<sub>3</sub>: Fodder maize - Fodder maize - Green manure (daincha) – Fodder maize with FYM; T<sub>4</sub>: Fodder maize- Fodder maize- Fodder maize – Fodder maize without FYM; T<sub>5</sub>: Fodder maize - Fodder maize- Fodder maize - Fodder cowpea without FYM and T<sub>6</sub>: Fodder maize - Fodder maize - Green manure - Fodder maize without FYM. The experimental soil was slightly alkaline with pH of 8.05 and EC of 0.56 dS/m. Organic carbon content of soil was 0.58%. The fertility status of the soil before the start of experimentation was low in available nitrogen (240 kg/ha), medium in available phosphorus (21.5 kg/ha) and high in available potassium (358 kg/ha). The results of the research experiment revealed that higher green fodder yield of 117 t/ha/year was recorded in fodder maize cropping sequences with addition of FYM @ 25 t/ha as compared with the cropping sequences without addition of FYM which produced the green fodder yield of only 98 t/ha/year. The cropping sequence viz., Fodder maize - Fodder maize - Fodder maize - Fodder cowpea (var. CO(FC)8) with addition of FYM @ 25t/ha had produced the maximum green fodder yield of 134 t/ha/year with higher net returns (Rs. 124462/-) and BCR (1.80) over other treatments. It could be concluded that higher green fodder yield of maize with higher profit and BCR could be obtained when three crops of fodder maize (var. African Tall) followed by one crop of fodder cowpea (var. CO(FC)8) in the cropping sequence along with addition of FYM @ 25 t/ha at the beginning of the cropping sequence. Such a cropping sequence could be recommended to the farmers and livestock growers who own a small piece of farm lands in/ near semi-urban areas of major cities in the country.

## PRODUCTION OF KACHRI (*CUCUMIS CALLOSUS*) (AHK-119) WITH SALINE WATER IRRIGATION IN HOT ARID REGION

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### ABSTRACT

In hot arid region, Kachri (*Cucumis callosus*) is the most important vegetable crop and potential source of income for farmers. The availability of good quality of irrigation water is very less. Thus sustainable irrigation systems using saline soils and waters have the potential to improve crop production in arid region. The field experiment was conducted at ICAR- Central Institute for Arid Horticulture, Bikaner during 2017-18 and to investigate the effect of saline water with the combination of different amendments on Kachri crop performance. It was observed that the maximum vine length (cm), number of fruit plant<sup>-1</sup>, number of vine plant<sup>-1</sup> and leaf size (cm) were (1.47cm, 16, 5, 9.0cm x 8.8 cm) respectively observed under the treatment of gypsum @5ton/ha + 4EC (dS m<sup>-1</sup>)<sub>IW</sub> followed by vermicompost @10 ton/ha+ 4EC(dS m<sup>-1</sup>)<sub>IW</sub>, FYM @15 ton/ha + 4EC (dS m<sup>-1</sup>)<sub>IW</sub>, 4EC (dS m<sup>-1</sup>)<sub>IW</sub>, 2EC (dS m<sup>-1</sup>)<sub>IW</sub> and .5EC (dS m<sup>-1</sup>)<sub>IW</sub>. The highest yield was observed with the treatment of gypsum @5ton/ha+ 4EC (dS m<sup>-1</sup>)<sub>IW</sub> that was (66.25 q/ha) followed by vermicompost @10 ton/ha+ 4EC(dS m<sup>-1</sup>)<sub>IW</sub> (60.00 q/ha) and FYM @15 ton/ha+ 4EC(dS m<sup>-1</sup>)<sub>IW</sub> (57.50 q/ha). 4EC (dS m<sup>-1</sup>)<sub>IW</sub> (32.30 q/ha), 2EC (dS m<sup>-1</sup>)<sub>IW</sub> (40.00 q/ha) and .5EC (dS m<sup>-1</sup>)<sub>IW</sub> (50 q/ha). This is clearly indicated that Kachri crop performance was good in the treatments where gypsum @5ton/ha+ 4EC (dS m<sup>-1</sup>)<sub>IW</sub> were applied

## MASS TRANSFER CHARACTERISTICS OF HORIZONTAL THIN FILM SCRAPED SURFACE HEAT EXCHANGERS IN CONCENTRATION OF SWEETENED CONDENSED MILK WORKING LIQUID UNDER VACUUM

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### ABSTRACT

The importance of mass transfer characteristics along with hydrodynamic and heat transfer characteristics in energy conservation and management is well known in the era of energy crunch. It is necessary to minimize the cost of energy consumption in production of quality products in continuous system of TFSSHEs under vacuum. This study was conducted for modeling of the mass transfer characteristics during heat transfer with phase change i.e evaporation/concentration of working liquid for production of sweetened condensed milk(SCM WL) in a horizontal thin film scraped surface heat exchangers (TFSSHE) under vacuum. The double rotary vacuum seal and rotor assembly with staggered blades were used in TFSSHE to concentrate buffalo milk with sugar (SCM working liquid). The flow rate varied from 50 to 200 liter/hrs.; rotor speed varied from 2.33 to 4.00 rps and steam pressure varied from 0.25 to 1.5 kgf/cm<sup>2</sup> gauge. When the concentration gradient being driving force along with an external field such as physical mixing through rotation of scraper blades in



TFSSHes, the molecular diffusion of water vapour into the unsaturated vapour phase is termed as eddy diffusion and is not restricted to diffusion through stagnant interface layers of fluids. And it is required to investigate to control the energy used for efficient heat and mass transfer processes. The velocity of eddy diffusion was determined in terms of liquid water diffusivity ( $D_v$ ), which was determined using Fortran software and to optimize, the process variables, the  $D_v$  was expressed in a Box-Wilson model as a function of average per cent total solids ( $X_{av}$ ), Temperature difference ( $\Delta T$ ), mass flow rates ( $M_f$ ) and circumferential velocity of rotor blades ( $V_c$ ). The partial regression coefficient of  $X_{av}$  and  $\Delta T$  were significant at  $P = 0.01$  having inverse effect on  $D_v$  and regression  $R^2$  of 0.94. ANOVA with interaction was performed to determine the effects of mass flow rates, steam condensing temperature and linear speed of rotor on mass diffusivity of water ( $D_v$ ) in concentrating SCM WL. Least square means of  $D_v$  was in increasing trend with mass flow rate ( $P = 0.01$ ) and in decreasing trend ( $P = 0.01$ ) with Steam condensing temperature and total solids of working liquid. Modelling of Sherwood number ( $N_{sh}$ ) as a function of  $Re_f$  (Flow Reynolds number), Rotational Reynolds number ( $Re_r$ ), Schmidt number ( $Sc$ ) and  $\Delta T/T_s$  was correlated in the Cobb-Douglas model with  $R^2$  as 0.91 and significant at  $P = 0.01$ . The increase in  $Re_f$  and  $Sc$  decreased the  $N_{sh}$  ( $P = 0.01$ ), however the effect of  $Re_r$  and  $\Delta T/T_s$  was found to increase the mass transfer rates ( $P = 0.01$ ).

## TRADITION AND MEDICINAL VALUE OF INDIAN GOOSEBERRY-A REVIEW

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### ABSTRACT

Research in medicinal plants has gained a renewed focus recently. The prime reason is that other system of medicine although effective come with a number of side effects that often lead to serious complications. Plant based system of medicine being natural does not pose any serious problems. Aonla is one of the oldest oriental medicines mentioned in Ayurveda as potential remedy for various ailments. The fruit is rich in quercetin, phyllaemblic compounds, gallic acid, tannins, flavonoids, pectin, and vitamin C and also contains various polyphenolic compounds. A wide range of phytochemical components including terpenoids, alkaloids, flavonoids, and tannins have been shown to possess useful biological activities. In this review, we have focused our interest on phytochemistry, traditional uses, cancer chemo-preventive, anti-microbial and antimutagenicity activities activity of *aonla*. It is having a strong memory enhancing property, in lowering cholesterol level applicable in ophthalmic disorder, antimicrobial action and in neutralizing snake venom.

## DIFFERENTIATION OF ACTIVE LIVE MYCOBACTERIUM AVIUM SUBSPECIES PARATUBERCULOSIS (MAP) FROM THE DEAD MAP CELLS IN FAECAL AND BLOOD PBMCS USING MRNA PROBE BASED REAL TIME PCR ASSAY IN SMALL RUMINANTS

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### ABSTRACT

Mycobacterium avium subspecies paratuberculosis (MAP) is the cause of chronic incurable Johne's disease (JD) in domestic ruminants. MAP is a global problem capable of infecting and causing disease in all ruminants both in captive and free-range living conditions. Effective control of Johne's disease is hampered due to the lack of information on infection due to MAP with a dearth of rapid and accurate diagnostic tests in line with the clinical and physiological status of the animal. Active and passive shedders of MAP are difficult to differentiate by microscopy or iELISA or any other conventional PCR based diagnostic tests. In this study, we report the application of mRNA as a target rather than genomic DNA, using specific probes targeting live MAP cells which are transcriptionally active. Active infection can be differentiated by detecting live MAP in the unknown samples using mRNA PCR targeting important genes of MAP. Initially the real time PCR for genes IS900 and ModD were standardized using known MAP RNA by SYBR green chemistry. Further, TaqMan® probe based reverse transcription real time PCR using Cy5 and HEX chemistries were targeted for IS900 and ModD genes of MAP respectively. IS900 is the attractive target in detection of MAP due its high genomic copies, but the same is available in ample number even in inactive cells. Hence another target, which is expressed in the live MAP cells, is *ModD*. *ModD* also called as Fibronectin (FN) attachment protein (FAP) that aids in binding pathogen to the M-cells. Host cell integrins have binding sites for FN, and hence binding to soluble FN establishes link between MAP and host cell cytoskeleton. IS900 transcripts are in abundance, which is amplified easily from any given MAP RNA. But *ModD* transcripts are quite sensitive to heat shock, which are amplified only



from fresh live cultures. Known live and heat killed dead MAP cells were subjected to RNA extraction and assayed for IS900 TaqMan® probe reverse transcription Real time PCR. CQs of Dead cells were 35 and above compared to CQ of live cells which were between 19-26 cycles. Two new primers and probes were designed targeting IS900 and *ModD* genes of MAP. Even in cultures stored beyond some period gave negative for *ModD* from MAP RNA by this technique, reinstating the fact that it would be an excellent candidate in differentiating the live MAP cells from dead. Active shedders have a probability to contain transcripts for *ModD*, while passive shedding of dead MAP bacilli or by immunological clearances which were otherwise positive by microscopy were all negative for *ModD* transcripts. The current technique promises to be a cutting edge tool that will aid in effective identification of Johne's disease infected animals based on the differentiation of active and passive shedders of MAP.

## MANGO MALFORMATION AN UNSOLVED MYSTERY

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### ABSTRACT

Mango (*Mangifera indica* L.) universally considered to be one of the finest fruits, and is an important crop in tropical and subtropical areas of the world. There are about 1500 varieties of mango in the world of which about 1200 are found in India. Among the known diseases of mango, malformation is one of the most destructive malady in nature. It is a major constraint to mango production in India and other mango growing countries of the world. It causes 50 to 60 % economic loss every year and in severe cases it may extent up to 100 %. The etiology of malformation has not yet been discovered due to paucity of information and thus no effective control measure is known (Krishnan, et al, 2009). Here, we discuss the biotic, abiotic factor and ethylene origin nature and cyanide derived from ethylene which is directly or indirectly responsible for mango malformation.

## ROLE OF NANOTECHNOLOGY IN ENHANCING THE CROP PRODUCTION

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### ABSTRACT

Nanotechnology is an emerging tool to improve productivity of crop and has capability to coup-up from present agricultural issues. The producing nanomaterials have several properties like slow release action, target action at active sites and high surface area etc. And due to this, nanotechnology applied in various fields including agriculture, food and processing industry and in precision farming. Use of nano sensors, nano herbicides, nano pesticides helps to improve efficiency of overall plant. Plant becomes more vigorous, competitive than weeds and other biotic factors. Agriculture is always most potentiated and stable sector because it produces and provides raw materials for food and feed industries. Due to the increasing world population, increased nutrient mining, for increase the total food grain production, shrinking arable lands, restricted water availability, deteriorating soil organic matter, climate change and so many other reasons; it is necessary to use the advance technologies such as nanotechnology in agricultural sciences. Nanotechnology has many applications in all stages of production, processing, storing, packaging and transport of agricultural products and other marketing facilities. The purpose of nano materials in agriculture is to reduce the amount of spread chemicals, minimize nutrient losses in fertilization and increased yield through pest and nutrient management. The significant interests of using nanotechnology in agriculture includes specific applications like nanofertilizers and nanopesticides to trail products and nutrients levels to increase the productivity without decontamination of soil, water and protection against various biotic and abiotic stresses. Nanotechnology may act as sensors for monitoring soil quality of agricultural field and thus it maintain the health of crops (Prasad *et al.*, 2017). Nanotechnology will transform agriculture and food industry by innovation of new techniques such as: precision farming techniques, enhancing the ability of plants to absorb nutrients, more efficient and targeted use of inputs, disease detection and control diseases. Increase the nutrient use efficiency of applied fertilizer with the help of nano clays and zeolites and restoration of soil fertility by releasing fixed nutrients. Nanoherbicides are being developed to address the problems in perennial weed management and exhausting seed bank of weed. Levels of environment pollution can be evaluated quickly and effectively by gas sensors and nano smart dust (Shaimaa and Mostafa, 2015). Now a day's silver nanoparticles has an effective role to check various seed and soil born phytopathogens. Hence, nanotechnology has proved their worth in agriculture.





## EVALUATION OF DIFFERENT MULBERRY GENOTYPES ON CONSUMPTION AND GROWTH PARAMETERS OF CHAWKI SILKWORM.

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### ABSTRACT

Mulberry (*Morus indica* L.) is the sole food plant of the silkworm (*Bombyx mori* L.) and has been exploited commercially in the sericulture industry. Consequently, a major determining factor for enhancing the production of silk is to produce qualitative mulberry foliage that can adapt to different climatic conditions. Mulberry leaves are exclusive source of nutrition for silkworm. This study was aimed to assess the impact of different mulberry genotypes namely ME-52, MI-79, V1, MR-2 and C-20 on growth parameters of silkworm (*Bombyx mori*). Among the studied genotypes MI-79 genotype recorded highest consumption index, growth rate, larval weight, and less larval duration and moulting duration. The results showed the MI-79 mulberry genotype can be used for commercial rearing and more productivity.

## MANAGEMENT OF SPOT BLOTCH OF WHEAT THROUGH BIO AGENT AND FUNGICIDES IN EASTERN UTTAR PRADESH

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### ABSTRACT

Wheat (*Triticum aestivum* L.) is very important cereal crop after rice in India and major staple food of South Asian countries. Wheat crop in eastern Uttar Pradesh suffers from a number of fungal diseases. Spot blotch caused by *Bipolaris sorokiniana* is more severe than other diseases. For the management of spot blotch disease of wheat two bio-agent and four fungicides were used. Plant disease intensity decreased with the application of different treatment over untreated control. Minimum plant disease intensity was recorded (21.73 per cent) under T<sub>5</sub> (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole @ 0.1 %, first at boot leaf Stage second after 20 days), Which has highly significant compared to all the treatments. However, Minimum AUDPC was recorded (247.2) under T<sub>5</sub> (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole @ 0.1 %, first at boot leaf Stage second after 20 days). All the fungicides gave significant impact on thousand seed weight over untreated control. Treatment T<sub>5</sub> (Seed treatment with vitavax 75 WP @ 2.5 gm/kg + 2 foliar sprays of propiconazole @ 0.1%, first at boot leaf Stage and second after 20 days) and T<sub>9</sub> (Seed treatment with vitavax 75 WP @ 2.5 gm/kg + 2 foliar sprays of Nativo (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 gm/lit, first at boot leaf stage second after at 20 days) were found significantly superior amongst all the treatment as thousand seed weight i.e. 45.49g. and 42.55g., respectively. Highest yield (39.69 q/ha) was recorded with T<sub>5</sub> (Seed treatment with vitavax 75 WP @ 2.5 gm/kg + 2 foliar sprays of propiconazole @ 0.1 per cent). This treatment was found significantly superior in cash of yield q/ha followed by T<sub>6</sub> and T<sub>9</sub> which gave the yield 36.12 q/ha and 38.06 q/ha, respectively. Maximum Per cent increase yield (24.69 per cent) was recorded under T<sub>5</sub> followed by T<sub>6</sub> (19.67 per cent) and T<sub>9</sub> (19.48 per cent), respectively over control.

