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Lead Papers/ Invited Papers

GLOBAL RESEARCH INITIATIVES FOR SUSTAINABLE AGRICULTURE (GRISAAS)

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Worldwide demands for food increases (population of over 8 billion by 2025) while land and water become increasingly scarce and human health issues rise and threaten food systems and their sustainability. There will be no sustainable future without eradicating poverty and hunger. Ensuring food security for all is both a key function of and a challenge for agriculture, which faces ever-increasing difficulties – as populations rise, urbanization increases and incomes grow, the agricultural sector will be under mounting pressure to meet the demand for safe and nutritious food. Agriculture has to generate decent jobs and support the livelihoods of billions of rural people across the globe, especially in developing countries where hunger and poverty are concentrated. Furthermore, the sector has a major role to play in ensuring the sustainability of the world's precious natural resources and biodiversity, particularly in light of a changing climate. Climate change will have an increasingly adverse impact on many regions of the world, with those in low latitudes being hit the hardest. Developing countries, in particular, will need support from the global community to facilitate their adaptation and mitigation efforts in relation to climate change and to transform their agriculture and food systems sustainably. As the migration crisis of recent years has shown, no country stands unaffected. What happens in one part of the globe will undoubtedly affect other parts, and domestic and foreign policies must take account of this.

Global Agriculture Research institutes

At global level only mandated international agricultural research organization is the CGIAR.. The CGIAR Fund supports 15 international agricultural research centers such as the International Water Management Institute (IWMI), International Rice Research Institute (IRRI), the International Institute of Tropical Agriculture (IITA), the International Livestock Research Institute (ILRI), the International Food Policy Research Institute (IFPRI) and the Center for International Forestry Research (CIFOR) that form the CGIAR Consortium of International Agricultural Research Centers and are located in various countries worldwide (as of 2011), The centers carry out research on various Agricultural commodities, livestock, fish, water, forestry, policy and management.Some other international agricultural organizations include the United Nations Food and Agriculture Organization, Global Forum on Agricultural Research (GFAR), The International Agriculture Center (Netherlands), The World Bank, International Fund for Agricultural Development, The Center for International Food and Agriculture Policy at the University of Minnesota. The CGIAR (Consultative Group on International Agricultural Research) is a small but significant component of the global agricultural research system. With its limited financial resources, it has to be selective in its role and choice of research portfolio. An updated report on CGIAR priorities and strategies is produced every five years by TAC (Technical Advisory Committee to the CGIAR) to guide system-wide resource allocation taking into consideration an appropriate balance between centers, activities, commodities, regions and agro-ecological zones. In considering priorities, TAC is guided by several important factors such as the CGIAR mission and goal, emerging trends in world agriculture, and the evolution of scientific capacity in developing countries. The current approach has been modified to account for the expanded mandate of the CGIAR, greater emphasis on sustain-ability and resource management issues, allow for meaningful interactions with stakeholders, ensure transparency in decision making, and develop mechanisms which facilitate CGIAR priority setting as a continuing activity.

Research priorities decided by CGIAR

According to Nelson and Mensbrugghe (2013) CGIAR decided public sector agricultural research priorities for sustainable food security and agricultural strategies to support food security in climate change. The focus is on the vulnerable small holder agricultural households that do not consistently and fully meet household nutritional needs. Climate change poses great risks to this group because it is dependent on agricultural production to meet both income and nutritional needs. Climate change also poses additional challenges to meet the individual and collective ambitions of development. The responses to climate change are varied, ranging from increasing resilience by development and adoption of new cultivars, maintaining eco-systems services such as soil health and water quality, diversification, and improved risk management tools. Climate change increases the value of "no-regrets" technologies that enhance flexibility and potentially enable transformative changes. Some technologies exist that can help with adaptation; others need to be developed. But while technology availability is a first step condition, adoption by farmers is the essential outcome. Adoption requires greater emphasis on building local institutions to support information dissemination, risk management and collective action. Two other important enabling conditions are

building coherence across agriculture, food security and climate change policies and increasing the available financing, including from climate finance sources. Priorities include: Better links with the global climate change research community are needed to address the nature of the vulnerability and uncertainties. This has to include better understanding of the likely changes in climate variability in the coming decades and its impacts on food systems and food security at all levels. Improving tools and guidelines for risk management, including better knowledge of the role of assets (physical, human and social capital), the role of collective action and increased engagement of civil society to improve participatory approaches and communication. Additional views from the reviewers and participants follow. There was a lively debate on the relative priorities between technology development and improving systems for technology adoption, and the optimal division between the public and private sectors. How can we better use the new technologies available today for information dissemination? Allocation of water among various users, including agriculture, as well as competition for land use from biofuels merits greater attention. What should be the relative roles of mitigation versus adaptation? How much mitigation can be expected from small holder farmers? What are the equity concerns? How can development be made compatible with mitigation? Should we focus on a 'climate justice' approach (analogous to the 'right-to-food' approach) given the inability of the global community to take effective action to limit greenhouse gas emissions. Attention to gender differences in the way information is absorbed and transmitted is important for technology adoption and mitigation. More collaboration is needed with a focus on data collection and dissemination and links across the different modeling platforms (across disciplines, e.g. climate to crop to economic, and across dimensions, household/farm to sub-region to country to global).

What is Sustainable Agriculture : Every day, farmers and ranchers around the world develop new, innovative strategies to produce and distribute food, fuel and fiber sustainably. While these strategies vary greatly, they all embrace three broad goals, or what SARE calls the 3 Pillars of Sustainability:Profit over the long term, Stewardship of nation's land, air and water and Quality of life for farmers, ranchers and their communities. The phrase 'sustainable agriculture' was reportedly coined by the Australian agricultural scientist Gordon McClymont.Wes Jackson is credited with the first publication of the expression in his 1980 book New Roots for Agriculture. The term became popular in the late 1980s. It has been defined as "an integrated system of plant and animal production practices having a site-specific application that will last over the long term, for example to satisfy human food and fiber needs, to enhance environmental quality and the natural resource base upon which the agricultural economy depends, to make the most efficient use of non-renewable and on-farm resources and integrate natural biological cycles and controls, to sustain the economic viability of farm operations, and to enhance the quality of life for farmers and society as a whole.

There are several key principles associated with sustainability in agriculture :

The incorporation of biological and ecological processes into agricultural and food production practices. For example, these processes could include nutrient cycling, soil regeneration, and nitrogen fixation.

Using decreased amounts of non-renewable and unsustainable inputs, particularly the ones that are environmentally harmful.