## EFFECT OF SEWAGE SLUDGE ON SOILS AND IN VARIOUS CROP SPECIES AT PATNA

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### ABSTRACT

The study of present investigations has been carried out where the soil and plant samples were collected from farmer's field receiving town wastes disposal since a longer period. The study revealed that there is an accumulation of trace metal cations and heavy metals in soils with maximum accumulation obtained at the point of discharge. Continuous disposal of sewage-sludge, containing domestic and industrial effluents on agricultural land is a major source of plant nutrients, but it also contains a sufficient amount of potential heavy metals causing soil pollution. Transfer of metals from added sewage-sludge to the soils and subsequently uptake by the plants that enter the feed and food-chain which pose hazardous for human health and animals. Moreover, it is pointed out that continued monitoring or treatment of sewage water before disposal into the land or integrated water management are some of the suitable measures for effective utilization of poor quality water in sustainable agricultural production. The concentration of Zn, Cu, Fe, Mn, Ni, Cr, Cd and Pb in sewage-sludge treated soils at nearby and



distant sites from discharge point at Patna bye-pass were investigated. The study revealed that the sites nearest to discharge point contained appreciably higher concentration of these metal cations in comparison to the sites away from the discharge point of the sewage water. Plants growing on such soils accumulate excess amount of micronutrients and heavy metals in their tissues which may enter in the system of animal and human being. Accumulation of trace metal cations in different plant species differed widely which varied from crop to crop and place to place. The relative accumulation of these metals in different plant species was noticed that leafy vegetables viz. *poi* and red spinach, spinach accumulated most of trace metal cations to the greater extent in comparison to other crops. However, toxic concentration of these trace metal cations in plants and soils should be the matter of concern and indicate the need for continuous monitoring or treatment of sewage water before it is laid down into the field. Though the study during the investigations confirm that sewage water (domestic & urban origin) can certainly and effectively increase water resource for irrigation but there is need for regular monitoring of the concentrations of trace metal cations and potentially toxic elements in soils as well as in plants.

## SCREENING OF RICE GENOTYPES UNDER SALT STRESSED SOILS OF BIHAR

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### ABSTRACT

The experiment screening of saltol rice genotypes was conducted at the experimental site located at Dr.RPCA, Pusa, Samastipur. Altogether, 30 genotypes were screened where 12 genotypes were found most promising on the basis of their growth and yield attributing characters in salt affected soils. The study also revealed that salinity affected plant growth at all development stages like plant height, number of tillers, spikelets fertility and grain yield which ultimately showed an adverse impact on the productivity. Amongst the genotypes, check (CSR-27) was found more tolerant to salinity stresses whereas, IR 83870-B-SD01-2-2-B was emerged as more sensitive to salt. A perusal of the data indicated that check (CSR-36) exhibited better response and produced the highest yield with respect to other genotypes under salt stressed soils.

## COMBINING ABILITY EFFECTS OF NEWLY DEVELOPED INBRED LINES OF EARLY SEGREGATING GENERATION (F<sub>4</sub>) IN BABY CORN (*ZEAMAYS* L.)

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### ABSTRACT

The vital point of consideration for success of any breeding programme is choice of parents. The true genetic potentialities of inbreds was assessed with an aid of estimation of combining ability effects of inbred lines. In the present study, two heterotic populations were crossed in line  $\times$  tester method and analysed for their nicking ability. The F<sub>4</sub> lines viz., P27 and P36 corresponding to Population A were found as best general combiners for important baby corn traits. Among the single crosses, P47  $\times$  HKI 323 (Population A) was considered as potential single crosses for yield and its contributing traits of baby corn.

## SELENIUM INDUCED CHANGES IN PHYSIOLOGICAL TRAITS TO DROUGHT STRESS AMELIORATION (*VIGNARADIATA* L. WILCZEK)

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### ABSTRACT

The pot experiment was conducted during Kharif 2019 and 2020 seasons in the screen house of the Department of Botany and Plant Physiology, CCS Haryana Agricultural University, Hisar, to study the effect of selenium and receding soil moisture levels on growth and yield characteristics of mungbean (*Vignaradiata* L. wilczek.). The experiment was laid out in factorial CRD consisting of three water levels, i.e., control ( $12.5 \pm 0.05$  % soil moisture content), moderate moisture stress ( $7.0 \pm 0.05$  % of soil saturation percent) and severe moisture stress ( $4.5 \pm 0.05$  % of soil saturation percent) and three selenium treatments. The treatments included control (without selenium application), soil selenium treatment (5 ppm), foliar application F1 (5ppm) and



foliar application F2 (10 ppm) at two stages of plant growth viz. 70 flowering and pod formation stages. Drought stress significantly influenced phenology, photosynthetic efficiency, water relations, yield attributes and yields. Selenium treatments showed significant effect on plant-water relations under both normal and water stressed conditions. Soil application of selenium showed long and finer root system despite of its minimum dry weight. It provided avoidance to plant by forming thick cuticle to reduce transpiration. It also allocated more dry matter accumulation to leaf by reducing stem height. Foliar application of selenium was found to be more beneficial to plant as it increased chlorophyll content and increased membrane stability by scavenging reactive oxygen species. Among the treatments F1 was found to be most effective in control, while F2 was most effective under moderate and severe water stress, which resulted in 6.6, 6.3 and 4.5% increase in seed yield, respectively as compared to control (no selenium). The plant water status and photosynthetic system had significant association with seed yield by use of selenium in mungbean under moisture stress environment.

## **DOUBLING FARMERS' INCOME : PLANT BREEDING PERSPECTIVE**

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### **ABSTRACT**

India today is not only self-sufficient in respect of demand for food, but is also a net exporter of agri-products occupying seventh position globally. The impressive agricultural growth and gains since 1947 stand as a tribute to the farmers' resilience to multiple challenges and to their grit & determination to serve and secure the nation's demand for food and raw material for its agro-industries. But yet this impressive agricultural growth did not bring out successful and significant increase of farmers income. Hence with this motto of doubling farmers' income by 2020, different schemes have been launched by Modi government in 2016 and Rs. 62376 crore fund has been allotted to agricultural sector in 2017-18 budget. A clear conceptual framework has been drafted for doubling farmers income such as improving crop productivity, Reduced cost of cultivation, Breeding for challenges, diversification of farm, Better market price for goods and Reduction in post harvest losses. As plant breeders we are highly responsible for this current issue by breeding successful and practical implacable crop varieties and hybrids. There are some of the successful examples where farmers' income was tripled when compared to a most successful rice variety "BPT 5204". "Kalanamak" a scented aromatic rice grown in parts of Uttar Pradesh and has GI tag. Although there are some breakthroughs regarding increasing or doubling farmers' income, we need to consider facts and figures before breeding for any challenges or requirements. An integrated approach of various disciplinarians' will be best in this regard.

## **MOLECULAR APPROACHES FOR BALANCED FOOD & NUTRITIONAL SECURITY TOWARDS INCREASING POPULATION**

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### **ABSTRACT**

Food and nutritional security refers to availability and access of food which provides essential nutrients to all people at all time. Production of best quantity and quality of food crops is essential to meet up the requirements of day by day increasing population in the world. These problems can be overcome by applying plant breeding and biotechnological approaches. Conventional plant breeding approaches like Pureline selection in inbreds, Recurrent selection, Pedigree method and Backcross breeding can defend certain problems like pests, diseases but the problems related to traits governed by polygenic traits viz quality, yield and nutritional parameters like differential ratios of saturated and unsaturated fatty acids, vitamins and other complex organic molecules remained unsolved. Modern biotechnological and molecular plant breeding approaches play immense role to overcome these problems and feed the growing population sustainably. To solve complex problems we have advanced technologies like Mutational breeding, MAS, *In-vitro* technologies and Molecular techniques such as GWAS, Genome editing and Gene knockdown through CRISPR/Cas9 technology. By following these methods we can identify different QTL responsible for qualitative and quantitative traits and transfer it from different genetic background into elite



lines by following wide hybridization technique and vector mediated or vectorless gene transfer. Problems in wide hybridization (Distant hybridization) can be solved by Embryo rescue technology. By using biotechnology creation of wide genetic variability and enhanced productivity can be done through rDNA technology. Superior resistant lines for biotic stresses like viral diseases, weeds, pests and abiotic stress like drought, submergence and temperature extremes can be developed. By following these strategies high yielding and high quality elite lines can be developed to ensure improvement in food and nutritional security.

## THE LESSER KNOWN FLOWERS USED FOR MULTIPURPOSE

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### ABSTRACT

Flowers provide natural medicines for humans and some animals and aid in a plant's reproduction by enticing outside pollinators. Without flowers, plants would merely be green, and the world would be a duller place. Flowers play an important role in making the life of a human being more cheerful and happy. People use flowers in several forms on several occasions. Lesser known flowers are newly discovered genera or species or newly introduced cultivars grown earlier years, but without complete information that can be produced with new production technologies. Many endemic ornamental plants are endowed with high ornamental and landscape value, such as *Ranunculus asiaticus*, *Argyranthemum frutescens*, *Euphorbia spinosa* and *Eustoma grandiflora*. Cut flowers are flowers or flower buds (often with some stem and leaf) that have been cut from the plant bearing it. It is usually removed from the plant for decorative use. Although usually thought of as "minor" cut flowers, *Gypsophila paniculata* (baby's breath), *Limonium* (statice), and *Gladiolus* are of major importance in the cut flower industry. One of the greatest advantages is that flowers and plants offer complete natural medicinal properties, often without the scary side effects that modern pills and medications bring on. Furthermore, remedies made from flowers can be much cheaper than drugs marketed by pharmaceutical companies. Kalaiselv et al. (2019) explored the synthesis of silver nanoparticles (Et-AgNPs) by using latex extract of *Euphorbia tirucalli* against root-knot nematode species like *Meloidogyne incognita*. The findings indicated that Et-AgNPs were lethal at J2 and also inhibited egg hatching (in-vitro). In planta trials suggest that infestation on tomato roots was significantly reduced when the Et-AgNPs were applied as a root dip treatment. Tomato plants treated with Et-AgNPs had healthier growth parameters with a concurrent reduction in overall gall formation, egg masses on roots, number of eggs per egg mass in J2 populations within the plants. They concluded that Et-AgNPs are helpful for the management of *Meloidogyne incognita* and will be an effective replacement for synthetic nematicides.

## IMPACT OF PROTECTED ENVIRONMENT ON GROWTH, YIELD AND QUALITY OF HORTICULTURE CROPS UNDER PROTECTED STRUCTURES

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### ABSTRACT

Environment effect on protected cultivation is the sustainable approach toward the horticulture production under adverse climate. Besides, from protection to adverse climatic condition, the horticulture crops under protected production gives higher yield and quality produce in terms of shape, size and colors due to congenial inside microclimate. The protected cultivation comprises different devices and technologies namely control some of the abiotic parameters like temperature, relative humidity, carbon dioxide, light, wind mulches etc. and the structures viz greenhouse, tunnel, shade net house help us production throughout the year by modifying the natural environment. It will further prolong the harvest period, increase yield, quality improvement and keep the availability of commodities frequently. Most of the horticulture crops are grown





extensively in the plastic greenhouses for higher productivity. The growing conditions especially light and temperature are known to influence both composition and quality of fruits. The open field production of horticulture crops encounter with many production constraints like heavy rain, excessive solar radiation, temperatures and humidity, higher insect pest infestation and fungal diseases. Environment is the most determinate factor in horticultural crop so we are need to protected cultivation is being used to control the all abiotic factors.

## ROLE OF BIO-FERTILIZERS IN FLOWER CROPS

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### ABSTRACT

Flowers are symbolised as love, purity, peace and beauty. Flower is a god's gift to mankind. They are used in almost all occasions of festivals, religious or social functions. In the new era, floriculture industries have been developed in higher scale and the demand of flowers increased in the local as well as in the international market. Biofertilizers can be supplemental to the chemical fertilizers and they contribute plant nutrients through N<sub>2</sub> fixation, P solubilisation, uptake of P and other mineral nutrients and synthesis of growth promoting substances including maintenance of soil reaction and improvement of soil fertility. In commercial scale, biofertilizers are available in the form of rhizobium, azotobacter, azospirillum, azolla, BGA, VAM and PSM.

The treatment with biofertilizers (PSB+KSB+VAM) + 100% NPK resulted in higher number of bulbs plant<sup>-1</sup> (1.91) and m<sup>-2</sup> (56.85) and bulblets plant<sup>-1</sup> (3.48), maximum weight of bulbs (779.33 g m<sup>-2</sup>) and bulblets plant<sup>-1</sup> (4.59 g) with maximum size of bulb (12.85 cm). Treatment with Biofertilizers (PSB+KSB+VAM) + 100% NPK to be superior in terms of yield and bulb production. Biofertilizers application enhanced various growth parameters at all stages of growth compared to chemical fertilizer application alone. Application of biofertilizers along with 50 per cent NPK brought about results on par with 100 per cent NPK fertilizer with respect to chlorophyll content, floral characteristics such as days taken to 50 per cent flowering, number and weight of flowers per plant, diameter of flowers, ten flower weight, flower yield per plant and shelf life of flowers, indicating replacement of NPK chemical fertilizers to the extent of 50 per cent.

## CHARACTERIZATION OF *EXSEROHILUM TURCICUM* (PASS.) LEONARD AND SUGGS, ISOLATES CAUSING TURCICUM LEAF BLIGHT IN MAIZE (*ZEA MAYS* L.) AND INTEGRATED MANAGEMENT OF THE DISEASE

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### ABSTRACT

Maize (*Zea mays* L.) is an important cereal crop being affected by many diseases. Among the foliar diseases of maize, Turcicum Leaf Blight (TLB) incited by *Exserohilum turcicum* disease causes more grain yield losses. A roving survey was carried out in major maize growing areas of Southern Karnataka, revealed that maximum disease severity (63.50 %) was recorded in Hassan district. Out of ten isolates collected during survey, Hassan (Et5) and Shivamogga (Et4) isolates have shown profuse mycelial growth with excellent sporulation. Based on the colony colour, all the ten isolates grouped into 6 categories viz., brownish grey, black, dark olive brown, greyish yellow brown, light grey and greyish olive. Among the five different media used to study the growth, maximum colony growth was observed on Oatmeal agar media (82.94 mm). However, maximum dry mycelial weight was recorded in Richard's broth (375.94 mg). Maximum conidial length and width was recorded in Et4 (139.67×27.00 μm) isolate. Maximum number of septation was observed in Et4 (7.44). A total of 324 maize genotypes were screened for resistant reaction against TLB and results revealed that 147 genotypes showed resistant reaction, while 116 genotypes exhibited moderately resistant reaction. Under field condition, combi fungicide, Trifloxystrobin 25 % + Tebuconazole 50 % (0.7 g/l), bioagent *Trichoderma harzianum* (5g/l) and botanical *Azadirachta indica* (10%) were found effective against the disease. Among different date of sowing times, early sowing (July 1<sup>st</sup> week) was recorded minimum disease severity of TLB in maize.



## **STUDY ON EFFECT OF WASTE DECOMPOSER ON PADDY CROP RESIDUE MANAGEMENT**

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### **ABSTRACT**

A field experiment (On Farm Testing) was conducted during year 2019-20 at farmer's field in Mandla District of Madhya Pradesh, India for the study of effect of waste decomposer on decomposition of paddy crop residue. The experiment consisted of 2 treatments viz. Farmer practices in which decomposition of crop residue was done in open hip and other recommended practices in which waste decomposer @ 30 gm/10000 metric tons paddy crop residue was used. Initially waste decomposer microbial consortium was mixed with 2 kg of jaggery in 200 litre of water in a plastic container and stir well then 30 gm of waste decomposer poured into the solution (avoid direct contact of hands with waste decomposer microbial consortium contents). Stir the solutions of the container and cover it with a paper or cardboard sheet and stir it daily once within 7 days the microbial consortium solution is ready. The experimental result revealed that the duration of decomposition of paddy crop residue decreases by about 44.45% over farmer practices. The average nutrient content were 24.3%, 0.40%, 0.24% and 0.41% of OC, N, P and K respectively in farmer practices and 26.4%, 0.55%, 0.34% and 0.54% of OC, N, P and K respectively in recommended practices. Partially decomposed crop residue and poor quality of compost prepared through open hip of farmer practices and fully decomposed crop residue and good quality of compost prepared through recommended practices of waste decomposer. It can be concluded that decomposition technology would be helpful to reduce the cost and time of decomposing as well as increase the nutrient content over farmer practices. This technology is helpful in managing of crop residue, improving soil health and decreasing environmental pollution by burning of crop residue in the field.

## **NUTRITIONAL ASSESSMENT OF IRON SUPPLEMENTATION OF ANAEMIC ADOLESCENT GIRLS**

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### **ABSTRACT**

Iron deficiency anaemia (IDA) is a lack of iron in the body which reduces the ability to produce haemoglobin, a pigment in red blood cells. Adolescence is a crucial phase of growth since it offers the second and last chance to catchup growth in the life cycle of girls. Adolescent girls are particularly prone to iron deficiency anaemia because of the increased demand of iron by the body. In adolescence the protein and calorie requirements are at maximum level. It is important to know the health and nutritional status of this group. The diet survey of the communities not only provide essential information regarding the deficiencies but also the quantity and type of food required for correcting anaemia. Their haemoglobin value was estimated using cyanmetmethod. For the dietary survey work, adolescent girls were purposive selected. Dietary consumption includes assessment of food consumption, calculation of nutritive value and comparison with nutritional requirements. The study revealed that a decline in calorie, protein and iron intake was evident with increasing severity of anaemia. Reducing iron deficiency anaemia can not only improve nutrition and work output of the adolescent girls but also the overall health status that ensure a better quality of life.

## **NUTRITIONAL AND FUNCTIONAL EVALUATION OF MILLETS AND SOY BASED INSTANT UPMA MIX**

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### **ABSTRACT**

The purpose of this paper is to study the nutritional composition of ready-to-cook value added nutritious mixture formulated by incorporating of foxtail millet semolina, wheat semolina and soy grits. Proximate analysis was observed that moisture, protein, fat, fibre, ash, carbohydrate and energy value content varied from 7.25 to 8.42%, 11.00 to 13.50%, 7.20 to 8.60%, 1.20



to 7.62%, 2.02 to 3.86%, 59.87 to 70.16% and 368.08 to 389.44 kcal/100g respectively in various instant upma mix formulations. Minerals content in instant upma mix such as calcium, phosphorus and iron varied from 27.00 to 40.91, 130.97 to 297 and 1.90 to 2.94 mg/100g respectively. Bulk density of instant upma mix was increased from 0.73 to 0.78 g/ml. as compared to control sample. The highest value of water absorption capacity (248 ml/100 g) and fat absorption capacity (198 ml/100 g) in instant upma mix attained by U6 prepared from 95% foxtail millet semolina and 5% soy grits. The shelf life studies indicated that the instant upma mixes were acceptable up to 2 months of storage at ambient condition in aluminium foil packaging.

## **IMPORTANCE OF BALANCE DIET AND ITS EFFECTS ON HUMAN HEALTH**

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### **ABSTRACT**

Balance food materials and meals are important social events. But other than for pleasure, we need food to get nutrients, vitamins, minerals and energy. Very few foods are either all good or all bad. By having an idea of the balance in your diet, it should be easier to enjoy food and be healthy. The present investigate the perceptions of worldwide researcher about nutritional balance diet and its effects on human health body main Focusing on nutritional proper balance diet and its effects on health, in case if improper nutritional balance diet intake in both form under nutrition and over-nutrition have adverse effects on health. Your body requires variety and specific amounts of nutrients to function properly and perform the activities of daily life. If your body does not get those nutrients, which is common when eating an unbalanced diet, it can develop health problems. A common-sense approach, including eating from a variety of food groups and maintaining proper portion control, may help avoid any potential problems, as well as keep you healthy and vibrant in the process.

Nutritional balance diet is the quantitative analysis of food material that the human health body absorber. The body breaks down the food to get the body that it necessary: proteins, fats, carbohydrates, vitamins, and minerals are the essential in human body. Nutritional to sum of all processes involved in how organisms obtain nutrients, metabolize them, and use them to support all of life's processes. If body does not have these things, than the body will unable to work properly. Balance diet has been one of the basic needs of every individual living on the earth. And is that process which provides energy to the human body to perform various tasks in human body. Different kinds of disease, weakness and disabilities are closely related with the intake of insufficient amount to food nutrients and proper balancing diet. This study main focus upon nutritional balance diet and its effects on human health.

At least forty percent of your nutritional intake every day has to be through fruits and vegetables. It is ideal to ensure that every meal includes a colorful assortment of veggies and fruits, but if this is difficult to implement you could cover it over the span of a week. By doing this each day, you get and adequate supply of vitamins, minerals, potassium, folate, antioxidants and so on, without compromising on quantity or quality.

## **EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF BRINJAL (*SOLANUM MELONGENA* L.)**

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### **ABSTRACT**

Brinjal or eggplant (*Solanum melongena* L.) is one of the important and popular vegetable crop grown in India, belong to the family Solanaceae. Various sizes, shapes, colours and forms of cultivated as well as wild type of brinjal are found in India, white type brinjal fruits is said to be good for diabetic patients. Brinjal fruits have medicinal properties. Some medicinal use of eggplant tissues and extract include treatment of diabetes, asthma, cholera, bronchitis and diarrhea, its fruit and leaves are reported to lower certain levels of blood cholesterol. The productivity of Brinjal can be increased by using integrated nutrient management. The integrated management of nutrient in its proper perspective may be adopted to support enhanced productivity and quality of vegetables. Keeping in view the present investigation was carried out to study the effect of integrated nutrient management on the nutrient of brinjal. An experiment was conducted at the Rajola Farm of the Faculty of Agriculture Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna Madhya Pradesh, India during Kharif season 2014-2015. Twelve treatments of integrated nutrient management viz., (T0) control (no use of fertilizer),



(T1) Farm Yard Manure (20 t/ha) +, (T2) VC (10 t/ha), (T3) Recommended Dose of Fertilizers (NPK), (T4) FYM (20 t/ha) + RDF (NPK), (T5) Vermi-compost (10 t/ha) + RDF (NPK), (T6) 75 % RDF (NPK), (T7) FYM (20 t/ha) + 75% RDF (NPK), (T8) VC (10 t/ha) + 75% RDF (NPK), (T9) 50% RDF (NPK), (T10) FYM (20 t/ha) + 50% RDF (NPK) and (T11) VC (10 t/ha) + 50% RDF (NPK) were evaluated in Randomized Block Design with three replications. Significantly higher values of yield attributes such as fruit yield per plot and fruit yield ton per ha were observed under VC @ 10 t/ha + 75% RDF (NPK). However, significantly minimum values of yield attributes were observed under control FYM @ 20 t/h + 75% RDF.

### **COMBINING ABILITY ANALYSIS IN BRINJAL (*SOLANUM MELONGENA* L.)**

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#### **Abstract**

In any heterosis breeding programme, proper choice of parents based on their combining ability is a prerequisite. Such studies not only provide necessary information regarding the choice of the parent but also simultaneously illustrate the nature and magnitude of gene action involved in the expression of desirable traits. Information on the nature and magnitude of heterosis in different cross combinations is a basic requisite for identification of the crosses that exhibit high amount of exploitable heterosis. Combining ability and gene action were studied in line x tester mating design using seven lines namely, IC 090053, IC 285140, IC 421194, IC 545893, IC 90806, Pusa Shyamala and Heera and three testers viz., Bhagyamathi, Gulabi and Shyamala. General combining ability studies revealed that Pusa Shyamala, Heera, Bhagyamathi and Gulabi were the best combiners for yield and yield contributing characters. However, the estimates of specific combining ability showed the highest desirable sca effects in crosses viz., IC 285140 x Bhagyamathi, Pusa Shyamala x Gulabi, Heera x Bhagyamathi, Heera x Gulabi and Heera x Shyamala were identified as promising for fruit yield per plant and number of fruits per plant, relatively high fruit length, fruit girth and more fruit weight. Gene action analysis revealed preponderance of both additive and non-additive genes for yield and its contributing characters.

### **AN IMPROVED CLASS OF ESTIMATORS OF FINITE POPULATION MEAN IN SAMPLE SURVEYS**

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#### **Abstract**

This investigation proposes an improved class of exponential estimators for evaluating the population mean utilizing accessible auxiliary information in large-scale agriculture surveys. Bias and mean squared error of the proposed class of estimators have been examined under large sample approximation. The conditions have been determined for the proposed class of estimators under which it performs superior to certain established and classical estimators. Under the experimental investigation, the utility of proposed family of estimators in agriculture and efficiency to some established estimators has been demonstrated.

### **KNOWLEDGE OF THE MEMBERS ABOUT THE FARMER PRODUCER ORGANIZATIONS**

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#### **Abstract**

Knowledge is an understanding of something such as facts, information, descriptions, which is acquired through experience or education by perceiving, discovering or learning. It plays a vital role in covert and overt behaviour of the human beings. It is apparent that if members of FPOs are well aware of the FPO activities then they will be able to gain more benefits from FPO.



Therefore an attempt was made to find out the knowledge of members about Farmer producer Organizations about concept, registration process, objectives and election process of Farmer Producer Organizations, services provided by NABARD, POPI and FPO, backward and forward linkages etc. Interview Schedule was used to gather information from 320 members of selected FPOs in Udaipur district. It was found that both the respondents possessed the knowledge of FPO formation, Producer Organization Promoting Institution (POPI) and financial support agency to the extent of MPS (62.92 to 60.02%). Moreover from a long time they were well versed with POPI namely Gandhi Manav Kalyan Society, Rajasthan Bal Kalyan Samiti, Samidha Seva Sansthan, Gayatri Seva Sansthan and Mahan Seva Sansthan. Further it was also observed that the knowledge of female regarding functioning of FPO and backward forward linkages were found between the extents of MPS (27 to 27.63). The overall knowledge of male members was observed more in comparison to female members of the FPOs.

## **AN INTEGRATED FARMING OF MAKHANA (*Euryale ferox* SALISB.) AND FISH CULTURE FOR OPTIMUM YIELD**

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### **Abstract**

Makhana (*Euryale ferox* Salisb.) is commonly used seed which is rich in micronutrients and antioxidants and are found throughout the Asia. Integrated farming of makhana and fish culture in wetland ecosystems provide not only yield of seeds but also the nutritional values such as sugars, minerals, proteins, starch etc. The nutritional values of makhana and yield of seeds varies by different Integrated Nutrient Management (INM) for makhana crop and fish culture. N<sub>3</sub> treatment showed the highest value where well-balanced inorganic and organic plant nutrients were received by both makhana plants and fish culture with fish feed including zinc spray. The combination of different farming system and Integrated Nutrient Management on nutritional values of makhana seeds were not significant. These important food ingredients obtained in N<sub>3</sub> treatment have great importance for poor and marginal section of the rural people and small as well as cottage industries.

## **CHALLENGES AND OPPORTUNITIES IN AGRI-ENTREPRENEURSHIP IN INDIA**

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### **Abstract**

The agriculture sector provides food for 1.3 million people in India as well as supports over 60 % of the population for their livelihood and plays a crucial role in the sustainable growth of the country's economy. Traditionally, agriculture has been seen as a low-tech industry with limited dynamics, largely controlled by a huge number of small families, which over the years paid attention to improving crop yield rather than looking at it as a money-making module. Many farmers are forced to migrate to cities for their livelihood in the wake of lower remuneration or unbearable crop losses on accounts of volatile market dynamics or unpredictable weather conditions. There is a need to bring about transformational changes in the agriculture sector by making farmers as agri entrepreneur. They need to consider their activities as businesses. Entrepreneurship should be encouraged in agriculture as innovation would not just help farmers improve crop productivity, more profit but create new avenues of employment generation for rural youth as well. Entrepreneurship helps in developing nation's economy, improves production and labour market, builds job opportunities and finally increases employment rate which influence most of the developing countries including India to encourage and support entrepreneurship for their economic development and reduced unemployment. India focused on entrepreneurial development which is nothing but an organized and regulated growth of an individual towards an entrepreneur employing cultivating entrepreneurial skills in terms of knowledge, financial support, marketing and other approaches. There is ample scope in different sectors of Agri business like agri inputs, farm mechanization, agri clinic, processing, trading, value addition, retail marketing, micro financing, logistics etc. In spite of unlimited growth potential in this field there are several challenges also. The most important is dependency on favourable weather conditions. In the absence of local entrepreneurship, the opportunities in agriculture are high jacked by outsiders, particularly the urban businessmen and traders, leading to misuse and lack of employment for the farmers. Although it is very difficult to change the mind set of farmers towards Agri Entrepreneurship but some progressive farmers may be attracted for establishing start-ups in this field.

## EFFECTS OF DIFFERENT CONCENTRATION OF UREA ON SEED GEMINATION IN *BRASSICA JUNCEA* L.

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### Abstract

The selection of an optimum fertilizer is mandatory step for proper growth and development of a crop. Many chemical and organic fertilizers have negative impacts on environmental, and human health. Urea is commonly used fertilizer. In the present investigation, effects of different concentrations of urea was observed in various attributes of seed germination viz. seed germination percentage, root length, shoot length, seedling size, dry matter content, and fresh matter content in *Brassica juncea* L., which is a common oil crop. Total four concentrations of urea (250 ppm, 500 ppm, 750 ppm, and 1000 ppm) were selected for the experiments. Seeds were germinated in petri-plates and all the experiments were done in triplicates. Results were analysed statistically. Results revealed that 500 ppm concentration of urea is optimum for seed germination parameters while the higher concentrations lowers seed germination. The present study, may help farmers to select optimum concentration for urea for a crop.

## INNOVATIVE AND RECENT APPROACHES FOR NUTRIENT MANAGEMENT IN CASHEW

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### Abstract

Cashew (*Anacardium occidentale* L.) is a tropical nut crop introduced to India and being extensively cultivated along the east coast and west coast regions apart from some plains and north eastern regions. The low productivity of cashew in India is mainly due to low care and attention given to the crop apart from the fact that most of the cashew plantations are raised on highly eroded landscapes. Most of the cashew growing soils are low in soil fertility in terms of nitrogen, base status, cation exchange capacity and micronutrients such as zinc and boron. The studies indicate that adequate nutrient management practices can improve yield of cashew. Proper nutrition is essential for the growth and development of crops. The nutrient management for the crop should be need based addressing the growing needs of the crop. The information and communication technologies (ICTs) can be used for accurate information delivery. For empowering the growers for arriving at the location specific nutrient requirement based on the actual field conditions, a software and mobile app on nutrient management was developed. Moreover, for in-season correction of nutrient deficiency, leaf analysis based nutrient management protocol utilizing the diagnosis and recommendation integrated system was developed. The use of recent technologies shall be beneficial to address the nutrient management issues in cashew.

## A STUDY ON MANAGEMENT OF ECO-FRIENDLY PRACTICES IN AGRICULTURE AMONG THE TRIBAL FARMERS OF BETUL DISTRICT OF MADHYA PRADESH

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### Abstract

The present study was conducted in Sahapur and Bhimpur block were purposively selected based on tribal area of Betul district of M.P. The total sample was consisted 120 respondents for the study. Variables like education, social participation, size of land holding, annual income, credit availability, occupation, source of information, material possession, extension contact, extension participation and innovativeness were positively and significantly correlated with knowledge about eco-friendly practices at 1 per cent level of significance and education, social participation, credit availability, extension

participation, extension contact and innovativeness were positively and significantly correlated with adoption of eco-friendly practices at 1 per cent level of significance. Majority of the respondents suggested making availability of pest resistant varieties, followed by three-fourth of respondents said organizing training on eco-friendly practices to minimise the ill effect of agrochemicals as perceived by farmers. The development of India is also depending on agriculture and it is engaging about 70 per cent of its population directly or indirectly. It contributes nearly 37 per cent of the net national product. The modern agriculture has been successful in meeting the increased food needs of alarmingly growing population. But the problem associated with modern agriculture like, the high cost of inorganic or chemical fertilizers and plant protection chemicals, stagnated yield level.

## **ECONOMIC TRAITS IN NATIVE BIRDS OF GULBARGA DIVISION UNDER FARM CONDITIONS**

**Sudhir N., Jayanaik, Basavraj Inamdar and C.R. Gopinath**

*Department of Poultry Science, Veterinary College, KVAFSU, Hebbal, Bengaluru, Karnataka, India*

### **Abstract**

This study was carried out to document the economic traits in native birds of Gulbarga division under farm conditions. The average weekly feed consumption and body weights were recorded and FCR was estimated, the FCR was 3.14, 3.16 and 3.26 in birds of Bidar, Gulbarga and Koppala districts, respectively. The average age at sexual maturity, body weight at sexual maturity and egg weight at sexual maturity were  $178.25 \pm 5.89$  days,  $1097.00 \pm 12.83$  gms and  $30.85 \pm 0.11$  gms, respectively. The per cent fertility, per cent hatchability on total eggs set and per cent hatchability on fertile eggs set were  $90.33 \pm 0.31$ ,  $80.58 \pm 0.67$  and  $89.02 \pm 0.80$ , respectively. The average hen housed egg production were  $41.30 \pm 1.82$ ,  $36.54 \pm 2.43$  and  $50.68 \pm 2.23$ , and survivor's egg production were  $53.08 \pm 6.32$ ,  $53.64 \pm 5.44$  and  $55.78 \pm 4.12$  in birds of Bidar, Gulbarga and Koppala districts, respectively at 52<sup>nd</sup> week of age. The mortality rate (percentage) was recorded and it was 5.38, 9.88 and 7.17 in day one – 8<sup>th</sup> week (Chick stage), 9-18<sup>th</sup> week (Grower stage) and 19-52<sup>nd</sup> week of age (Layer stage). This study revealed distinctive variations in economic traits among the birds of three districts of Gulbarga division, providing the basis for proper selection and development of improved backyard stains.

## **MORPHOLOGICAL CHARACTERIZATION IN NATIVE BIRDS OF GULBARGA DIVISION UNDER FARM CONDITIONS**

**Sudhir N., Jayanaik, Basavraj Inamdar and C.R. Gopinath**

*Department of Poultry Science, Veterinary College, KVAFSU, Hebbal, Bengaluru, Karnataka, India*

### **Abstract**

This study was carried out to morphologically characterize the native birds of Gulbarga division under farm conditions. All the birds were normal feathered and the males were mostly multicoloured, whereas the females were black. The dominant primary plumage pattern observed was solid in males and dull in females. The color of the skin and shanks were yellow in majority of the birds. All the birds had red ear lobes and most of the birds were brown eyed. Majority of the birds had wattles and were single combed. The body weights of birds were recorded from day old to 20<sup>th</sup> weeks of age and it was observed that the birds of Koppala district had significantly higher body weights than the birds of Gulbarga and Bidar districts. The average shank length recorded was  $59.19 \pm 0.26$  and  $52.43 \pm 0.21$  mm, and the average breast angle was  $80.41 \pm 0.14^\circ$  and  $72.04 \pm 0.17^\circ$  in males and females, respectively at 8<sup>th</sup> week of age. This study revealed distinctive variations among the birds of three districts of Gulbarga division, providing the basis for further characterization of these native birds.