Using the expertise of farmers to both productively work the land as well as to promote the self-reliance and self-sufficiency of farmers.

Solving agricultural and natural resource problems through the cooperation and collaboration of people with different skills. The problems tackled include pest management and irrigation.

Sustainable agriculture can be understood as an ecosystem approach to agriculture. Practices that can cause long-term damage to soil include excessive tilling of the soil (leading to erosion) and irrigation without adequate drainage (leading to salinization). Long-term experiments have provided some of the best data on how various practices affect soil properties essential to sustainability. In the United States a federal agency, USDA-Natural Resources Conservation Service, specializes in providing technical and financial assistance for those interested in pursuing natural resource conservation and production agriculture as compatible goals.

Initiatives by United Nations for sustainable development

The year 2015 signalled the arrival of two landmark initiatives that recognized the need for countries to take collective action to promote sustainable development and combat climate change: the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), and the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC). Both initiatives reflect evolving thinking around global issues, and both call for a fair and transparent international trade system. In food and agriculture, trade can play a role and contribute to meeting the targets of both the 2030 Agenda and the Paris Agreement.

In the meeting at the United Nations Headquarters in New York from 25-27 September 2015 as the Organization celebrated its seventieth anniversary, have decided on new global Sustainable Development Goals. UN adopted a historic decision on a comprehensive, far-reaching and people-centred set of universal and transformative Goals and targets and committed to working tirelessly for the full implementation of this Agenda by 2030.

The sustainable development goals : The sustainable development goals (SDGs) are a new, universal set of goals, targets and indicators that UN member states will be expected to use to frame their agendas and political policies over the next 15 years.The SDGs follow and expand on the millennium development goals (MDGs), which were agreed by governments in 2001 and are due to expire at the end of this year.

Need for set of goals : There is broad agreement that, while the MDGs provided a focal point for governments – a framework around which they could develop policies and overseas aid programmes designed to end poverty and improve the lives of poor people – as well as a rallying point for NGOs to hold them to account, they were too narrow.

The eight MDGs – reduce poverty and hunger; achieve universal education; promote gender equality; reduce child and maternal deaths; combat HIV, malaria and other diseases; ensure environmental sustainability; develop global partnerships – failed to consider the root causes of poverty and overlooked gender inequality as well as the holistic nature of development. The goals made no mention of human rights and did not specifically address economic development. While the MDGs, in theory, applied to all countries, in reality they were considered targets for poor countries to achieve, with finance from wealthy states. Conversely, every country will be expected to work towards achieving the SDGs.

Proposed 17 Sustainable Development Goals (SDGs)?

End poverty in all its forms everywhere

End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

Ensure healthy lives and promote wellbeing for all at all ages

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Achieve gender equality and empower all women and girls

Ensure availability and sustainable management of water and sanitation for all

Ensure access to affordable, reliable, sustainable and modern energy for all

Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all

Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation

Reduce inequality within and among countries

Make cities and human settlements inclusive, safe, resilient and sustainable

Ensure sustainable consumption and production patterns

Take urgent action to combat climate change and its impacts (taking note of agreements made by the UNFCCC forum)

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Strengthen the means of implementation and revitalise the global partnership for sustainable development

Within the goals are 169 targets, to put a bit of meat on the bones. Targets under goal one, for example, include reducing by at least half the number of people living in poverty by 2030, and eradicating extreme poverty (people living on less than $1.25 a day). Under goal five, there's a target on eliminating violence against women, while goal.

16 has a target to promote the rule of law and equal access to justice.

The interlinkages and integrated nature of the Sustainable Development Goals are of crucial importance in ensuring that the purpose of the new Agenda is realised. If we realize our ambitions across the full extent of the Agenda, the lives of all will be profoundly improved and our world will be transformed for the better.

This paper focuses on what are the recent developments undertaken for sustainable management that have wide, although not universal, applicability and can help guide the transition to sustainability.During the past half century agriculturalists

allowed the immediate effectiveness of modern agricultural inputs such as fertilizers and pesticides to somewhat divert their attention from the need to manage soil organic matter. There is a large number of research activities and projects related to soils around the world. Many projects would benefit from an increased coordination with other on-going research activities. Communication among the research communities dealing with the various aspects of soils are often limited or inexistent and interdisciplinary research is still very limited. Bridging between the various research communities could bring large benefits to the global scientific knowledge base and lead to more coherent soil related activities. Breaking the still existing walls between geology, soil science, agronomy, forestry, pasture/rangeland management, agro-climatology, soil biology and ecosystems research could improve the quality and applicability of research and provide new avenues for future integrated research and development programs.

The Global Research Alliance (GRA) : Is an international network of nine applied research organizations that works to promote application of science and technology to solve large scale issues facing developing countries. The alliance was formed in 2000 in Pretoria, South Africa. Today, the GRA has access to over 60,000 people across its membership. Vision is for a world where the application of innovative science and technology, through collaboration and co-creation, delivers access equality, improves lives, and solves global development challenges.The GRA uses the best science and technology to solve some of the biggest problems in the developing world. These global issues span borders, cultures and religions and require a cross-boundary response. They address these problems by :

Mobilising the creative energy of our globally and culturally diverse researchers to address global development challenges through innovation

Saring the breadth and depth of our science and technology resources and uniting with local partners, communities, industry and collaborators

Generating and implementing appropriate, affordable and sustainable solutions with positive and lasting impact

The GRA is a dynamic alliance of nine knowledge intensive research and technology organisations from around the world. Its goal is to create 'A Global Knowledge Pool for Global Good'. The focus is to apply science, technology and innovation in the pursuit of solving some of world's gravest challenges.

GRA and Inclusive Innovation : The Global Research Alliance (GRA) believes Inclusive Innovation requires a holistic and new way of approaching demand-driven projects and co-creation with partners such as end-users, technology organizations and both the private and public sectors. This includes: success through technical innovation (products), social innovation (interaction/co-creation), management innovation (business models); and chain innovation (relationships in the value chain). Inclusive Innovation is not new to the GRA. Over the last few years, the GRA has systematically addressed global challenges through the deployment of Inclusive Innovation initiatives.

Why do we need climate-smart agriculture : The UN Food and Agriculture Organisation (FAO) estimates that feeding the world population will require a 60 percent increase in total agricultural production. With many of the resources needed for sustainable food security already stretched, the food security challenges are huge. At the same time climate change is already negatively impacting agricultural production globally and locally. Climate risks to cropping, livestock and fisheries are expected to increase in coming decades, particularly in low-income countries where adaptive capacity is weaker. Impacts on agriculture threaten both food security and agriculture's pivotal role in rural livelihoods and broad-based development. Also the agricultural sector, if emissions from land use change are also included, generates about one-quarter of global greenhouse gas emissions.