## **MANAGEMENT OF CROP RESIDUES IN THE CONTEXT OF CONSERVATION AGRICULTURE**

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### **Abstract**

The amount of surplus crop residue available in India is about 141 million tons a year, out of which 92 mt is burned each year. The two crops as rice and wheat are produced large amount of residues in India. Processing of agricultural produce through milling and packaging also produces substantial amount of residues. Crop residues are natural resources with tremendous

value to farmers. These residues are used as animal feed, composting, thatching for rural homes and fuel for domestic and industrial use. About 25% of nitrogen, 25% phosphorus, 50% of sulphur and 75% of potassium uptake by cereal crops are retained in residues, making them valuable sources of nutrients. However, a large portion of the residues, about 141 Mt, is burned in field primarily to clear the field from straw and stubble after the harvest of the preceding crop. The problem is severe in irrigated agriculture, particularly in the mechanized rice-wheat system. The main reasons for burning crop residues in field include unavailability of labour, high cost in removing the residues and use of combines in rice-wheat cropping system especially in the Indo-Gangetic plains (IGP). Primary crop types whose residues are typically burned include rice, wheat, cotton, maize, millet, sugarcane, jute, rapeseed-mustard and groundnut. Farmers in northwest India dispose a large part of rice straw by burning *in situ*.

## **ADVANCE BREEDING TECHNIQUES FOR ACCELERATING IMPROVEMENT OF SMALL MILLETS**

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### **Abstract**

Minor millets (Nutri cereals) comprise a group of small seeded cereal species belonging to the family Poaceae that are genetically diverse and adapted to a range of marginal growing conditions where major cereals such as wheat, rice, and maize are relatively unsuccessful. The most important cultivated species of small millets are finger millet, Foxtail, proso millet, barnyard millet, kodo millet and little millet. Minor millets are also full of micronutrients like Mg, Ca, Mn, tryptophan, phosphorous, fibre, B vitamins. These micronutrients act as antioxidants which are essential to human body. Millets require few inputs and withstand severe biotic and abiotic stresses. They are also more nutritious than major cereals. Despite these advantages, neglect in several arenas has resulted in a steady decline in the cultivation of minor millets in India over the past few decades. Among millets, the sequencing of whole genomes of two millets sorghum and foxtail millet has been done. It will speed up the genomic selection of better performing millets by marker assisted breeding, QTL mapping, gene tagging etc. Marker assisted breeding can be speed up by doing multiplexed genotyping, next generation sequencing and targeted resequencing. Advance genomic tools can be applied in minor millets for analysis of germplasm resources, allele mining, QTL mapping, fine mapping, gene tagging, foreground and background selection, genome wide marker trait association for further improvement of millets. Thus detail analysis on all omics information i.e., genomics, transcriptomics, proteomics, and metabolomics could promote millets as model systems for biofortification of staple crops and enhance targeted nutritional values. There is need of new high yielding, promotional strategies and policies are necessary to increase the area under nutri cereals crops to achieve nutritional security as well as sustain rainfed farming in the country.

## **PREPARATION OF COST EFFECTIVE, SENSORY AND NUTRITIONALLY EVALUATED MIX GRAIN FLOUR WITH OAT BISCUITS AND ITS NUTRITIONAL IMPACT ON ADULT WOMEN**

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### **Abstract**

Oats as a functional food having physiological benefits like hypoglycemic effect, hypocholesterolemic effect, has effect on reduction of cancer and hypertension. Soluble fibres have been known to lower blood cholesterol levels. Oat fibre has been associated with reduced risk of heart diseases. It is a good source of carbohydrates and quality protein with good amino acid balance. Colour is one of the most important sensory attribute that affect directly the consumer preference of any product. The word Biscuit derived from Latin word Biscoctum means twice baked. Biscuits are one of the low cost processed foods, which are most widely consumed. It, amongst many snack items has certain advantages such as being cheaper than the conventional snack items easy to use at home or even during travel, easily being available in massive variety of shapes, sizes, tastes and appeals to adult age groups. Apart from the good taste, these foods with substantial energy having wholesome and nutritious quality are available at reasonable price. They have good shelf life at ambient temperature. Besides being a very palatable vehicle of nutrition and energy, these biscuits convey the goodness of flour, fat and sugar in most acceptable and economical



term. The study was carried out for determination of the highest sensorially acceptable level of the added oat flour to biscuits. Blends were carried out using concentrations of 20%, 40%, 60%, 80% oat flour and 80%, 60%, 40%, 20% (w/w) added wheat flour as described in 2.1. Then the prepared biscuits were sensorially evaluated by 8 trained panelists chosen from the teaching staff and technicians of the Department of Home Science, M.L.B. Govt. College, Indore (M.P.). The samples were evaluated for overall acceptability using a 9-hedonic scale test as described by Larmond 1991, varying from 9, which means like extremely to 1, which means dislike extremely. Water was used to neutralize the taste between samples testing. Oat compounds provide various opportunities for incorporating oats in functional food products, it has a well-balanced nutritional composition.

## **EFFECT OF NPK THROUGH DRIP FERTIGATION ON VEGETATIVE GROWTH PARAMETERS OF CHRYSANTHEMUM**

**Ashok Choudhary, Ajit Kumar, B.D. Bhuj, R. Srivastava, V.K. Rao and S.K. Guru**

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### **Abstract**

A field experiment was conducted during the winter season of 2019-20 at G.B. Pant University of Agriculture and Technology, Pantnagar to study the effect of NPK through drip fertigation on vegetative growth parameters of Chrysanthemum. The experiment was laid out in randomized block design (RBD) with three replications in open field condition. The different dose of NPK (100:150:100 and 75:112.5:75 kg NPK/ha/year) used at three different stage (vegetative, bud and flowering stage) of crop. The maximum plant height, Plant spread, number of branches per plant, length of branches and internode length were recorded in T<sub>3</sub> (100:150:100 kg NPK/ha/year) as compared to control. Thus it can be concluded that the vegetative growth parameters significantly affect the NPK through drip fertigation.

## **IDENTIFICATION OF MICRONUTRIENT RICH RICE GENOTYPES DEVELOPED BY ANGRAU, ANDHRA PRADESH**

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### **Abstract**

Twenty popular rice varieties developed by ANGRAU, including sixteen released and four pre-released varieties obtained from Regional Agricultural Research Station (RARS), Maruteru during *Kharif* – 2019, were screened for micronutrient content (iron and zinc), proximate composition, Among the varieties investigated for mineral content six varieties namely Swarna, Sri Dhruthi, Indra, MTU 1210, MTU 1224 and MTU 1262 were under a high iron category. Five varieties Swarna, Sri Dhruthi, Indra, MTU 1224 and MTU 1262, were under the high zinc category. Moreover, varieties such as Swarna, MTU 1224 and MTU 1262 have high iron and zinc levels. Mineral content (Iron and Zinc) decreased during polishing. The per cent loss during polishing was given according to the grain type. It is revealed that the percent loss of iron was more in medium slender grains (61.90-74.02%) followed by long bold (64.66-73.88%) and long slender (62.77 -72.52 %) at 5% and 10%, respectively.

## **BLENDING IMPROVES NUTRITIONAL QUALITY AND OXIDATIVE STABILITY OF EDIBLE OILS**

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### **Abstract**

Quality of edible oil depends up on its fatty acid composition, relative proportion of essential fatty acids and nutritive value as well as oxidative stability which imparts thermo stability and enhanced shelf life. Availability of wide variety of cooking oils in the market with varied fatty acid profile and nutritive value with each tagged to be the best cooking oil makes it difficult for consumers to select the healthy cooking oil. Among all cooking oils being marketed, not even single oil offers the desired ideal essential fatty acid ratio and oxidative stability. Quality of cooking oils can be improved by blending different oils of varied

fatty acid composition in suitable proportions. To obtain healthy cooking oil of desired quality, 231 blends were formulated by mixing oils of five different oilseed crops viz. Indian mustard (*Brassica juncea*) cv. Giriraj, canola oilseed rape (*Brassica napus*) cv. GSC 7, sesamum (*Sesame indicum*) cv. Punjab Til No. 2, sunflower (*Helianthus annuus*) cv. PSH 1962 and groundnut (*Arachis hypogaea*) cv. SG 99 in different proportions. These blends were analyzed for their fatty acid profile on gas chromatography (GC). Of these 231 blends, 26 blends derived by mixing different proportions of canola, sunflower and sesame were selected on the basis of (i) ideal -6: -3 ratio (3.5-10:1); (ii) proportion of monounsaturated fatty acid i.e. oleic acid more than 45% and (iii) saturated fatty acid i.e. palmitic and stearic acid content less than 10%. These blends were further evaluated for their antioxidative profile such as total phenols, tocopherols and DPPH radical scavenging capacity which varied from 3.02-6.80 mg/100g, 55.13-70.62 mg/100g and 63.76-73.50%, respectively. Physico-chemical properties such as acid value, saponification value, iodine value, peroxide value, p-anisidine value and smoke point of these reduced slightly compared to individual oils. Of these 26 oil blends, blends of canola: sesame and canola: sunflower: sesame showed higher antioxidative potential in comparison to canola:sunflower blends. These oil combinations also possessed higher smoking point (241.30-253.77°C) indicating their suitability for frying purpose.

## **EFFECT OF SOWING DATES ON FALL ARMY WORM (*SPODOPTERA FRUGIPERDA*) INFESTATION AND YIELD IN MAIZE**

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### **Abstract**

Studies were conducted during the *Kharif* season of 2018 at Maize Research Centre, Agricultural Research Station, Vijayarai, West Godavari District with an objective of determining the effect of sowing dates on fall armyworm (FAW) infestation to minimize yield losses in maize. Popular maize hybrid Kaveri 50 was used in this study. Five dates of maize sowings starting from June 2<sup>nd</sup> fortnight to August 2<sup>nd</sup> fortnight were taken up at fortnightly intervals in a Randomized Complete Block Design (RCBD). The mean percent plant infestation of fall army worm was severe in late sown crop i.e, 2<sup>nd</sup> fortnight of August (50.06) as compared to early sown crop i.e, 1<sup>st</sup> fortnight of July (16.94). Leaf damage was scored by visual observation using the scale of 0–9 reported by Davis and Williams (1992). The crop sown during 2<sup>nd</sup> fortnight of August under natural infestation recorded more leaf damage with a mean score of 6.55 as compared to 1<sup>st</sup> fortnight of July (4.22). The per cent cob damage was lowest in early sown crop 1<sup>st</sup> fortnight of July (32.60) followed by 2<sup>nd</sup> fortnight of July (38.52) than in late sown crop i.e., 2<sup>nd</sup> fortnight of August (78.61). Highest yields were recorded in crop sown in 1<sup>st</sup> fortnight of July (5960 Kg ha<sup>-1</sup>) followed by 2<sup>nd</sup> fortnight of July (5688 Kg ha<sup>-1</sup>). Therefore, considering all facts, 1<sup>st</sup> fortnight of July and 2<sup>nd</sup> fortnight of July as sowing dates could be recommended in realizing higher yields.

## **INSECT POLLINATION**

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### **Abstract**

Without insect pollinators, many plants fail to reproduce. Knowledge of insects that aid in pollination is important for obtaining higher yields. Beetles, flies, honey bees, wasps, ants, butterflies, moths and thrips play a key role in pollinating various crops. The major beetle families that commonly or exclusively contain anthophilous species are the Buprestidae (jewel beetles), Cantharidae (soldier beetles), Cerambycidae (longicorn or longhorn beetles), Cleridae (checkered beetles), Dermestidae, Lycidae (net-winged beetles), Melyridae (soft winged flower beetles), Mordellidae (tumbling flower beetles), Nitidulidae (sap beetles) and Scarabaeidae (scarabs). Major pollinator taxa in Brachycera (Diptera) are the Bombyliidae (bee flies), Syrphidae (hoverflies), Calliphoridae (blowfly/ blue bottle fly) and muscoid families. Nematoceran (Diptera) belonging to family Ceratopogonidae, Bibionidae and Culicidae also play a major role in pollination. Among hymenopterans, long tongued bees (Apidae, Megachilidae) and short tongued bees (Andrenidae, Colletidae, Halictidae, Melicidae) play an important role in pollination. Moth families (Sphingidae, Noctuidae, Geometridae, Pyralidae Oecophoridae) and butterfly families (Danidae, Nymphalidae, Papilionidae, Pieridae, Hesperidae) of Lepidoptera are reported to be involved in pollination. Thrips visit the flowers during anthesis and transfer pollen to stigma during movement.

## **SCREENING OF RICE GERMPLASM FOR IRON AND ZINC CONTENT IN BROWN AND POLISHED RICE USING ED-XRF**

**Shalini T., Chamundeswari N., Satyanarayana P.V., Lal Ahmed M., Sireesha A. and Srinivasa Rao V.**

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### **Abstract**

Forty eight rice genotypes were analysed for iron and zinc content in brown and polished rice. Iron content in brown and polished rice among forty eight genotypes ranged from 6.45 ppm to 14.30 ppm and 0.8 to 4.4 ppm with mean values of 9.28 ppm and 2.12 ppm respectively. Whereas zinc content ranged from 14.7 ppm to 26.7 ppm and 6.90 to 20.6 ppm with mean values of 20.69 ppm and 12.12 in brown and polished rice respectively. Among the 48 genotypes, eleven genotypes had more than 22 ppm of zinc content in brown rice. Brown rice has more iron and zinc content than polished rice, loss of iron content was more in polished rice compare to the zinc content. Among the genotypes, landraces and traditional varieties has more iron and zinc content than improved cultivars. The present study revealed Chittimutyalu, local landrace has more iron and zinc content in both brown and polished rice and selected as rice and selected as one of the parent in development of mapping population to identify the QTLs related to iron and zinc in rice.

## **HERITABILITY AND GENETIC ADVANCE STUDIES IN SINGLE CROSS HYBRIDS OF MAIZE (*ZEAMAYS L.*)**

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### **Abstract**

Ten single cross maize hybrids developed in Acharya N.G. Ranga Agricultural University were evaluated in Randomised Block Design with two check varieties at Maize Research Centre, VIJAYARAI, West Godavari Dist., Andhra Pradesh to know the selection efficiency of twelve agronomical, yield and yield contributing traits. Analysis of variance revealed significant differences for all traits except number of cob girth (cm). The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) recorded for all traits. Kernel yield showed the highest PCV (14.36%) and GCV (11.15%) whereas the lowest PCV (0.953%) and GCV (1.753%) were recorded for test weight. Heritability (broad sense) ranged from 20.445 (kernel girth in cm) to 73.832 (ear placement height in cm). Kernel yield (Kg/ha) had shown 60.316 broad sense heritability with 17.842 genetic advance as percent of mean. Days to maturity, Plant Height (cm), Ear placement height (cm), number of kernel rows per cob and Kernel yield (Kg/ha) had shown high heritability of >50% with high GCV and PCV. Hence these traits can be used further in crop improvement program.

## **EFFECT OF HORMONAL CONCENTRATION IN TISSUE CULTURE RAISED SAPLINGS OF BANANA (*MUSA SPP.*)**

**D.R. Rathod, R.R. Katkade, B.S. Mundhe, S.S. Jamodkar, P.R. Shingote, D.A. Padole, V.S. Madake, G.D. Chandankar, S.M. Gogate, S.K. Burghate, P.R. Padghan and S.B. Sakhare**

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### **Abstract**

The present study was conducted at plant tissue culture laboratory of Biotechnology Centre, Dr. PDKV, Akola during the year 2020-2021 to assess the effect of different concentrations of cytokine (BAP) and auxin (NAA, IAA, IBA) on disease free plant regeneration. The source explants suckers from agronomically well managed authentic orchards and high yielding Grand naine banana mother were tagged and procured for plantlets production. Among different treatment combination of BAP and NAA, the concentrations, 2 mg/l BAP + 0.5 mg/l NAA showed highest shoot proliferation of 1.25, 3.25 and 7.00 shoots per explant at 10, 20 and 30 days after inoculation (DAI), respectively. The longest shoot 1.10, 2.74 and 4.03 cm were noticed at 10, 20 and 30 DAI, respectively. The treatment combination of 2 mg/l BAP + 0.5 mg/l NAA found promising and significant over others in respect to later shoot growth and high rate of shoot proliferation. While root initiation using MS medium supplemented with different levels of IBA @ of 0.5, 1.0 and 1.50 mg/l and IAA @ of 0.5 and 1.0 mg/l was used. Root numbers

shows variable response and was varied with different concentrations level of IBA and IAA. The highest number of roots were produced when 1mg/l IAA + 1 mg/l IBA. Whereas, highest shoot to root length 3.25, 5.33 and 6.15 cm were recorded at 10, 20 and 30 DAI in the same treatment, which was shown statistically significant. Rooting plantlets were transferred to poly bags containing 1:1 (soil rite: cocopeat) mixture after 15 days hardening in room temperature (28-30°C) and established plantlet was ready for secondary hardening and further plantation in the field conditions.