Practical adaptation options to improve food security and resilience : What practical steps can smallholder farmers take to adapt their agricultural practices to secure dependable food supplies and livelihoods? And can they do this while also decreasing greenhouse gas emissions or increasing carbon sequestration, thereby decreasing future climate change?

In a search for answers the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is working with a vast range of partners to test a range of interventions in climate-smart villages.This Flagship addresses the challenge of how to transition to climate-smart agriculture at a large scale. We work with partners at all levels to test, evaluate, promote and scale up integrated portfolios of technologies and practices that meet the needs of farmers - including women and marginalized groups. We help build adaptive capacity and resilience to climate variability and change, while increasing food availability and generating mitigation co-benefits. We integrate, and apply the best and most promising methods, tools and approaches for equitable local adaptation planning and governance, and develop innovative incentives and mechanisms for scaling out CCAFS identifies agricultural development options that reduce greenhouse gas emissions and

increase carbon sequestration. Together with our partners, CCAFS produces research to improve estimates of farm emissions in smallholder systems, provides tools and information to agriculture decision-makers and supports the widespread implementation of low emissions agricultural practices and policies.

The Global Water Partnership's : vision is for a water secure world. Its mission is to support the sustainable development and management of water resources at all levels.GWP was founded in 1996 by the World Bank, the United Nations Development Programme (UNDP), and the Swedish International Development Cooperation Agency (SIDA) to foster integrated water resource management (IWRM).

IWRM is a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare without compromising the sustainability of ecosystems and the environment.The network is open to all organisations involved in water resources management: developed and developing country government institutions, agencies of the United Nations, bi- and multi-lateral development banks, professional associations, research institutions, non-governmental organisations, and the private sector. In the "Our Approach" section one can read about GWP's global strategy - Towards 2020 - how GWP are currently pursuing vision of water security.Dealing with water issues requires commitment at the highest political level. Water security will only be reached when political leaders take the lead, make the tough decisions about the different uses of water and follow through with financing and implementation.GWP sees its role as having the technical expertise and convening power to bring together diverse stakeholders who can contribute to the social and political change processes that help bring the vision of a water secure world closer to reality.GWP regularly reports on outcomes at the national, regional, and global level. GWP is implementing its strategy and up-to-date information on activities across the globe.

The Global Water Partnership (GWP) has announced the launch of its new 2014-2019 global strategy.The strategy, Towards 2020, outlines a new direction for GWP with the goals of catalyzing change, sharing knowledge, and strengthening partnerships for a water secure world. The 2014-2019 Strategy builds on GWP's previous work and achievements. It was developed through a year-long process of regional dialogues and consultations with GWP's growing network of over 2,900 Partner Organizations across 172 countries."The strategy Towards 2020 stresses the need for innovative and multi-sectoral approaches to adequately address the manifold threats and opportunities relating to sustainable water resource management in the context of climate change, rapid urbanization, and growing inequalities," Knowledge generation and communication continues to be a central part of GWP's work with this strategy."Knowledge and new tools are needed to support policy development and decision making and enable the effective and sustainable management of water resources," "Knowledge can stimulate behavioural change towards a new 'water culture'. New to this strategy is a thematic approach in six key areas of development – climate change, transboundary cooperation, food, urbanisation, energy, and ecosystems. "Integrated water management is fundamental to all of these areas of the global development agenda. Our new thematic approach will ensure the crucial link to water security is made across these thematic focus areas for meeting sustainable development goals," explains GWP Executive Secretary Dr Ania Grobicki.

The global launch of the strategy took place at the Official United Nations World Water Day celebrations in Tokyo, Japan, on 21 March 2014.

Global Soil Partnership : Soil is under pressure. The renewed recognition of the central role of soil resources as a basis for food security and their provision of key ecosystem services, including climate change adaptation and mitigation, has triggered numerous regional and international projects, initiatives and actions. Despite these numerous emergent activities, soil resources are still seen as a second-tier priority and no international governance body exists that advocates for and coordinates initiatives to ensure that knowledge and recognition of soils are appropriately represented in global change dialogues and decision making processes. At the same time, there is need for coordination and partnership to create a unified and recognized voice for soils and to avoid fragmentation of efforts and wastage of resources.

Maintaining healthy soils required for feeding the growing population of the world and meeting their needs for biomass (energy), fiber, fodder, and other products can only be ensured through a strong partnership. This is one of the key guiding principles for the establishment of the Global Soil Partnership.

Responses to soils today :

Soil data - fragmented, partly outdated (fertility, SOC, etc.) heterogeneous and difficult to compare, not easily accessible, not responding to users needs

Soil capacities - increasingly a scarce resources (loss of soil expertise and skills)

Soil knowledge and research - fragmented (fertility, CC, ecology), domain of soil scientists, not accessible for use by various disciplines and for decision making, not tailored to address problems/development agendas of today

Awareness and investments in soil management - extremely low compared to the needs that soil is a precarious resource and requires special care from its users

Soil policy - Often received as a second tier priority; lack of international governance body to support coordinated global action on their management

Need for compatible and coordinated soil policies - a unified and authoritative voice is needed to better coordinate efforts and pool limited resources (for agriculture, forestry, food security, UNCCD, CBD, UNFCCC, disaster and drought management, land competition, rural and urban land use planning and development).

Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. In the same year, the UN General Assembly endorsed the action by WMO and UNEP in jointly establishing the IPCC. The IPCC is a scientific body under the auspices of the United Nations (UN). It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis. Review is an essential part of the IPCC process, to ensure an objective and complete assessment of current information. IPCC aims to reflect a range of views and expertise. The Secretariat coordinates all the IPCC work and liaises with Governments. It is established by WMO and UNEP and located at WMO headquarters in Geneva. Because of its scientific and intergovernmental nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers. By endorsing the IPCC reports, governments acknowledge.

The Intergovernmental Technical Panel on Soils (ITPS) was established at the first Plenary Assembly of the Global Soil Partnership held at FAO Headquarters on 11 and 12 of June, 2013.

The ITPS is composed of 27 top soil experts representing all the regions of the world. The main function of the ITPS is to provide scientific and technical advice and guidance on global soil issues to the Global Soil Partnership primarily and to specific requests submitted by global or regional institutions. The ITPS will advocate for addressing sustainable soil management in the different sustainable development agendas.