## **ROLE OF PRETREATMENTS ON THE QUALITY OF DEHYDRATED FRUITS AND VEGETABLES**

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### **Abstract**

India is the second largest producer of fruits and vegetables. They contribute more than 30% of the agriculture GDP. Out of the total production of fruits and vegetables nearly 76 percent is consumed in fresh form, while wastage and losses account for 20 to 40 %. Only 2-3 percent of production is being processed. Drying is one of the oldest method and most traditional method. By reducing the moisture up to a certain level in fruits and vegetables, the microbiological spoilage and deteriorative chemical reactions are greatly minimized. In addition to preservation, drying lowers the cost of packaging, storage and transportation by reducing both the weight and volume of the final product. In fruits and vegetables many deteriorative reactions occur when they are subjected for processing. These reactions may be enzymatic or non enzymatic. Pretreatments are given to fresh products before drying to prevent the changes that occur during processing. The use of pre treatment on crops before drying is aimed at preventing fruits and vegetables from darkening. Many light coloured fruits such as apples darken rapidly when cut and exposed to air. If not pretreated, these fruits will continue to darken after dried. Pretreatments given to fruits and vegetables are blanching, acid dip, alkaline dip, sulphuring, CaCl<sub>2</sub>, Syrup and salt blanching, honey dip, fruit juice dip, Hydrogen peroxide. The commonly used pre treatments are sulphiting, syrup blanching.

## **SEASONAL INCIDENCE OF SWEET POTATO WEEVIL, *CYLAS FORMICARIUS* (FAB.) (BRENTIDAE, COLEOPTERA) AND ITS CORRELATION WITH WEATHER PARAMETERS**

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### **Abstract**

Studies on seasonal incidence of sweet potato weevil (*Cylas formicarius*) in relation to major abiotic factors was carried out at College of Horticulture, Venkataramannagudem. Seasonal incidence of the weevil was recorded on the basis of the population of adult weevils caught in pheromone traps and stem injury caused by the grub in sweet potato. Population of sweet potato weevil and stem damage was recorded from first week after planting that increased till the harvest of the crop. The highest number of weevils (367.27/trap/week) and highest stem injury percent (36.14 percent/ plant) was observed during 11<sup>th</sup> SMW (5<sup>th</sup> Mar. – 11<sup>th</sup> Mar.). The adult sweet potato weevil population was significantly positively correlated with maximum temperature and stem injury percentage was significantly positively correlated with the maximum temperature and maximum humidity.

## **CLUSTER AND PRINCIPAL COMPONENT ANALYSIS IN MAIZE HYBRIDS**

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### **Abstract**

The present investigation comprised with 11 set of maize hybrids to evaluate the diversity existed suing correlation, principal component and cluster analysis. The correlation coefficient analysis revealed that kernel yield (kg/ha) showed significantly positive correlation with the traits like kernel yield per plot (kg), cob yield per plot (kg), days to 50% silking, number of seeds per cob, number of seed rows per cob and shelling percentage (%). From the cluster analysis and principal component analysis it is clear that the hybrid *i.e.*, PDMH-1449 formed in cluster-3 which showed higher values for the traits like kernel yield (kg/ha), shelling percentage (%), kernel yield per plot (kg), cob yield per plot (kg), number of seeds per cob, number of seed



rows per cob, cob girth (cm) and cob length (cm). Out of four components, PC-1, PC-2 and PC-3 showed >1 eigen value which contributed 90.53% of the total variability among the maize hybrids assessed for yield and its associated traits. Out of three components, PC-I contributes the maximum towards the variability (68.42%) followed by PC-II (13.11%) and PC-III (8.99%). From the study it is clear that the traits like plant height (cm), kernel yield (kg/ha), cob yield per plant (kg), days to 50% pollen shed and kernel yield per plot (kg) were the main cause for maximum diversity and also for higher yields.

## MORPHOLOGICAL EVALUATION OF ECONOMICAL AND COMMERCIAL BAMBOO SPECIES

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### Abstract

Present study entitled “Characterization of economically important bamboo species using morphological and molecular markers” was attempted at Biotechnology Centre, Dr. PDKV, Akola during 2020-21. Main aim was to characterize morphologically economically important bamboo species viz., Sp1: *Dendrocalamus stocksii*, Sp2: *Bamboosa balcoa*, Sp3: *Dendrocalamus strictus*, Sp4: *Bamboosa tulda*, Sp5: *Bamboosa vulgaris* (green). The morphological characterizations of these important bamboo species were attempted based on field based observations. This was carried out by samples collected randomly from three plants of each spp in field grown Bamboo sectum, College of Agriculture, Dr. PDKV, Nagpur campus for twenty one traits includes 17 quantitative and four qualitative traits namely internodal distance (cm) of clum, solid or hollow nature of clum, thorny or non-thorny nature of bamboo plant, clump wall thickness (mm), growth habitat: erect v/s spreading, branching pattern: primary v/s secondary, maturity in years, leaf length (cm), leaf width (cm), leaf area (cm), yield of bamboo yield (tons/ha), culm diameter at breast height (cm), culm height (m), number of culms/clump, clump girth. Statistical analysis indicate that *B. balcoa* and *tulda* possess more genetic diversity with 47.51% and 43.85 % while *B. vulgaris* has lowest diverse (20.33%). Based on dendrogram, it proves that *D. stocksii* and *strictus* are closely related and shows highest similarity among them. While *B. species, tulda* and *vulgaris* shows closest spp and they are genetically distance with *B. balcoa*. The morphological markers give an idea about similarity and distance between the bamboo species taken under study. The information generated will be useful for future Bamboo breeding programme.

## ASSESSMENT OF WOODY PLANT MEDIA EFFICIENCY ON SHOOT PROLIFERATION IN *BAMBUSA TULDA*

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### Abstract

Effect of modified woody plant media (WPM) on shoot proliferation of commercial species of bamboo (*Bambusa tulda* L.)” was conducted at plant tissue culture laboratory, Centre of Excellence in Plant Biotechnology, Department of Agricultural Botany, Post Graduate Institute (PGI), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Dist. Akola (M.S.) during academic year 2019-20 and 2020-21 with the objectives to study efficiency and effectiveness of modified WPM on in vitro culture establishments of commercial species of bamboo *B. tulda* and optimization of combination of woody plant media for in-vitro shoot proliferation. The mother explants source were obtained from the well-established bamboo setum developed under AICRP on Agroforestry, College of Agriculture, Dr. PDKV, Nagpur. Nodal explant of *B. tulda* of 3-4 year old was used. These explant were sterilized with 0.1% tween 20 for 20 mins, 1% bavistin for 30 mins, 1% streptomycin for 20 mins and 0.1% HgCl<sub>2</sub> for 10 mins durations. Explants were inoculated during Jan to Feb and it gives maximum initiation rate 92.47% and lowest contamination percentage 20.88%. However, bamboo explants of size 3 cm showed effective growth with less contamination rate. The Nodal explants when cultured on WPM media supplemented with 3 mg/l BAP (6-Benzylamino purine) showed high initiation and survival rate 81.41 and 45.93 %, respectively. Shoot multiplication and proliferation was performed using modified WPM media supplemented with 3 mg/l BAP +2 mg/l kinetin +0.5 mg/l IBA found significantly best for high shoot multiplication and survival rate 60.99% and 69.88%, respectively after 8<sup>th</sup> week of inoculation. Same treatment gives high bud break frequency at 7 days of its inoculation. Efficiency of WPM on various agar concentration was assessed

and it was recorded that 0.8% agar was found more effective as compared with liquid media with agar concentration at 0.3% and 0.6%, respectively. Various adjuvants and adsorbents namely ascorbic acid, citric acid, charcoal (1%), streptomycin were added in the media to control the browning effect that resulted due to phenolic release. Among treatments, charcoal (1%) when added to WPM media supplemented with 3 mg/l BAP +2 mg/l kinetin +0.5 mg/l IBA showed reduction in browning rate 13.33%. While ascorbic acid at 50 mg/l +citric acid at 25 mg/l when pretreated to explant showed highest initiation and survival rate 82.45 and 54.80%, respectively.

## MOLECULAR GENOTYPING OF SINGLE CROSS DESI COTTON HYBRIDS FOR BOLL RELATED TRAITS USING SSRs

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### Abstract

Present experiment entitled “Molecular assessment of single cross hybrids of *desi* cotton boll related traits using SSR markers” was undertaken at Biotechnology Centre, Dept of Agril. Botany, Dr. PDKV, Akola during 2019-20 with objective to transfer important traits related to boll size and seed cotton yield to enrich gene pool of *G. arboreum* (*desi*) cotton using popular and released varieties viz., AKA-7 (P1), Phule Dhanwantari (P2) as a female parent, while donor parent's *G. cernuum* (D1) and PA-812 (D2). Four single cross hybrids viz., SC-I (AKA-7x*G.cernuum*), SC-II (AKA-7xPA-812), SC-III (PD x *G.cernuum*) and SC-IV (PDxPA-812) attempted during 2018-19 were used further to develop possible two double cross (DC) and one multi cross (MC) hybrids. Accordingly, a total of 333 crosses were attempted consisting of 59, 102, 67 and 105 crosses of SC-I, II, III and IV respectively. Out of these, a total of 55 crosses made successful with 10, 18, 7 and 20, from crosses of SC-I, II, III and IV respectively. A total of 971 F<sub>1</sub>s seeds harvested individually with 190, 377, 131 and 273 seeds from single crosses SC-I, II, III and IV, respectively. Mean performance of varietal features of parents were assessed under field condition for nine quantitative characters viz., days to 1<sup>st</sup> flower, days to 1<sup>st</sup> boll bursting, plant height, no. of monopodia, sympodia and bolls plant<sup>-1</sup>, boll weight and size, seed cotton yield plant<sup>-1</sup>. Morphological data recorded on five randomly selected plants confirms its varietal identity. Each SC progeny lines found promising for boll wt. 3.70-5.10g big boll size. During molecular characterization, parental polymorphism and genetic hybridity was performed using 70 SSRs. Out of which, 39 shows polymorphism among parents. While, out of 20 tested in SC hybrids, only eight SSR found polymorphic and informative to be used for screening of boll size and related traits. The average number of alleles was found 3.44 primer<sup>-1</sup> with highest polymorphism (94%). Among SSRs, only BNL-1694 and BNL-3580 showed highest level of polymorphism 94%. These true hybrids were further evaluated for trait evaluation for introgression of gene in segregating progenies of each single cross *desi* hybrids.

## EFFECT OF MODIFIED WOODY PLANT MEDIA ON *IN-VITRO* PROPAGATION OF LOCAL JAMUN (*SYZIGIUM CUMINI* L.)

**Prachi R. Bocharé, D.R. Rathod, V.V. Sirsat, D.V. Piprade, C.M. Pote, B.S. Mundhe, S.S. Jamodkar, R.R. Katkade, P.R. Singote, N.J. Choudhary and S.B. Sakhare**

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### Abstract

Present study was carried out with the aim of rapid multiplication of local Jamun species for its large scale seedling production. In India, Jamun has great medicinal and commercial value, however availability of quality seedling hinders its large scale plantation. Botanically Jamun is a poly-embryonic and is propagated from seeds or other means of semi ripen cutting, recalcitrant grafting, layering etc. but these methods are of time consuming, season bound. Due to recalcitrant nature of seed, it's lost its viability very rapidly and has poor germinability in its natural habitat. Hence there is great scope for its large scale production. *In-vitro* tissue culture method is best options to solve the problem. Considering this aspect, an experiment is being conducted at Biotech Centre, Dr. PDKV, Akola during 2020-21. An efficient protocol for rapid propagation has been followed using Lloyd and McCown woody plant medium (WPM), as basal media with combination of

growth regulators. Surface sterilized nodal explants using  $\text{HgCl}_2$ , combination of antibiotics and antioxidants were attempted using WPM with BAP (6-Benzylamino purine), Kn (Kinetin). Effect of these media combination on survival, bud breaking frequency and rate of shoot multiplication were noticed. The preliminary result of the study shows a combination of WPM with BAP+Kn+NAA at different concentration resulted in optimization of initial explant establishment. BAP (6-Benzylamino purine 8, 8.5 and 9  $\mu\text{M/l}$ ), Kn (Kn 8, 8.5 and 9  $\mu\text{M/l}$ ). WPM supplemented with BAP + Kn @ 8  $\mu\text{M/l}$  was proved to be significantly best at 5% level for high survival rate of 93.33% and required less time i.e. 32.43 days to initial shoot sprout after explants inoculated with 2.53 initial shoot multiples. Effectiveness of WPM with various combinations for high rate of shoot proliferation will be assessed to establish reproducible tissue culture protocol for Jamun species.

## MORPHOLOGICAL EVALUATION OF *JAVA CITRONELLA* FOR HIGH OIL TRAIT UNDER RAINFED CONDITION

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### Abstract

The present study “morphological evaluation of *Java citronella* for high oil trait under rainfed condition” was carried out at Biotechnology Centre, Department of Agricultural Botany, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during academic year 2018-19. Main aim of the study was to identify superior mutagenized variant of *Java citronella* for oil yield. Experiment was conducted in RBD using nine genotypes as treatments with three replications at four different environmental locations of Akola, Amravati, Buldhana and Yavatmal districts of Vidarbha region under rainfed and limited irrigated conditions. Among nine genotypes tested, five genotypes are the mutagenic variants of popular Bio-13 and remaining genotypes were best checks namely Bio-13, Jallpalavi, Maidani and Mandakini. During morphological evaluation of all nine genotypes tested under multi-location trial (MLTs), BTC-04 mutant variant show significantly best result at all location and found promising in respect of oil yield along with other distinguishable morphological features over all control genotypes. Among variants BTC-04 and BTC-05 performed at par with each other over best checks for plant height 97.75 cm and 93.58 cm, numbers of tillers per plant 61 and 58 tillers, leaf blade length 73.49 cm and 77.20 cm, leaf width 1.48 cm and 1.49 cm, total biomass yield 4261.6 and 3899.4 g/plant, oil yield 1.56 % and 1.48 % respectively under rainfed. While in case of leaf width none of variants surpass to an checks Bio-13 (1.70 cm), Jallpalavi (1.72 cm), Maidani (1.78 cm) and Mandakini 1.53 cm. Stem pigmentation, variant BTC-01, BIO-13 and Jallpalavi had shown dark brown pigmentation, BTC-02, BTC-04, Maidani and Mandakini shows faint green, while BTC-03 and BTC-05 showed green stem pigmentation. MLTs analysis and result of BTC-04 confirms its significance in utilization as an efficient citronella germplasm for high oil yield trait under rainfed situation of Vidarbha region.

## EVALUATION OF NITROGEN LOSSES AND NITROGEN USE EFFICIENCY IN MAIZE CROP, FERTILIZED WITH RESIN COATED UREA (RCU)

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### Abstract

The chemical fertilizers are one of the costly inputs in agriculture and it is ironical that the nutrient use efficiencies of the conventional chemical fertilizers are very low. The rest of the applied fertilizers are lost causing pollution to soil, water and atmosphere continuum. Therefore, the development of nutrient efficient fertilizers is the need of the hour. In this context controlled release coated fertilizer might provide solution to the above issues. This might improve the mineral nutrition and yield of the crop. Keeping in view of the above, an attempt was made to study the nutrient losses specifically N from different coated urea fertilizers; and their effect on yield, nutrient content and uptake, nutrient use efficiency of maize (*Zea mays* L.) var. Nutan KH-101 grown on a Vertisol. The coated urea fertilizers were applied to maize crop at 100% and 75% recommended doses (RDs) along with RDs of P and K; conventional urea fertilizers along with P and K (100% RDs) and absolute control without any fertilizers were maintained. Application of coated urea fertilizers such as neem coated urea (NCU) and pine oleoresin coated urea (RCU) in a Vertisol reduced the ammonia volatilization by 27.5% and 41.1%, respectively. Similarly reduction of  $\text{NO}_3\text{-N}$  leaching due to application of neem, resin, nano rock phosphate and nano ZnO coated urea were 18.3%,

28.0%, 25.7% and 35.1%, respectively. The percent increase in shoot and grain yield due to application of urea (100% RD), RCU (100% RD) and NUC (100% RD) along with P and K was 29.4% and 28.3%, 53.2% and 67.5%, and 61.0% and 51.9%, respectively. N, P and K content of leaf, grain and stem was significantly higher in RCU (100% RD) and NUC (100% RD) applied treatments than urea (100% RD) applied treatment. The higher N uptake in shoot and grain was found in coated urea fertilizers applied treatments than normal urea applied treatment. In case of P and K uptake also coated urea fertilizers particularly RCU (100% RD) and NUC (100% RD) applied treatments showed significant improvement than normal urea. Agronomic efficiency, utilization efficiency and partial factor productivity for N, P and K were improved in coated urea fertilizers applied treatments than normal urea applied treatment. There was no much significant different in soil physico-chemical properties among different fertilizer treatments. Further it is worth to mention that application of coated urea at 75% RDs also over performed the normal urea for improving crop yield and NUE. Therefore, the reduction of N losses, higher crop yield and nutrient use efficiency imparted by coated urea fertilizers could be a viable N source for crops. Moreover both neem and pine oleoresin coated urea applied treatments were almost equal in their impact on maize yield and nutrient uptake, that indicates resin coated urea could be a good alternative N source to neem coated urea that is largely consumed in India at present.