Functions of ITPS : The ITPS have the following functions :

provide scientific and technical advice on global soil issues primarily to the GSP and in relation to specific requests submitted by global or regional institutions.

advocate for the inclusion of sustainable soil management into different development agendas.

review and follow up on the situation and issues related to soils in the contexts of food security, use and management of natural resources, ecosystem services provision, climate change adaptation and mitigation, and other relevant areas.

review and endorse from a technical viewpoint the GSP Plans of Action.

Follow up on the implementation of these Plans of Action with due attention to their impact and contributions to different global policies and initiatives related to sustainable development, MDGs, food security, climate change adaptation and other subject matters.

in exceptional cases, when complex technical matters arise, request the Plenary Assembly and the Secretariat to form technical committees aiming to gather specific advice.

Intergovernmental Platform on Biodiversity and Ecosystem Services : The Intergovernmental Platform on Biodiversity and Ecosystem Services is a mechanism proposed to further strengthen the science-policy interface on biodiversity and ecosystem services, and add to the contribution of existing processes that aim at ensuring that decisions are made on the basis of the best available scientific information on conservation and sustainable use of biodiversity and ecosystem services. It was established in 2012 as an independent intergovernmental body open to all member countries of the

United Nations. The members are committed to building IPBES as the leading intergovernmental body for assessing the state of the planet's biodiversity, its ecosystems and the essential services they provide to society.

What is the science-policy interface : Science-policy interfaces are social processes which encompass relations between scientists and other actors in the policy process, and which allow for exchanges, co-evolution, and joint construction of knowledge with the aim of enriching decision-making at different scales. This includes 2 main requirements:

that scientific information is relevant to policy demands and is formulated in a way that is accessible to policy and decision makers; and

that policy and decision makers take into account available scientific information in their deliberations and that they formulate their demands or questions in a way that are accessible for scientists to provide the relevant information.

Need for IPBES : There are already several mechanisms and processes at national, regional and global level that are designed to ensure that scientific information is considered when designing policies or making decisions (examples of this are technical bodies/panels under the environmental agreements or national research institutions attached to ministries, among many others). However, there is no global ongoing mechanism recognized by the scientific and policy communities, that pulls this information together, synthesizes and analyzes it for decision making in a range of policy fora.

We have listed some of the numerous global alliances which have been established to address the global research platfirms. This is in brief and there are others also across the globe taking shapes : One of the fundamental lessons learned through the past half century of agricultural research is that there are no "one size fits all" sustainable management practices and a holistic approach is the need of the hour.

Sustainable development in Indian Agriculture

Agriculture is the main occupation in India as large population is living in the rural areas and having agriculture as their livelihood. Sustainable development in the agriculture sector aims to increase the productivity, efficiency and level of employment and further aims to protect and preserve the natural resources by the over utilization. Agriculture faces many challenges, making it more and more difficult to achieve its primary objective – feeding the world – each year. Agriculture must change to meet the rising demand, to contribute more effectively to the reduction of poverty and malnutrition, and to become ecologically more sustainable India has been witnessing a blinding pace of growth and development in recent times. Experts are now calling for "sustainable development" and the term has gained currency in the last few years. In spite of fast growth in various sectors, agriculture remains the backbone of the Indian economy. Sustainable agricultural development seeks not only to preserve and maintain natural resources, but also to develop them, as future generations would have much more demand quantity-wise and quality-wise for agricultural and food products. Such goals should ensure a balance with the development of livelihoods enjoyed by the individuals concerned. Agriculture plays a crucial role in sustainable development and in hunger and poverty eradication. The challenges faced by agriculture in sustainable development is in working out ways of bringing about a society that is materially sufficient, socially equitable, and ecologically sustainable and one that is not obsessed by growth only, but motivated by satisfying human needs and equity in resource allocation and use. Sustainable agriculture must meet economic, social and ecological challenges. All 4 these challenges are closely related. Sustainable agriculture needs to protect the natural resource base, prevent the degradation of soil and water; conserve biodiversity; contribute to the economic and social well-being of all; ensure a safe and high-quality supply of agricultural products; and safeguard the livelihood and well-being of agricultural workers and their families. The main tools towards sustainable agriculture are policy and agrarian reform, participation, income diversification, land conservation and improved management of inputs. This policy document is an effort to identify the strategies, guidelines and practices that constitute the Indian concept of sustainable agriculture. This is done in order to clarify the research agenda and priorities thereof, as well as to suggest practical steps that may be appropriate for moving towards sustainable agriculture. Some tend to confuse sustainable agriculture with organic farming. But both are very different form each other. Sustainable agriculture means not only the withdrawal of synthetic chemicals, hybrid-genetically modified seeds and heavy agricultural implements (as in organic farming). Sustainable agriculture involves multiculture, intercropping, use of farmyard manure and remnants, mulching and application of integrated pest management. If this is followed then there is no reason why agriculture cannot be an economically viable activity in addition to being environmentally sustainable.

In India, the crop yield is heavily dependent on rain, which is the main reason for the declining growth rate of agriculture sector. These uncertainties hit the small farmers and laborers worst, which are usually leading a hand to mouth life. Therefore, something must be done to support farmers and sufficient amount of water and electricity must be supplied to them as they feel

insecure and continue to die of drought, flood, and fire. India is the second largest country of the world in terms of population; it should realize it is a great resource for the country. India has a huge number of idle people. There is a need to find ways to explore their talent and make the numbers contribute towards the growth. Especially in agriculture, passive unemployment can be noticed. The sustainable development in India can also be achieved by full utilization of human resources. A large part of poor population of the country is engaged in agriculture, unless we increase their living standard, overall growth of this country is not possible. If we keep ignoring the poor, this disparity will keep on increasing between classes. Debt traps in country are forcing farmers to commit suicides. People are migrating towards city with the hope of better livelihood but it is also increasing the slum population in cities. Therefore, rural population must be given employment in their areas and a chance to prosper. India has been carrying the tag of "developing" country for quite long now; for making the move towards "developed" countries, we must shed this huge dependence on agriculture sector.

For promoting sustainable agriculture, following components can be considered :

Yield increase : India need to focus on improving its yields. Currently, yield level of food crops is 2,056 kg/ha, which is far below the yields of many countries. The current average yield of paddy in India is around 3.5 tonnes /ha, while China's yield is more than 6 tonnes/ha. Similar is the case with wheat and other major crops. This is despite increase in fertilisers and pesticides by several folds.