## **GENETIC POLYMORPHISMS IN PART OF INTRON 8 AND EXON 11 OF HSP90AA1 GENE AND ITS ASSOCIATION WITH HEAT TOLERANCE AND PRODUCTION TRAITS IN TROPICALLY ADAPTED INDIAN KARAN FRIES (*BOS TAURUS* X *BOS INDICUS*) CATTLE**

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### **Abstract**

Heat shock proteins (HSPs) act as a chaperone activity and are expressed in response to heat stress ensuring the folding, and refolding of denatured proteins, which help in a protective role during thermal stress in dairy cattle. This study aimed to detect genetic variations of the HSP90AA1 gene and to determine their association with heat tolerance traits in the Karan Fries cattle breed. Four single nucleotide polymorphisms (SNPs) (SNP 1-4) were identified in 100 multiparous lactating Karan Fries cattle: one SNP (g.3292A>C) in the Intron 8, three SNPs loci (g.4776A>G, g.5218T>C, g.5224A>C) in the coding region (exon 11). The association analysis revealed that the SNP locus i.e. g.3292A>C was significantly ( $P<0.01$ ) associated with the respiration rate (RR) and heat tolerance coefficient (HTC) traits. Pair linkage disequilibrium analysis and haplotype construction of the HSP90AA1 gene were performed using Haploview 4.2 and SHEsis softwares. Eight haplotypes were constructed and association analysis showed that Hap3 (CATA) genotype combination was advantageous for thermotolerance breeding in Karan Fries cattle. In summary, there was an association between genetic polymorphisms and haplotypes in the HSP90AA1 and heat tolerance traits. This association could be used as an effective SNP/Hap marker in genetic selection for heat tolerance in cattle breeding programs.

## **EFFECT OF FURROW IRRIGATED RAISED BED (FIRB) SOWING METHOD ON THE YIELD OF CHICKPEA (*CICER ARIETINUM* L.)**

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### **Abstract**

The productivity of chickpea is low in India in comparison to most developed countries as it is cultivated following traditional way of cultivation and planting system. Chickpea is also susceptible to water stagnation due to flood irrigation or rainfall even for a shorter period during the crop growth, keeping this in mind the farmer's fields on farm trials were conducted at different village of the Indore district of Madhya Pradesh during Rabi season 2016-17 and 2017-18 for chickpea crop to test the furrow irrigated raised bed system of sowing to assess the impact on the growth and yield of chickpea in comparison of flat bed sowing done by normal single seed drill. From the study it was found that FIRB seed cum fertilizer drill gave better results in term of growth characters and yield of chickpea in the comparison with normal single box seed drill. The net return is the best



index of profitability of chickpea crop and higher net return per ha of Rs. 44709 was recorded for chickpea crop under FIRB seed cum fertilizer drill whereas lower net return per ha of Rs. 32083 was recorded under normal single box seed drill sowing and yield was found 1719 and 1395 Kg/ha respectively.

## **CLINICOPHYSIOLOGICAL STUDIES OF ZOLETIL AND SEVOFLURANE ANAESTHESIA IN DEXMEDETOMIDINE PREMEDICATED DOGS**

**Kanika Tiwari, N.S. Jadon, Arun Kumar, Sara Kaushal and Jyotsana Bhatt**

*College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar*

### **Abstract**

Twelve dogs used in the present study were divided into two groups viz. A and B having six animals in each group. All the animals of group A and B were premedicated with atropine sulphate @ 0.04 mg/kg subcutaneously. After 10 minutes of administration of atropine sulphate, the animals of group A were subjected to the administration of zoletil @ 6.66 mg/kg intravenously as an induction agent while the animals of group B were premedicated with dexmedetomidine @ 5 g/kg intravenously followed by administration of zoletil @ 2.96 mg/kg intravenously. Sevoflurane was used as a maintenance anaesthetic agent in both the groups of animals. The efficacy of drugs was observed by determining the clinicophysiological parameters including pedal reflex, palpebral reflex, muscle relaxation, analgesia, heart rate, respiration rate, systolic arterial pressure, diastolic arterial pressure and mean arterial pressure. Physiological parameters viz. heart rate, respiration rate, systolic arterial pressure, diastolic arterial pressure and mean arterial pressure were higher in animals of group A as compared to animals of group B at various time interval. Loss of pedal reflex and palpebral reflex was better in the animals of group B as compared to animals of group A. Muscle relaxation and analgesia were noticed better in animals of group B as compared to animals of group A. Results revealed that the anaesthetic combination of dexmedetomidine-zoletil-sevoflurane produces better level of anaesthesia as compared to animals of group A subjected to the administration of zoletil and sevoflurane only.

## **NUTRITIONAL AND FUNCTIONAL EVALUATION OF MILLETS AND SOY BASED INSTANT UPMA MIX**

**Ketki Dhumketi<sup>1</sup>, Alpna Singh<sup>2</sup>, Mayank Mehra<sup>3</sup>, Anamika Patel<sup>4</sup>**

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### **Abstract**

The purpose of this paper is to study the nutritional composition of ready-to-cook value added nutritious mixture formulated by incorporating of foxtail millet semolina, wheat semolina and soy grits. Proximate analysis was observed that moisture, protein, fat, fibre, ash, carbohydrate and energy value content varied from 7.25 to 8.42%, 11.00 to 13.50%, 7.20 to 8.60%, 1.20 to 7.62%, 2.02 to 3.86%, 59.87 to 70.16% and 368.08 to 389.44 kcal/100g respectively in various instant upma mix formulations. Minerals content in instant upma mix such as calcium, phosphorus and iron varied from 27.00 to 40.91, 130.97 to 297 and 1.90 to 2.94 mg/100g respectively. Bulk density of instant upma mix was increased from 0.73 to 0.78 g/ml. as compared to control sample. The highest value of water absorption capacity (248 ml/100 g) and fat absorption capacity (198 ml/100 g) in instant upma mix attained by U6 prepared from 95% foxtail millet semolina and 5% soy grits. The shelf life studies indicated that the instant upma mixes were acceptable up to 2 months of storage at ambient condition in aluminium foil packaging.

## **HYPOPHOSPHATAEMIA IN A COW - A CASE REPORT**

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*<sup>2</sup>Department of Veterinary Medicine, Ranchi Veterinary College, BAU, Ranchi*

### **Abstract**

A four year bovine was presented at Department of Veterinary Clinical Complex, Ranchi Veterinary College, BAU, Ranchi with the history of hematuria since 3 days. Clinical examination revealed subnormal body temperature, inappetence, pallor mucus membrane, haemoglobinuria, anaemia, tachycardia and dyspnea. Blood samples were collected and subjected to

hemato-biochemical analysis which revealed reduction in Hb%, TEC and PCV levels with marked decrease in serum phosphorus level. The affected cow was treated with 50 ml of sodium acid injection (Inj. Novizac) intravenously followed by 25ml for next 2-3 days along with supportive therapy with dextrose 20%, B complex @ 5ml and iron preparation (Ferritas) @ 5ml I/M. Hemato-biochemical parameters were estimated on 5<sup>th</sup> day post treatment and were within normal physiological limits.

## **IMPORTANCE OF BALANCE DIET AND ITS EFFECTS ON HUMAN HEALTH**

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*Krishi Vigyan kendra Sagar-II, Bijora, JNKVV, Jabalpur*

### **Abstract**

Balance food materials and meals are important social events. But other than for pleasure, we need food to get nutrients, vitamins, minerals and energy. Very few foods are either all good or all bad. By having an idea of the balance in your diet, it should be easier to enjoy food and be healthy. The present investigate the perceptions of worldwide researcher about nutritional balance diet and its effects on human health body main Focusing on nutritional proper balance diet and its effects on health, in case if improper nutritional balance diet intake in both form under nutrition and over-nutrition have adverse effects on health. Your body requires variety and specific amounts of nutrients to function properly and perform the activities of daily life. If your body does not get those nutrients, which is common when eating an unbalanced diet, it can develop health problems. A common-sense approach, including eating from a variety of food groups and maintaining proper portion control, may help avoid any potential problems, as well as keep you healthy and vibrant in the process. Nutritional balance diet is the quantitative analysis of food material that the human health body absorber. The body breaks down the food to get the body that it necessary: proteins, fats, carbohydrates, vitamins, and minerals are the essential in human body. Nutritional to sum of all processes involved in how organisms obtain nutrients, metabolize them, and use them to support all of life's processes. If body does not have these things, than the body will unable to work properly. Balance diet has been one of the basic needs of every individual living on the earth. And is that process which provides energy to the human body to perform various tasks in human body. Different kinds of disease, weakness and disabilities are closely related with the intake of insufficient amount to food nutrients and proper balancing diet. This study main focus upon nutritional balance diet and its effects on human health. At least forty percent of your nutritional intake every day has to be through fruits and vegetables. It is ideal to ensure that every meal includes a colorful assortment of veggies and fruits, but if this is difficult to implement you could cover it over the span of a week. By doing this each day, you get an adequate supply of vitamins, minerals, potassium, folate, antioxidants and so on, without compromising on quantity or quality.

## **INFLUENCE OF BIOAGENTS POPULATION UNDER DIFFERENT WEATHER PARAMETERS IN RICE FIELD ECOSYSTEM OF EASTERN UTTAR PRADESH CONDCTIONS**

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### **Abstract**

An intensive study was undertaken to investigate the influence of bioagents population under different weather parameters in rice field ecosystem of Eastern Uttar Pradesh conditions for two consecutive years, 2014 and 2015. The population of bioagents were observed under particular weather parameters, *i.e.* temperature maximum, temperature minimum, relative humidity, and rainfall in different growth stages of rice. The influence of weather parameters on population of bioagents were inferenced by correlation coefficient. Of the total observed population of most bioagent groups in all growth stages of rice under temperature maximum, temperature minimum, relative humidity, and rainfall, the correlation coefficients were - 0.602, - 0.581, - 0.490, and 0.768 for predators; - 0.459, - 0.436, - 0.337, and 0.649 for parasitoids respectively. The abundance of most bioagent groups, both predators and parasitoids were inferenced negative correlation with particular weather parameters, except rainfall was inferenced positive correlation. The correlation coefficients were inferenced non-significant between most bioagent groups and particular weather parameters in all growth stages of rice. The correlation coefficients between major bioagent species and particular weather parameters in all growth stages of rice were inferenced non-significant except between relative humidity and Field longjawed spider (*Tetragnatha maxillosa*) were inferenced significant correlation. The population of most of the major bioagent species were highly decreased with increasing temperature maximum, temperature

minimum, and relative humidity and decreasing rainfall in seedling stage, and highly increased with moderately decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in transplanting stage, while moderately decreased with highly decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in flowering stage respectively.

## **STUDIES ON ASSESSMENT OF AVOIDABLE YIELD LOSS CAUSED BY PURPLE BLOTCH OF ONION**

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<sup>2</sup>*Department of Plant Pathology, College of Agriculture Tikamgarh, JNKVV, Jabalpur, M.P.*

### **Abstract**

The experiment was conducted at Dr. B.R. Ambedkar Samajik Vigyan Kendra Bordhi, Rehti under the Dr. B.R. Ambedkar University of Social Sciences (Mhow) Indore. The field experiment was laid down in randomized block design with eight treatment and three replication. During the experiment in 2019-20 the avoidable bulb yield loss was calculated after harvesting, the minimum significant avoidable onion bulb yield loss was recorded in the treatment T2 (25.25 q/ha) while the maximum avoidable onion bulb yield was recorded in the treatment T6 (51.51 q/ha). In the year of 2020-21, the avoidable bulb yield loss, the minimum significant avoidable onion bulb yield loss was recorded in the treatment T2 (25.25 q/ha) while the maximum avoidable onion bulb yield was recorded in the treatment T6 (51.51 q/ha).

## **GUNI CULTIVATION OF FINGER MILLET–AN INDIGENOUS PRACTICE FOR SUSTAINED PRODUCTIVITY AND SCIENTIFIC EVALUATION**

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### **Abstract**

An experiment was conducted at All India Coordinated Research Project on Small Millets, Bengaluru during *Kharif* 2020. The experiment was laid out in Factorial Randomized Complete Block Design with eighteen treatment combination comprising three spacing levels (30cmX10cm, 30cmX30cm, S3:45cmX45cm), two planking (no planking, planking at 20 & 40 days after planting) and three levels of Farm yard manure (7.5 t/ha, 10 t/ha, 12.5 t/ha). Results showed that plant growth parameters viz., plant height (108 cm), number of productive tillers per plant (7.87), number of fingers per ear head (8.93), ear length (13.00) and yield parameters viz., grain yield (2993 kg/ha), straw yield (2901 kg/ha) and harvest index (43.41%) were found significantly higher in treatment receiving the spacing of 30 cm X 30 cm, planking at 20 & 40 days after planting and farm yard manure at 12.5 t/ha when compared to other treatment combinations. Further, the results obtained were also found economically superior i.e., gross returns (Rs.94280 /ha), net returns (Rs.60212/ha) and B:C ratio (2.77). The treatment combination i.e., 30cm X 30cm spacing coupled with planking at 20 & 40 days after transplanting and application of 12.5 t FYM /ha enhanced the productivity of Finger millet under Guni method cultivation and the technology also emerged as the cost-effective technology for sustainable production.

## **INFLUENCE OF DIFFERENT COMBINATION OF ORGANIC, INORGANIC AND FOLIAR GRADE FERTILIZER ON GROWTH AND YIELD OF GROUNDNUT**

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### **Abstract**

The optimization of the mineral nutrition is the key to optimize the production of groundnut, as it has very high nutrient requirement and the recently released high yielding groundnut varieties remove still more nutrients from the soil. On contrary groundnut farmers use very less nutrient fertilizer and sometime only one or two nutrients resulting in severe mineral nutrient deficiencies due to inadequate and imbalance use of nutrients is one of the major factors responsible for low yield in

groundnut. India is the world's largest producer of groundnut where nutritional disorders cause yield reduction from 30-70 per cent depending upon the soil types. A field experiment entitled "Effect of water soluble foliar grade fertilizer in summer groundnut" was conducted at Oilseed Research Unit Dr. PDKV, Akola during summer season 2011-12 at Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India. The gross and net plot sizes were 3.60 X 3.0 m<sup>2</sup> and 3.0 X 2.80 m<sup>2</sup> respectively. The crop variety TAG 24 was sown at 30 x 10 cm<sup>2</sup>. Eight treatments were compared which are as under T<sub>1</sub> (Absolute control), T<sub>2</sub> (100% RDF 25:75:25 NPK kg per ha), T<sub>3</sub> (Foliar application of starter dose (11:36:24 NPK + trace element) + foliar application of Booster dose (8:16:39 NPK + trace elements), T<sub>4</sub> (100% RDNPk + T<sub>3</sub>), T<sub>5</sub> (FYM @ 7.5 t ha<sup>-1</sup> + 100% RDNPk), T<sub>6</sub> (FYM @ 7.5 t ha<sup>-1</sup> + 100% RDNPk + T<sub>3</sub>), T<sub>7</sub> (FYM @ 7.5 t ha<sup>-1</sup> + 85% RDNPk), T<sub>8</sub> (FYM @ 7.5 t ha<sup>-1</sup> + 85% RDNPk + T<sub>3</sub>). Treatments compared to evaluate the effect of different combination of organic, inorganic and foliar grade fertilizer on growth and yield of groundnut. Experiment results revealed that the growth and yield attributes are enhanced significantly with combination of organic, inorganic and foliar grade fertilizers. The results revealed that plant growth characters, yield and benefit: cost ratio were significantly superior with application of FYM @ 7.5 t ha<sup>-1</sup>+100% RDF 25:75:25 NPK kg ha<sup>-1</sup>, Foliar application of starter dose (11:36:24 NPK + trace element) + foliar application of Booster dose (8:16:39 NPK + trace elements). This treatment recorded highest pod yield (28.90 qt ha<sup>-1</sup>), net monetary return (84263 Rs. ha<sup>-1</sup>) and Benefit: cost ratio (2.84). It was closely followed by treatment FYM @ 7.5 t ha<sup>-1</sup>+100%RDNPk recorded significant pod yield (27.18 qt ha<sup>-1</sup>), net monetary return (79464 Rs. ha<sup>-1</sup>) and benefit: cost ratio (2.77). It was concluded that integration of organic (7.5 t ha<sup>-1</sup>), inorganic fertilizer (100% RDF) and water soluble grade fertilizer recorded, highest dry pods yield and getting maximum economic return from summer groundnut.