Water-use efficiency. India is still focusing on supply side management of water. This is leading to major investments while causing degradation of ecosystems without any major benefit to farmers. The investments have to be clearly on reducing the water per unit of production.Currently, the focus of drip irrigation is only on material supply rather than the entire process and training. Creating specific incentives for using less water while improving the productivity have not even initiated. With modern technology, it is possible to create incentives to use less water and set up mechanisms to monitor water use at farm level. Budget should be allocated for creating well-designed projects with institutional mechanisms to implement and monitor. The goal is to use the existing infrastructure far more efficiently—both at system level and individual farm level.

Diversity of food grains: Consumers are aware of the benefits of eating coarse grains such as jowar and bajra. But there are no specific programmes to produce and market these food grains. Farmers need income, not just production. So, incentivising farmers to produce these grains will not only save water and ecosystems but promote healthy eating habits.

Farm-based approaches: In India, farmers are receptive to experimenting with farm-based approaches. For example, the System of Rice Intensification (SRI), Sustainable Sugarcane Initiative (SSI), and System of Crop Intensification (SCI) of wheat, millets and mustard are very popular with farmers. It is time we had Centre-sponsored scheme to promote these approaches in large scale with large budget provisions and institutional mechanisms.

Organic agriculture: India needs to slowly move from chemical-based farming to organic farming. Phase-wise approach towards removing subsidies to chemical fertilisers and introducing incentives to organic agriculture through budget provisions is the way to go about it.

PHYTONEMATODES PROBLEM IN AGRICULTURAL CROPS AND THEIR MANAGEMENT

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ABSTRACT

Phytonematodes are microscopic invertebrate animals often called as thread worms, eelworms or roundworms. They are distributed all over the world in different kinds of habitats and found in nearly every biological niche that supports life. They cause severe losses to economically important crops like vegetables, cereals, pulses, oilseeds, fruit crops, etc. Large number of plant parasitic nematode is recorded from rhizosphere of many crops like Root-knot nematode (*Meloidogyne* spp.), Reniform nematode (*Rotylenchulus reniformis*), cyst nematode (*Globodera* spp.), lesion (*Pratylenchus penetrans*) etc. Among all plant parasitic nematodes, root-knot nematode (*Meloidogyne* spp.) are the major phytonematodes causing damaging to crops. Sasser and Freckman (1987) have indicated an annual crop losses due to phytonematodes on worldwide basis to the tune of $ 100 billion. Annual losses worth as high as Rs. 40, 000/= in wheat and Rs. 30,000,000/= in barley due to cereal cyst nematode (*Heterodera avenae*) in Rajasthan alone have been reported. The degree of damage caused by nematodes depend upon population density of nematodes, susceptibility of the crop, environmental condition such as soil fertility, moisture and also presence of other pathogenic microorganisms which may interact with nematodes as they are known to cause disease complex in association with fungi, bacteria and viruses. Crop losses due to nematodes appear in different forms. It may be loss in yield, deterioration in quality of product and the increase in cost of production, etc. However, continuous feeding of nematodes provides entry points to other pathogenic micro-organisms and breaks the physical as well as mechanical barriers of the host. In such a complex situation, nematodes may either act as wound causing agents, as resistance breaking agents or as modifiers of host tissues or as vectors. Thus, nematodes either alone or in combination with other pathogens like fungi, bacteria, viruses, mycoplasma, etc. and the intensity of disease often gets aggravated hence, constitute an important constraint to world agricultural production.

The symptoms caused by the phytonematodes in vegetables are mainly divided into two types i.e., above ground and below ground symptoms. The a**bove ground symptoms:** non-specific and may be mistaken for micronutrient deficiencies in the soil; stunting, yellowing, wilting, patchyness and reduced yield. The patches of poor growth visible in fields from a distance. Chlorosis, wilting, delay in flowering and fruit formation, reduction in plant size, yield etc. may be noted in above ground parts of infected plants. The b**elow ground symptoms:** Small galls/knots seen on the roots which at a latter stage coalesce to form very large galls; Bushy appearance of secondary roots; Total reduction in root system; other symptoms include Lesions and "Dirty Roots".

Nematode management is important for high yields and quality that are required by the high cost of modern crop production. Therefore, the idea of keeping the nematode population below the economic damage level by adopting different management tactics is advised to the growers. The young tender seedlings of various crops are very much vulnerable to attack by nematode while older plants achieve some degree of tolerance. The losses in our agriculture production due to phytonematodes justify need for adopting their different management practices to check their population and level of infestation. The various management strategies i.e., Cultural, Physical, Chemical, Biological, Regulatory and IPM are undertaken to minimize crop losses caused by nematodes.

Cultural methods These are the most effective and economical means of managing nematode problems and are as follows—

(1) Following : Clean fallow during the off-season is probably the single most important and effective cultural control method available for nematodes. Due to fallowing the food sources are no longer readily available, soil population densities of nematodes gradually decline with death occurring as a result of starvation.

(2) Deep summer ploughing : Of nematode infested fields 2-3 times at an interval of 10-15 days during the hot summer month oin may and June under tropical and subtropical conditions helps in reducing the population of root knot nematode and reniform nematodes in soil.

(3) Cover/trap crops : Are useful for reducing nematode population as well as conserving soil and often improving soil texture. In localities where land availability permits, use of cover crops, especially plants that serve as trap crop offer

suppressive effects on nematode populations. Incorporation of such crop in cropping system either as inter-crop or alternative crop should be considered whenever feasible.

(4) Time of planting/harvesting : May be utilized to exploit differential environmental effects on nematode populations versus crop growth and maturity. For example, early planting of crops such as wheat, barley, rye, chickpea and potato has restricted associated nematode damage in some instances because of the prevailing temperatures and conditions required for optimum growth of most crops.

(5) Crop rotation : This is one of the oldest and most effective tactics for managing plant-parasitic nematodes. The goal of rotation is to bring about a striking population decline of the target nematodes that will facilitate the subsequent crop to grow and produce an acceptable yield. Use of non host crop like mustard, garlic, onion and cereals at least for 2-3 years in suitable cropping system helps in controlling nematode population. Thus, incorporation of such crop in cropping system either as inter-crop or alternative crop should be considered whenever feasible.

(6) Organic amendment : The use of organic amendment is a well established and age old practice. The three basic principles involved in management of phytonematodes with organic amendments are – habitat management, host modification and direct toxicity of the allelo-chemicals which are released through decomposition of organic materials, the nematodes may be affected by a single-factor, but in nature the factors usually run concurrently. Farmers use plant and animal wastes in the form of compost and farmyard manure, crop residues, oilcakes, municipal refuse and industrial wastes have been used by farmers as they provide better media for plants to grow, result in better soil texture, increase water holding capacity, supply nutrients to deficient soil and stimulate microbial population of actinomycetes, bacteria, fungi and elements of which might be antagonistic to nematodes. The decomposition of residues results in the accumulation in soil of specific compounds that may be nematicidal. The organic amendments have not only been found effective in normal cultivated crops but are also well suited in nurseries of vegetables fruits and ornamental plants.

Physical Control : The different physical methods of control are as follows :

(1) Solarization : Soil solarization is a simple, safe and effective method of nematode control. It allows grower to bypass lengthy crop rotations and gives the added benefit of controlling other soil pests such as insects and weeds. Radiant heat from the sun is the lethal agent involved in soil solarization. A clear polyethylene mulch or tarp is used to trap solar heat in the soil. Over a period of several weeks to a few months, soil temperatures become high enough to kill nematodes, as well as many other soil pests and weeds. None of the pests will be completely eradicated, but their numbers will be greatly reduced, allowing successful production of crop. The longer the soil is heated, the better and deeper the control of nematodes and other soil pests will be there. Soil solarization of the nursery bed area using thin transparent polythene sheet for 2-4 week in summer and application of carbofuran and phorate @ 0.1 g a.i/m2 before sowing could provide nematode free healthy seedlings of transplanted crop like tomato and brinjal under Indian conditions.

(2) Flooding : This is sometimes used as a management tool to control nematodes. Flooding the soil for seven to nine months kills nematodes by reducing the amount of oxygen available for respiration and increasing concentrations of naturally occurring substances—such as organic acids, methane, and hydrogen sulfide—that are toxic to nematodes. It may take two years to kill all the nematode egg masses. Flooding works best if both soil and air temperatures remain warm.

Biological Control : Biological control or biocontrol is broadly defined as the "use of natural or modified organisms, genes or gene products" to reduce the effects of pests and diseases. (Singh and Prasad, 2010; Prasad and Mittal, 2004) The different approaches of biological control can be categorized simply into three strategies 1) Regulation of the pest population 2) exclusionary systems of protection and 3) systems of self-defense. This method of control is more inconsistent, less effective and slower acting than control normally achieved with chemicals. Several bioagents like *Pseudomonas fluorescens, Paecilomyces lilacinus and Trichoderma harzianum* each @ 10 g/kg seed and their soil application @ 50 g/m^2 were found effective in reducing population of nematodes. But, *Paecilomyces lilacinus* as nursery treatment and its soil application at transplanting alone and in combination with toxic fungus like *Trichoderma viride* or *Aspergillus terreus/A. niger* was found effective in controlling root knot nematode population (Mittal and Goswami, 2004; Mukherjee and Mittal, 2007)

Host Plant Resistance : Plant resistance plays an important role in nematode management programme however, availability of resistant varieties of vegetable crops are very few in number and many of them are not acceptable to the farmers. It will provide an increasingly important contribution to the solution of many nematode problems. With the enhanced availability of germplasm that has nematode resistance genes and rapidly advancing molecular-transfer techniques, resistant cultivars should become a primary management tactic in nematode management (Mittal et al., 2000)

Chemical Control : This method with the application of nematicides is an effective means of nematode management. However, most of the effective nematicides have been withdrawn from the world market. At present, a fewer insecticides having nematicidal property are so far available to the farmers and many of them are not cost effective and environmentally acceptable. Despite their inherent drawbacks, chemical nematicides could be applied judiciously so that doses and cost are reduced drastically. The application of nematicides through seed treatment, bare-root dip treatment and nursery bed treatment have been proved to be effective to protect young seedlings from nematode attack.

Integrated Nematode Management : A long/medium term strategies by combining low input components alone or together with other management practices to bring down population level below threshold level should be main aim for successful cultivation of crops. The best way for management of phytonematodes can be achieved by the integration of different farming practices. During the last few years, nematologists and breeders followed conventional approaches of plant breeding to transfer nematode resistance genes into agronomically superior cultivated species. Crop cultivars resistant to phytonematodes can be most useful and cheapest means of nematode control for small-scale farmers. It will provide an increasingly important contribution to the solution of many nematode problems. With the enhanced availability of germplasm that has nematode resistance genes and rapidly advancing molecular-transfer techniques, resistant cultivars should become a primary management tactic in nematode IPM. This approach will become more critical as chemical nematicides become more restricted. The striking returns from deployment of some nematode-resistant cultivars reflect greater potential of this management tactic. The first approach includes season to season or year to year integration of strategies and is particularly relevant to annual cropping cycles. The second major approach to INM involves simultaneous application of two or more strategies. It is one of the most feasible and reliable approach for the control of plant parasitic nematodes in different agricultural crops for increasing crop productivity. The approach of an integrated nematode management should be :

Minimization of environmental and health hazards,
Utilization of several compatible measures,
Maximization of natural biotic and abiotic environmental resistance,
Understanding and counteracting nematode survival strategies,
Minimum use of drastic control measures,
Increased reliance on location specific and resource compatible management strategy,
Minimizing input costs in harmony with potential gains and
Maximizing of profit to the grower

Once the various integrated control programme are developed, it is necessary that they should be put to practice. The implementation of these programmes will require scientists/trained technicians and efficient extension media. In addition to these, they should also possess communication skills which are needed to work with the farmers. The success of integrated nematode management will depend on a wide range of appropriate expertise on research/demonstration/training projects. It requires a strong research base, to provide information on nematode pests, crops, agronomic practices related to the crop and their interactions. Similarly, farmers with their available resources could follow integration of cultural, biological, chemical methods and resistant varieties in suitable combination for each crop cultivation system for controlling nematode population and getting good yield. Hence, suitability of different practices should be adopted based on feasibility, utility and compatibility in the INM programme and thereby successfully managing nematode population. In future, the IPM should be converted into Integrated Crop Management Programme enwrapping all agricultural practices leading to a healthy growth of the plant, higher yields with low cost of production, ecologically viable and farmer friendly Co-operative Farming, contact Farming and involvement of Government and NGO's in pest management programme will definitely result in sustainable agriculture and effective pest management ensuring food security. Phytonematodes will continue to be a major production constraint and hence effective awareness programmes have to be launched among the farming community for imparting a clear understanding of nematode damage.