## SCREENING OF WHEAT GENOTYPES FOR HEAT TOLERANCE TRAIT BY USING PHYSIO-MOLECULAR MARKERS

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### Abstract

Wheat is one of the main cereal crops which is widely grown and consumed food all over the world. Heat stress as a result of global warming is one of the longer reaction time to increased wheat productivity. Ten wheat genotypes were used in the experiment viz. PBN-4449, PBN-1666, PBN-4876, PBN-4357, PBN-4881, PBN-3958, PBW-4905, PBN-2189, HI-1633, and AKDW-2997 were grown on field and in the laboratory of Plant Biotechnology, Vilasrao Deshmukh College of Agriculture Biotechnology Latur during rabi season of 2019-2020. Heat stress was created by delaying sowing for 35 days from the regular date of sowing in order to experience heat stress during the reproductive stage. Ten RAPD and Six SSR markers were utilized for differentiating heat tolerance genotypes of wheat. Out of these two RAPD markers S32 and S127 and six SSR i.e WMC-154, GWM-44, WMC-266, WMC-198, WMC- 245, WMC-156 markers differentiate wheat genotypes for heat tolerance. Heat tolerant wheat genotypes PBN-1666, PBN-4357, PBN-4881, PBN-3958, and PBN-2189 were found, while intolerant wheat genotypes PBW-4905 and AKDW-2997 were reported. Under heat stress, susceptible wheat genotypes showed greater reductions in chlorophyll content, plant height, spike length, grains yield per spike and yield per plant.

## LIVELIHOOD PATTERNS OF TRIBAL IN KORAPUT DISTRICT OF ODISHA WITH SPECIAL ATTENTION TO AGRICULTURE AND ALLIED ACTIVITIES

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### Abstract

Odisha is inhabited by 62 tribes with constituting 22.43 per cent of the total State population. The livelihood strategies of households are determined mostly by their social, demographic, economic and cultural settings. Tribal economy is affected by poverty of the physical environment, ignorance of efficient technique of exploiting natural resources and lack of capital for investment, therefore, lack of food security is a major problem for them. As the socio-economic improvement of the tribal still remains in question in spite of implementation of many developmental projects, the sustainable rural livelihood approach is being adopted to mitigate problems related to development in the region. Investigation on tribal livelihoods necessitates examination of socio-economic settings, livelihoods options, their aspirations and constraints to get livelihood. The current study is carried out to support the 3 year programme titled "Integrated farming systems for income enhancement of small and



marginal farmers in south Odisha” implemented by CYSD a CSO in Odisha with the help of FORD Foundation. For proper grounding of the programme and scoping for possible convergence option from line departments it is important to understand the intricacy of the livelihood pattern, their aspiration and constraints faced by them in accessing on farm and off farm livelihood. Majority of tribal is found to devoid of literacy (54.16%), agriculture is the primary occupation of the tribal household followed by labour work, NTFP collection and poultry rearing in the study area. Majority (35%) of the tribal fall under the categories of 30000-40000 in annual income range. 64.15% have no membership in any community based organisation. Tribals have medium level of engagement in both on-farm and off farm activity. Majority of tribal aspire for income augmentation through increased crop production, poultry rearing, animal husbandry (majorly goat rearing) and labour work under MGNREGA. Lack of irrigation was the major constraints described by the farmers for on-farm activity while lack of availability of wage related work is prior most concern for the tribals in non-farm segment of livelihood. The tribals in the sample size is realising only 24 days of entitlement or job opportunity under MGNREGA and income from MGNREGA stood only at 13.7% of the total annual income. Having a preliminary overview of livelihood pattern and aspiration of individual livelihood models are being prescribed to be implemented with resource leveraging from ongoing schemes and provisions in the block from various line department and panchayats. The models is formulated keeping in view better job employment under MGNREGA, feasible diversified of cropping models and possible asset creation to support the farming models. The departments like directorate of agriculture, directorate of horticulture, directorate of soil conservation and watershed development, DRDA (District rural development agency), ITDA (Integrated Tribal development agencies) etc. are important stakeholders of the convergence model. The designed convergence model is proposed to income augmentation of farmers by 30% with adoption of alternate livelihood options.

## **DETERIORATION OF YIELD PARAMETERS AND JUICE QUALITY DUE TO POKKAH BOENG OF SUGARCANE AND THEIR MANAGEMENT**

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### **Abstract**

Pokkah boeng disease (PBD) caused by *Fusarium* sp. complex is considered a serious and emerging threat in sugarcane industry throughout the world. The disease caused 5-90% reduction in yield and quality parameters by reducing plant height, number and length of internodes, stem diameter, pol %, and sucrose %. The occurrence and severity of PBD differ greatly from year to year depending on varieties grown and different environmental considerations. This disease spreads through windblown rain, infected cane cuttings, pupae and adults of sugarcane stem borers. Now this disease has become a matter of concern as it is spreading rapidly in India having monoculture of single variety and due to lack of effective management strategies. Predominantly cultivated variety Co 238 in North-West zone showed the highest disease incidence. Fungicides like carbendazim (0.1%) or copper oxychloride (0.2%) or tebuconazole (0.1%) and use of resistant varieties were found effective for reducing the PBD. Thus pokkah boeng is responsible for economic losses for farmers as well as millers to reduction in yields and quality of sugarcane.

## **GENETIC DIVERSITY ANALYSIS OF CITRUS ACID LIME BY USING SSR MARKER”**

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### **Abstract**

Normally citrus plants are diploid, with chromosome number  $2n=18$ . Flowers are cross pollinated produced natural hybrid. In addition, citrus fruits can be processed to obtain other food products such as dehydrated citrus products or marmalades and jams, Citrus essential oils are another by-product of citrus fruits Made them unique and economically profitable. Six genotypes were used in the experiment viz. Phule sarbati, Sai sarbati, kagzi lime, PDKV Bahar, PDKV Trupti, and PKM1, are collected from region of Parbhani and Akola in maharashtra. These fresh leaf sample were preserved at 4C in refrigerator and used for further studies. The present study entitled “analysis of genetic diversity of citrus; acid lime (*Aurantifolia swingle*) genotype using SSR marker” was carried out at the Department of Plant Biotechnology, Vilasrao Deshmukh College of Agricultural Biotechnology, Latur during rabi season of 2019-2020. The high molecular weight genomic DNA was extracted

from young leaves of Acid Lime genotypes by Cetyl Trimethyl Ammonium Bromide (CTAB). PCR amplification of genomic DNA samples of Acid Lime genotypes was performed in thermal cycler (Senso Quest Labcycler, Germany). The concentration of genomic DNA, 10X PCR buffer, mgcl<sub>2</sub>, dNTPs, primer and Taq DNA polymerase were optimize for SSR analysis. Genetic diversity analysis among Citrus (acid lime) genotypes, Genetic similarity estimate (Jaccard's coefficient) based on SSR banding pattern was used for UPGMA cluster analysis and generating Dendrogram among selected six genotype of citrus. The selected six citrus cultivars are grouped into two main clusters The major cluster I consist four genotype and remaining genotype Sai Sharbati and PKM-1 group in to second major cluster II. PDKV Bahar and PDKV Trupti shows highest similarity Among Six Citrus (acid lime) genotypes The highest genetic similarity 0.96 (i.e. 96%) was recorded between PDKV trupti and PDKV Bahar, are the most similar genotypes, belonging to same origin, PDKV, Akola. Whereas lowest similarity was observed in Sai Sharbati and Phule Sharbati in this genotype only 0.28 (i.e. 28%) similarity. They are most diverse, so these can be used for breeding/hybridization programme. By using DNA of different genotype, improvement in the Citrus (acid lime) can be possible. Because germplasm has wide variation in the characters such as yield, plant height, earliness, resistance and susceptibility to biotic and abiotic stresses. This can be achieved at molecular level by using molecular markers.

## **EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF BRINJAL (*SOLANUM MELONGENA* L.)**

**Sukhlal Waskel\*, Ashish Kumar Tripathi and Mayank Mehra**

*KVK, Sagar-II, Bijora, Sagar (M.P.)*

### **Abstract**

Brinjal or eggplant (*Solanum melongena* L.) is one of the important and popular vegetable crop grown in India, belong to the family Solanaceae. Various sizes, shapes, colours and forms of cultivated as well as wild type of brinjal are found in India, white type brinjal fruits is said to be good for diabetic patients. Brinjal fruits have medicinal properties. Some medicinal use of eggplant tissues and extract include treatment of diabetes, asthma, cholera, bronchitis and diarrhea, its fruit and leaves are reported to lower certain levels of blood cholesterol. The productivity of Brinjal can be increased by using integrated nutrient management. The integrated management of nutrient in its proper perspective may be adopted to support enhanced productivity and quality of vegetables. Keeping in view the present investigation was carried out to study the effect of integrated nutrient management on the nutrient of brinjal. An experiment was conducted at the Rajola Farm of the Faculty of Agriculture Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna Madhya Pradesh, India during Kharif season 2014-2015. Twelve treatments of integrated nutrient management viz., (T0) control (no use of fertilizer), (T1) Farm Yard Manure (20 t/ha) +, (T2) VC (10 t/ha), (T3) Recommended Dose of Fertilizers (NPK), (T4) FYM (20 t/ha) + RDF (NPK), (T5) Vermi-compost (10 t/ha) + RDF (NPK), (T6) 75 % RDF (NPK), (T7) FYM (20 t/ha) + 75% RDF (NPK), (T8) VC (10 t/ha) + 75% RDF (NPK), (T9) 50% RDF (NPK), (T10) FYM (20 t/ha) + 50% RDF (NPK) and (T11) VC (10 t/ha) + 50% RDF (NPK) were evaluated in Randomized Block Design with three replications. Significantly higher values of yield attributes such as fruit yield per plot and fruit yield ton per ha were observed under VC @ 10 t/ha+ 75 % RDF (NPK). However, significantly minimum values of yield attributes were observed under control FYM @ 20 t/h + 75% RDF

## **GENETIC ANALYSIS AND SELECTION OF SUPERIOR CLONES WITH HIGHER NITRATE REDUCTASE ACTIVITY IN INTER-SPECIFIC POPULATION OF MULBERRY**

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### **Abstract**

Mulberry foliage yield is a complex trait and aim of the mulberry breeders is to improve the yielding potential of existing varieties along with development of new varieties. The objective of this study was to estimate the genetic variability, direct and indirect effects, and correlation coefficients of thirteen foliage yield traits with nitrate reductase activity in two year old clonal plantation of pseudo F<sub>2</sub> inter-specific population Kajli OP (*M. alba*) × V-1 (*M. indica*) during 2018 winter crop at experimental farm of CSRTI, Berhampore. Analysis of variance revealed significant differences among the progenies and also moderate to high genotypic and phenotypic coefficients of variations for all traits studied except leaf moisture, indicating the existence of genetic variability and offering greater opportunities for selection. High heritability coupled with high genetic

advance was noticed for unit leaf weight, shoot length, NRA, chlorophyll index and leaf yield indicating additive gene action in their inheritance. NRA had positive and significant phenotypic correlation with leaf yield, shoot length, shoots per plant, leaf weight & moisture content. Total shoots length, unit leaf weight and NRA had positive and high direct effect on leaf yield indicating direct selection for these traits can be effective for improve yield in mulberry breeding programs. K-Means cluster analysis based on Ward's method grouped 150 progenies into six clusters and maximum genetic diversity was present between Cluster III and Cluster V. Cluster IV with highest cluster mean for NRA (>10) and leaf yield per plant (>650 g) should be considered for selection of genotypes. Genotypes C73 (B30), C68, C2 (A03), C3, C71, C161 (E13) and C149 were identified as high yielding with high NRA could be evaluated for varietal development.

## **CHEMICAL WEED CONTROL IN DIRECT SEEDED RICE**

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### **Abstract**

Rice is one of the most important cereal crop as it is staple food of more than 70% of the world population. weeds are a major impediment to rice production through their ability to compete for resources and their impact on product quality. Out of the losses due to various biotic stresses, weeds are known to account for nearly one third. Uncontrolled weeds reduced the grain yield by 75.8, 70.6 and 62.6% under dry-seeded rice (DSR), WSR and transplanted rice (TPR), respectively. Among the methods highest grain yield and number of panicle/m<sup>2</sup> was recorded under wet seeding (4.66t/ha) however the differences with dry seeding in term of grain yield was non significant. Among the weed treatments highest grain yield was recorded with need based hand weeding 5.58t/ha which was at par with the treatment pre emergence application fb post emergence herbicide application fb post emergence herbicide application (1, 2 and 3<sup>rd</sup> flush of weed). At 40 DAHA the differences in weed dry weight between both methods was non significant. In weed control treatments lowest weed dry weight 3.37 g/m<sup>2</sup> was recorded with pre emergence application fb post emergence herbicide application fb post emergence herbicide application (1, 2 and 3<sup>rd</sup> flush of weed) however the differences between need based hand weeding and pre emergence application fb post emergence herbicide application (1, and 2 nd flush of weed) was non significant.

## **NITROGEN RESPONSE TRIALS ON SELECTED BASMATI CULTURES UNDER HIGH AND LOW INPUT MANAGEMENT**

**Vivek Yadav and Rajendra Singh**

*SVPUAT-ZRS, Nagina, Bijnor, U.P.*

### **Abstract**

An experiment was designed to study the grain yield potential of promising basmati cultures of rice under high & low input management under transplanted conditions. Highest grain yield ( 4.31t/ha) and panicles (349) was recorded with 150% RDN however it was found at par with 100% RDN. Highest grain yield (4.22q/ha) was recorded with entry IET 24577 which was found at par with the entries and checks however it was significantly superior over entry IET 24570 & IET 24575. Highest number of panicles/m<sup>2</sup> was recorded with entry 24566 which was at par with IET 24576, IET 24577, IET 24565, IET 24573 and was significantly superior over all the checks and entries under test.

## **NITROGEN RESPONSE TRIALS ON SELECTED EARLY RICE CULTURES UNDER HIGH AND LOW INPUT MANAGEMENT**

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### **Abstract**

An experiment was designed to study the grain yield potential of promising early cultures of rice under high and low input management under transplanted conditions. Highest grain yield (4.90t/ha) and panicles (273) was recorded with 150% RDN which was significantly superior over other treatments. Different varieties failed to bring any significant difference in grain yield however highest grain yield 4.40 t/ha was recorded with IET 23300. Differences in number of panicles between IET 23300 and IET 23275 was non significant.

## EMERGING AND RE-EMERGING THREATS TO GLOBAL FOOD SECURITY IN THE CLIMATE CHANGE SCENARIO : A STUDY ON CEREAL CROP AGRO ECOSYSTEMS

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### Abstract

In the global climate change scenario delivering food security via effective crop improvement programs for enhanced yield, supported by pre- and post-harvest technologies to secure the food quality has become a global concern. Assessing the impacts of climate change on agriculture is a vital task. With the changing global climate, yield gains are on a steady decline, and post-harvest crop losses have increased as a result of emerging and re-emerging diseases and pests in the major food crops viz., maize, rice, wheat and sugarcane which have become vulnerable to the emerging diseases viz., fungal diseases in maize, rice and wheat (root rots, soft rots, damping off, seedling blights, leaf and sheath blights, rusts, mildews and wilts caused by several genera of fungi viz., *Pythium*, *Rhizoctonia*, *Fusarium*, *Macrophomina*, *Bipolaris*, *Excerohilum*, *Polysora*, *Sclerophthora*, *Peronosclerospora*, *Curvularia*, virus diseases viz., maize streak virus, sugarcane mosaic virus, maize stripe virus, maize chlorotic mottle virus) as well as sugarcane (red rot, smut, wilt, top rot, pokkha boeng, yellow leaf disease, mosaic, rust, brown spot, ring spot and eye spot) are spreading to newer areas under cultivation. Re-emergence of bacterial diseases viz., *Erwinia amylovora*, *E. stewartii*, *Pseudomonas syringae* pv. *Phaseolicola*, *Pseudomonas syringae* pv. *tomato* and *Xanthomonas campestris* pv. *vesicatoria* in crops is also on rise. With predicted changes in climate, viral diseases of plants are expected to increase in importance. The newly introduced viruses will be very significant challenges. A warmer climate might also allow viruses prevalent in greenhouses to establish in the field. The effect of temperature in temperate regions may allow winter survival of vectors thus, accelerating natural spread of vectors, pests and diseases across previous climate barriers. This may cause severe outbreaks of plant-disease vectors like aphids, white flies, thrips or beetles, and their introduction and establishment of new areas.

The changing trend of these pathogens and pests which have been monitored over the last two decades raises an alarm to review the bio security technologies for mitigating the effects of emerging/re-emerging diseases in major food crops. Strategic biosecurity programs with integrated multidisciplinary approach encompassing the policy and regulatory frameworks (including instruments and activities) to analyze and manage risks in the sectors of food safety, animal and plant health, as well as associated environmental risk are recommended for potential farm profits that are sufficient to offset the costs of implementation and maintenance.

## SPECIES DIVERSITY OF SOIL BORNE FUNGI WITH PROGRESS OF CROP STAGES FROM SOWING TO HARVESTING : A CASE STUDY ON ZEA MAYS L.