Future line of work

Intensive and extensive surveys on the presence of parasitic nematodes infesting agricultural crops should be conducted.
Use of cultural practices should be emphasized depending on area/locality.
Emphasis should be given on the integration of nematode management practices by adoption of cultural practices, resistant varieties, nematicides, organic amendments, biological control agents, etc.

Role of secondary organisms in causing diseases along with nematodes should be studied and nematode management practices be evolved.

Need to develop varieties, which are resistant or tolerant to nematodes. Varietal screening and subsequent breeding programmes should be intensified.

Attempts should also be directed towards biological control. *Paecilomyces lilacinus*, *Trichoderma harzianum*, *Verticillium chlamydosporium* and VAM fungi have been identified all over the world as potential biocontrol agents against plant parasitic nematodes. The possibility of using these bacteria and fungi as biocontrol agents against nematodes infecting vegetable crops should be explored.

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DOUBLING FARM INCOME OF TRIBAL FARMERS BY ALTERNATIVE IFS MODULES

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Abstract

Integrated Farming System (IFS) not only enhances income of the tribal household but also provide on and off farm employment opportunities for small and marginal farmers, thereby reducing migration. Integrated farming system approach is a multi-disciplinary holistic approach to solve the problems of small and marginal tribal farmers. The declining trend of per capita land availability poses a serious challenge to the sustainability and profitability of tribal farming community. Small and marginal farmers are the core of the Indian agrarian rural economy constituting 80% of the total farming community but possessing only 36% of the total operational land holdings. The declining trend of per capita land availability poses a serious challenge to the sustainability and profitability of tribal farmers. Under such situations, it is appropriate to integrate land based enterprises, viz., dairy, crop production and horticulture crops within the farm with the objective of generating adequate income and employment for these small and marginal tribal farmers and thereby improve and sustain their livelihood.

Key Words : *Farm Income, Tribal, Integrated Farming System, Sustainability, livelihood.*

"There is no waste", and "waste is only a misplaced resource which can become a valuable material for another product" in Integrated Farming System. *–Food and Agriculture Organization (FAO)*

In India, the farmers maintain different enterprises for their complimentary and supplementary nature and for ensuring sustainable livelihood from time immemorial. After the advent of green revolution in late-1960s and economic liberalization in early-1990s, the farmers gradually started focusing on a few enterprises due to several imposing factors including shrinking farm sizes, fluctuating commodity prices, livelihood diversification and shortage of labour during peak agriculture season. It had a severe impact on food and nutritional security of millions of poor farm households. Although suggestions are pouring from experts and leaders of organization for strengthening the income base of farmers, the government cannot implement them entirely due to compulsions from socio-economic and political considerations. However, the Government of India has made an announcement about Doubling Farmers' Income by 2022. Experts are judging the options and strategies for achieving this enviable target. One of the options is to evaluate the potential of age-old integrated farming system (IFS) in enhancing income of farm families within the reasonable time period.

India is one of the countries having the largest concentration of the tribal population in the world. According to 2011 census, the population of the scheduled tribes of the country was 8.43 crores, consisting about 8.2 per cent of the total population indicating approximately one tribesman for every fourteen Indians. Majority of tribal population is concentrated in the states namely Madhya Pradesh, Bihar, Orissa, Gujarat, Rajasthan, Assam, West Bengal, Maharashtra and Andhra Pradesh. Though 80 per cent of the tribes depend on agriculture as the main source of livelihood they still remain in poverty line.

Integrated Farming System (IFS) not only enhances income of household but also provide on and off farm employment opportunities for small and marginal farmers, thereby reducing migration. Integrated farming system approach is a multi-disciplinary holistic approach to solve the problems of small and marginal tribal farmers. The declining trend of per capita land availability poses a serious challenge to the sustainability and profitability of tribal farming community. It is appropriate to integrate land based enterprises *viz.*, crop production, dairy, horticultural crops, poultry and fisheries within the farm with the objective of generating adequate income and employment for these small and marginal tribal farmers and thereby improving livelihood and nutritional security. The traditional monoculture production system adopted by these tribal farmers has been explorative and the natural resources like soil and water were subjected to immense pressure beyond carrying capacity. As a result sustainability of agriculture production system and the farming system is in crisis. This suggest an urgent need of integrated farming system development where the various components of the farming system may be integrated to improve productivity and profitability as well as resource conservation along with maintenance of the environment. Farming system approach is an important solutions to face this peculiar situation as in this approach the different enterprises can be carefully undertaken and the location specific systems are developed based on available resources which will result into sustainable development. To achieve doubling farmer's income might require novel strategies to integrated farming system practices of tribal community. Hence, it is important to review the existing farming practice of tribal community. This paper reviews the existing IFS and suggests the need based alternative models

The aims of the Integrated Farming System can be achieved by

1. Efficient recycling of farm and animal wastes
2. Minimizing the nutrient losses and maximizing the nutrient use efficiency
3. Following efficient cropping systems and crop rotations
4. Complementary combination of farm enterprises

Goals of Integrated Farming System

1. Maximization of yield of all component enterprises to provide steady and stable income at higher levels.
2. Rejuvenation/amelioration of system's productivity and achieve agro-ecological equilibrium.
3. Control the buildup of insect-pests, diseases and weed population through natural cropping system management and keep them at low level of intensity.
4. Reducing the use of chemical fertilizers and other harmful agro-chemicals and pesticides to provide pollution free, healthy produce and environment to the society at large.

Existing and alternative IFS Models of tribal farmers

Integrated farming system approach is a multi-disciplinary holistic approach to solve the problems of small and marginal tribal farmers. It is appropriate to integrate land based enterprises *viz.*, crop production, dairy, horticultural crops, poultry and fisheries within the farm with the objective of generating adequate income and employment for these small and marginal tribal farmers and thereby improving livelihood and nutritional security.

Doubling farm income can be achieved of tribal farmers by alternative IFS modules

Case study : 1

Integrated Farming System approach for livelihood and nutritional empowerment of Tribal farmers of southern Rajasthan. (Singh *et al.* 2015).