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### Abstract

Investigations were undertaken to examine the species diversity in the maize crop biome from pre-sowing to pre harvesting stages in the crop cycle. Soil samples were examined for species diversity at six stages of growth from maize field trials viz. pre sowing (7 days before sowing), post emergence (7 days after sowing), 30 days crop, silking stage, tasseling stage, cob formation stage, harvesting stage. The studies were conducted at CCS HAU Regional Research Station, Karnal. Soil isolations were done on Potato Dextrose Agar (PDA, HiMedia Labs Pvt. Ltd.) and colonies were examined under microscope for morphometric characteristic. The study revealed that, major fungal and bacterial component in the pre sowing stage were saprophytes and scavengers viz., bacteria of genus *Pseudomonas* *Actinobacteria* *Streptomyces* *scabies*, *Nocardioideis*, *Marmoricola*, *Lysobacter*, *Bryobacter*, *Steroidobacter*, *Cyphellophora*, *Hannaella* and fungi of genus *Alternaria alternata*, *Bipolaris* *Rhizopus* *Stachybotrys*, *Mucor*, *Chaetomium* sp. *Phoma*, *Magnaporthiopsis* and *Trichoderma* spp. However, in the soil samples of post sowing stages species of pathogenic bacteria and fungi were dominant viz., *Acremonium strictum*, *F. chalmydosporum*, *Phoma* sp. *Bipolaris maydis*, *Colletotrichum graminicola*, *Curvularia launata*, *Exserohilum rostratum*,



*Fusarium moniliformae*, *F. oxysporium*, *Cladosporium* spp., *Cephalosporium* spp., *Macrophomina phaeolina*, *Alternaria solani*, *Chetomium* spp., *Fusarium verticilloides*, *Alternaria alternata* and *Pythium ultimum* were dominant. Bacterial colonies of *Pseudomonas* *Actinobacteria* and *Streptomyces scabies* were also recorded. With the progress of crop stage dominance of *Bipolaris* sp., *Fusarium* sp., *Curvularia launata*, *Alternaria solani* and *Macrophomina phaeolina* was recorded. The study revealed that with the progress of crop stages microbial communities migrate towards rhizosphere due to some signals which may be the plant exudates released in soil.

## **ESTIMATION OF ADOPTION LEVEL OF KALONJI (*NIGELLA SATIVA* L.) PRODUCTION TECHNOLOGY IN NEEMUCH DISTRICT OF MADHYA PRADESH**

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### **Abstract**

India is one of the asian countries which produce and exports various spices to other countries. Kalonji (*Nigella sativa* L.) is an important stiff annual flowering plant which mainly grows by producers for its seeds. An increasing demand of Kalonji seed and oil in local, national and international market for medicinal, consumption and commercial purpose makes the best alternative crop for small holder farmers in Neemuch. In spite of its importance, not much has been done to improve its production and productivity in India. Therefore, this research was designed to ascertain the adoption level of farmers about recommended cultivation practices of kalonji. Primary data were collected using a semi-structured questionnaire administered on 100 kalonji producers selected from 10 villages from Neemuch and Manasa tehsils of Neemuch district of Madhya Pradesh using systematic random sampling technique. Moreover, various data analysis methods were used for analyzing the data. The results revealed that maximum farmers (62 %) fell under medium knowledge level. Likewise, majority of respondent (87.0%) were included under highest extent level of adoption for the practice of sowing under irrigated condition. Lowest extent of adoption was observed for blight disease control measures applied (18%). Out of ten characteristics studied age, education, area under kalonji crop, irrigation facilities, social participation, sources of information and scientific orientation, were positively and significantly correlated with knowledge and adoption level. Likewise, land holding was positively and significantly correlated only with knowledge and non-significantly correlated with adoption. The annual income was non-significantly correlated with both knowledge and adoption.

## **MODE OF PERPETUATION OF ANGULAR LEAF SPOT PATHOGEN [*PHAEOSARIOPSIS GRISEOLA* (SACC.) FERRARIS] OF FRENCH BEAN IN KASHMIR**

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### **Abstract**

The studies conducted on mode of perpetuation of angular leaf spot pathogen [*Phaeoisariopsis griseola* (Sacc.) Ferraris] of French bean (*Phaseolus vulgaris* L.) in/on seed and plant debris revealed that the pathogen survival declined over time and varied under different storage/ placement conditions. The seed borne inoculum lost its viability completely after a storage period of 12-15 months. The viability of conidia, present on infected seeds, was also completely lost after 10 months of storage. However, on infected plant debris, the pathogen survived for longer duration. On infected pod husks, synnemata production was observed up to 18, 8-9 and 5-7 months, whereas the conidia lost viability after 19, 10 and 5-8 months when placed under laboratory conditions, on soil surface and buried 15 cm deep in soil in bean fields, respectively. Similarly on infected leaf bits, the pathogen survived up to 15, 8 and 6 months and the conidia lost their viability after 16, 9 and 5-6 months after being placed in laboratory conditions or on soil surface or 15 cm deep in soil in bean fields, respectively. It was concluded that under temperate conditions of Kashmir valley, use of at least 15 months old seed and a two year crop rotation with non-host crop could eradicate the seed- and soil-borne inoculum of *P. griseola*.

## USE OF SAVE GRAIN BAGS FOR SAFE STORAGE OF FOOD GRAINS

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### Abstract

Post-harvest management of agricultural products is a significant challenge in developing countries and it includes handling and storage. Important staple crops such as wheat, rice and pulses are susceptible to storage losses mostly due to insect pests. Hermetic technologies as an alternative to traditional and chemical control methods have gained significant interest among farmers, the private sector, governments, and development agencies. Hermetic technologies owe their effectiveness to the airtight conditions created during storage. Biological processes such as respiration and metabolic activities are driven mostly by the presence of insects and other biological activities that lead to the depletion of oxygen and release carbon dioxide inside hermetic containers. Developments in the use of hermetic bags for grain storage. Hermetic bags significantly reduce food safety risks posed by the conventional method of treating stored grains with insecticides. ICAR-Krishi Vigyan Kendra, Dharwad introduced save grain bags (SGBs) by PCI among farm families for storing food grains. The SGB bags consist of 5 layers to produce the hermetic storage solution that can safely protect your grains. The most important of these layers is a polymer called Ethylene Vinyl Alcohol (EVOH) manufactured using proprietary Japanese technology under the EVAL trademark. The presence of EVOH ensures that the SGB bags act as airtight containers and create a level of isolation necessary to preserve the flavour, freshness and aroma of your grains. It was observed that insect load was not seen in grains stored in save grain bags for 6 months whereas, insect incidence was observed in traditional method. Hermetic bags are appropriate alternatives to traditional and conventional storage methods as they maintain the quality of stored products and allow smallholder farmers to be food secure and have the flexibility to sell their grain when prices are high.

## RECORDS OF POLLINATOR BEES FROM UTTARAKHAND, INDIA

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### Abstract

Pollinators are essential components of almost all of the world's terrestrial ecosystems. More than 75% of the flowering plants on the Earth need pollinators. They not only provide pollination services, but are also excellent indicators of the state of terrestrial environments including responses to global warming. Among various *pollinators*; viz., hummingbirds, bats and insects, etc.; *bees* are considered unique and excellent pollinators as they visit flowers often to collect pollen and nectar. Unlike other pollinators, they have specialized pollen-carrying structures called *scopa* or *corbicula* made up of thick, plumose setae. Worldwide 20,000 species of bees are known under Superfamily Apoidea. Solitary bees like sweat bees, leaf cutter bees and orchard mason bees constitute 90% of the total bee population and are significant pollinators. Hence, an intensive survey was conducted during 2019-2020 to record the diversity of bee pollinators in various locations of Uttarakhand, viz., Bhimtal, Joleikot, Chaubatia, Pant Nagar and Dehradun. Collections were made with the help of yellow pan traps and sweep nets. A total of 58 bee specimens were collected and brought to the taxonomy laboratory, IARI, New Delhi, India for processing and identification. The analysis revealed that the specimens belonged to 4 families, viz., Apidae, Megachilidae, Halictidae and Andrenidae. The family Halictidae was represented by 3 genera under two sub families i.e., Halictinae (*Halictus* and *Lassioglossum*) and Nomiinae (*Nomia*) while family Apidae was represented by 4 genera under 2 sub families Apinae (*Bombus*, *Lepidotrigona* and *Tetragonula*), and Xylocopinae (*Ceratina*). In comparison, the family Andrenidae was represented by just single Genus *Andrena* under the subfamily Andreninae and the family Megachilidae was represented by 2 genera under sub family Megachilinae (*Megachile* and *Lithurge*). The occurrence of high diversity of non-*Apis* bee pollinators in the region necessitates exploring these further.

## **EFFECT OF VITRIFICATION TECHNIQUES AND DIMETHYL SULPHOXIDE-SUCROSE VITRIFICATION SOLUTION ON *IN VITRO* MATURATION OF OOCYTES ON THE BASIS OF CUMULUS CELL EXPANSION IN SHEEP**

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### **Abstract**

This trial was performed to know the effect of vitrification techniques and dimethyl sulphoxide-sucrose (DMSOS) vitrification solution on *in vitro* maturation of oocytes on the basis of cumulus cell expansion in sheep. Sheep ovaries were collected from Municipal slaughter house, Jammu and oocytes were collected by three methods viz., aspiration, puncture and slicing. A total of 810 oocytes were vitrified using dimethyl sulphoxide-sucrose (DMSOS) vitrification solution and three vitrification techniques viz. Conventional straw (CS), Open pulled straw (OPS) and Hemi straw (HS) (270 oocytes each) at conc. 10%, 15% and 20% (90 oocytes each), respectively to observe *in vitro* maturation rate of oocytes. The *in vitro* maturation rate on the basis of cumulus cell expansion of vitrified post-thawed oocytes at 10%, 15% and 20% vitrification concentration (DMSOS) in CS, OPS and HS vitrification techniques were significantly lower ( $P<0.05$ ) compared to control group. In present study, the proportion of the oocytes that matured in all vitrified thawed groups ranged from 11.11% to 25.56% which were significantly lower ( $P<0.05$ ) than control group (50.00%). Whereas *in vitro* maturation rate at different vitrification concentration within technique did not differ significantly with each other.

## **EFFECT OF VITRIFICATION TECHNIQUES AND ETHYLENE GLYCOL-DIMETHYL SULPHOXIDE-SUCROSE VITRIFICATION SOLUTION ON *IN VITRO* MATURATION OF OOCYTES ON THE BASIS OF CUMULUS CELL EXPANSION IN SHEEP**

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### **Abstract**

This experiment was undertaken to study the effect of vitrification techniques and ethylene glycol-dimethyl sulphoxide-sucrose (EG+DMSO+S) vitrification solution on *in vitro* maturation of oocytes on the basis of cumulus cell expansion in sheep. Ovaries of ewe were collected from Municipal slaughter house, Jammu and oocytes were retrieved by three methods viz., aspiration, puncture and slicing. A total of 810 oocytes were vitrified using ethylene glycol-dimethyl sulphoxide-sucrose (EG+DMSO+S) vitrification solution and three vitrification techniques viz., Conventional straw (CS), Open pulled straw (OPS) and Hemi straw (HS) (270 oocytes each) at conc. 10%, 15% and 20% (90 oocytes each), respectively to observe *in vitro* maturation rate of oocytes. The *in vitro* maturation rate on the basis of cumulus cell expansion of vitrified post-thawed oocytes at 10%, 15% and 20% vitrification concentration (EGS+DMSO+S) in CS, OPS and HS vitrification techniques were significantly lower ( $P<0.05$ ) compared to control group. In this study, the proportion of the oocytes that matured in all vitrified thawed groups ranged from 21.11% to 42.22% which were significantly lower ( $P<0.05$ ) than control group (50.00%). Whereas *in vitro* maturation rate at different vitrification concentration within technique did not differ significantly with each other.

## **SOLAR OPERATED NIPPING MACHINE IN CHICKPEA FOR INCREASING PRODUCTIVITY**

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### **Abstract**

Chickpea is an important *rabi* crop of Dharwad district and supplies cheap protein diet for poor people. Apart from other production enhancement indicators, nipping appeared to be a factor responsible for increasing yield and yield contributing

parameters. The horizontal spread of the plants due to nipping would result in more yields, at least 1-2 quintals per acre, by bearing more branches, flowers and pods. But, nipping the crop grown on vast tracts of lands by hand is a tiresome job. It requires more laborers resulting in escalation in the cost of production. Solar operated nipping machine was introduced to tackle labour problem. The Krishi Vigyan Kendra, Dharwad conducted frontline demonstrations on farmer fields in adopted villages to study the effect of nipping on seed yield. The solar operated nipping machine developed by UAS, Raichur was used to demonstrate the technology. The results revealed that nipping of the terminal bud in between 45 to 50 days of crop growth stage significantly reduced the height of the plant and increased the number of primary and secondary branches and pods per plant. The nipping operation has given increased yield of 19.40 q/ha per cent over check 16.20 q/ha. Number of branches/plant increased due to nipping (16.60) and farmer could harvest nearly 27 kgs of leafy vegetable. The leafy vegetable is in high demand as vegetable in local market (Rs.150/kg) and met labour expenses incurred for nipping using machine. There is a need to adopt multi pronged strategy which involves enhancing chickpea production through horizontal and vertical expansion and productivity improvements. Compared to manual, nipping machine covers 4 acres /labour/day. The attack of tip aerial blight also reduced due to proper nipping. The productivity gain under FLD over existing practices created greater awareness and motivated the other farmers to adopt nipping technology in Chickpea.



# Our Conference Memory





## About the Conference Chairman



**CONFERENCE CHAIRMAN**

**Dr. S.P. Singh**, born in Village Jevri, Post Rajbun, District Meerut (U.P.), in 1970 and Graduated in Agriculture with Honors from G.M.V., Rampur Maniharan, Saharanpur (U.P.). He did his Post Graduation in Agricultural Botany, Institute of Advance Studies, Meerut University Campus, Meerut and Doctorate in the same discipline (Ag. Bot.) from C.S.J.M. University, Kanpur. Presently, he is working as Scientist (Plant Breeding) at C.S.A. University of Agriculture and Technology, Zonal Agriculture Research Station, Kalai, Aligarh (U.P.). Dr. Singh is a fellow of SRDA, and member of many other professional Societies, having **21** years of experience in Research and Extension Education Works. **He authored many books** such as Plant Breeding, Agriculture at a Glance, Hand Book of Agriculture (Hindi), Crop Physiology (Hindi & English), College Botany, Environmental Science & Agroecology, Concepts of Ecology etc. He is well recognized Scientist and having more than **300** publications in reputed National and International Journals. Dr. S.P. Singh is also **Editor-in-Chief**, **Progressive Research-An International Journal & Frontiers in Crop Improvement** (both Journals are NAAS recognized), **Secretary**, Society for Scientific Development in Agriculture & Technology and also **Chief Managing Director**, Astha Foundation, Meerut, working in the field of Science & Education.

He has been awarded as Best Editor and Writer Award-**2006**, Young Scientist Award-**2007**, Dr. M.S. Swaminathan Young Scientist Award-**2009**, Distinguished Scientist Award-**2014**, Scientific Initiator Award-**2014** from Directorate of Rice Research, Hyderabad, Science Leader Award-**2015** From RVSKVV, Gwalior, Outstanding Scientist in Agriculture Award-**2016**, Outstanding Achievement Award-**2016**, Excellence in Research Award-**2017**, Innovative Scientist of the Year Award-**2017** Outstanding Scientist in Agriculture Award-**2018** Before this International conference, Dr. S.P. Singh has already organized five conference at different corner of country, first conference was National symposium on “**Achieving Millennium Development Goal : Problems & Prospects**” at Bundelkhand University, Jhansi (UP) during October 25-26, **2009** under the umbrella of SSDAT, Meerut, Dr. Singh has been acted as an Organizing Secretary. The second was National conference on Emerging Problems and Recent Advances in Applied Sciences : Basic to molecular Approaches (**EPRAAS-2014**) during February 08-09, 2014 at Ch. Charan Singh University, Meerut (UP) again by SSDAT, Meerut in which Dr. S.P. Singh has played his role as an Organizing Chairman. The Third, Conference was Organized by SSDAT, Meerut and Astha Foundation, Meerut at Directorate of Rice Research, Hyderabad on Emerging Challenges and opportunities in Biotic and Abiotic Stress Management (**ECOBASM-2014**) during December 13-14, **2014**. Fourth Conference organized by Astha Foundation, Meerut & SSDAT, Meerut at RVSKVV, Gwalior on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (**GRISAAS-2015**). Fifth Conference was jointly organized by SSDAT, Meerut & Astha Foundation, Meerut at PJTSAU, Rajendranagar, Hyderabad, Telangana State on Innovative and Current Advances in Agriculture & Allied Sciences (**ICAAAS-2016**) during December 10-11, 2016. Sixth Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, MPUAT, Udaipur; CSAUAT, Kanpur; UAS, Raichur at MPUAT, Udaipur, Rajasthan on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (**GRISAAS-2017**). Seventh Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, CSAUAT, Kanpur; IGKV, Raipur; BAU, Sabour; MPKV, Rahuri; RARI, Durgapura, Jaipur; Global Research Initiatives for Sustainable Agriculture & Allied Sciences (**GRISAAS-2018**). Eight Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, CSAUAT, Kanpur; IGKV, Raipur; BAU, Sabour; MPKV, Rahuri; UAHS, Shivamogga, Global Research Initiatives for Sustainable Agriculture & Allied Sciences (**GRISAAS-2019**). Ninth Conference organized by SSDAT, Meerut in collaboration with Astha Foundation, Meerut, Innovative and Current Advances in Agriculture & Allied Sciences (**ICAAAS-2020**) at Bangkok, Thailand.

### Glimpse of SSDAT & Astha Foundation's Conferences



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