Seed Replacement Rate in Crop Production

Table-1 : Effect of seed replacement rate on productivity of major crops and income of the farmers (4 years' pooled data)

Crop	Average Yield (q/ha)		Increase over local check	Gross Return Demons (Rs./ha)
	Demons	Local check		
Kharif Maize	32.70	25.0	30.8	34975
Rice	31.50	22.0	43.2	78750
Soybean	14.80	12.0	22.9	32000
Rabi Maize	40.80	32.6	25.2	40850
Wheat	33.20	27.1	22.5	41891
Barely	31.60	23.7	33.3	36993
Gram	14.50	10.5	38.1	47000

Cereal-cereal crop rotation was the prevalent cropping system followed by the tribal farmers for their subsistence. Maize-wheat was the major cropping system in the region. The productivity of these crops was very low due to use of food grains as seed, very high seed rate, indiscriminate fertilizers use, improper crop geometry, weed and poor water management. During the participatory research programme farmers were trained with recent production technology and provided with improved variety seeds as critical input. Seed replacement in 43.2 % over local existing varieties of these crops (Table 1). In low lying areas rice recorded highest gross returns (Rs. 78750 per ha) while gram cultivation found more profitable instead of wheat with maximum gross return (Rs. 47000 per ha).

Income improvement through Hybrid Vegetables Production

The commercial vegetable production is generally not followed by the tribal farmers due to lack of knowledge, high risk and marketing problems. During the NAIP project hybrid vegetable cultivation were promoted along with crop production in the adopted region. This intervention alone has made major impact on livelihood of the farmers since earlier from same piece of land they rarely got more than Rs. 4000 and now they are getting more than Rs. 10000. Farmers fetched very high returns from Chilli var. *Ujala* (Rs 130000 / ha) followed by Okra var. *Bhindi No. 10* (Rs. 127000 / ha) and green leaves of coriander (Rs. 105000 / ha). Farmers earned Rs. 9500 to 32000 from 0.2 ha land area (Table 2).

Table-2 : Income generations of Tribal farmers through hybrid vegetable cultivation (4 years' pooled data)

Crop	Average Productivity(q/ha)	(q/ha)	Average Gross	Return (Rs./ha)
Lady's Finger (Okra)	127.5	188750	127500	25500
Chilli	132.5	230000	130000	32000
Tomato	170.0	112500	65000	9500
Coriander	350.0	160000	105000	42000
Onion	155.0	63750	30000	6500
Cluster bean	87.5	75000	50000	10000

The facility of mobile refrigerator van has been made available to fetch good prices of vegetables in surrounding markets.

Nutritional Security through Nutri-garden

Rural tribal farmers are facing the malnutrition problems due to less diversified food habit and low intake of vegetables in their diet. Farmers generally grow maize round the year so they eat maize with locally available vegetable *i.e. Khatlo* (butter milk + green sag), okra etc. They rarely purchased vegetables due to poor economy. Nutri-gardens consisting of seasonal vegetable crop's seeds were established nearby their houses for their own consumption to improve their nutrition.

Table-3 : Nutritional Security through Nutri-garden

Year	Farm Families	Average production of vegetables (Kg)	Average consumption of vegetables (Kg)	Marketable surplus	Value (Rs.)
2008-09	760	325	110	215	1075
2009-10	2000	300	125	175	950
2010-11	2300	350	150	200	1250
2011-12	2300	300	165	135	1000

It was recorded that after their own consumption, farmers also earned some income i.e. Rs. 950 to 1250 per farm family through selling out vegetables. Five fruit plant saplings of each papaya, mango, aonla, guava and lemon were also provided to the farmers to improve nutrition.

Increasing water use efficiency

The soils of the region are stony clay loam which having more conveyance losses of water through seepage. Farmers generally grow crops near the source of water. Under the project, farmers were trained to utilized water resources efficiently in their fields. For this purpose farmers were provided 3500 PVC irrigation pipes on share basis. This intervention brought 75 ha additional area under irrigation in the ten adopted villages. Farmers were using irrigated area mostly for growing vegetables and green fodder for livestock. This intervention also helped to improve their livelihood.

Mechanization of farm

The farmers of the region generally used their own traditional farm implements such as deshi plough, buckhar etc. which took lot of time and labour in preparing the fields. To improve agronomic efficiency and reduction in drudgery in agriculture, farmers were provided improved farm implements on custom hiring basis from the Rural Technology Centre. The improved

farm implements includes-bullock drown MB plough, bund former, bullock drawn seed cum fert-drill, serrated sickle, hand hoe, hand rakes, tractor drawn thresher, seed drill, mini seed grader, power operated reaper, feed block machine, improved seed storage bins etc. The farmers were using these implements to complete timely field operations. The State Government of Rajasthan is also planning to have such centres which can provide farm implements to the farmers.

Farmer's Producer Company: A step to upgrade livelihood of Tribal farmers

Under NAIP project, farmers were further tied up with the market by providing adequate facilities and roping in a private sector to help them to get better prices for their produce. Farmers were grouped into farmers business groups (FBGs) on the basis of self help principles and ultimately forming farmer's producer marketing company. The producer company will provide platform for the small and marginal farmers to organize themselves as a free market entity. They follow the values and principles of co-operation. In the adopted ten villages, 61 FBGs were formed with help of Access Development Services. These 61 FBGs were further federated into producer company namely "Jhambu Khand Agro Producer Company Limited (JKPCL)" and registered under company Act, 1956. The company has stared collective procurement and marketing of agricultural inputs like seeds, fertilizers, pesticides etc. The annual turnover of JKPCL was Rs. 28.5 lacs during the year 2010-11 and targeted one crore for the year 2011-12. In this way replication of such model can set to bring revolutionary positive change in the livelihood of under privileged people of the disadvantaged districts.

Case study : 2

Contribution of Integrated Farming System for Livelihood Security of Tribal's in Pachamalai Hill of Tiruchirappalli District **(**Dhanushkodi *et al.* 2017).

Most of the respondents were involved in the adoption of integrated farming system, but the components are based on size of land holding, economic conditions, knowledge, experience and interest of the respondent etc. Eight different components of Integrated farming system were considered in the study. Among them agriculture with backyard poultry, livestock and piggery which are adopted by most of the respondents. Farmer's responses that integrated farming system has increased the economic yield per unit area by providing income to the farmers round the year, providing food, nutritional security and increasing input usage by the result of expected output. Hence it is essential to create awareness to improve knowledge, skill and attitude regarding the adoption of more components of integrated farming system. Therefore it was concluded from the study that integrated farming system is a multidimensional farming approach, which is very effective in solving many problems of achieving farmers' livelihood security.

Case study : 3

Economic feasibility of goat farming under IFS in NEK region of Karnataka (Satihal *et al*, 2016).

Table-4 : Discounting cost and returns of goat rearing under IFS farming

In the study area about 45 per cent (28 farmers) of IFS farmers had raised goats with an average of 3 goats per family.

Year	Total cost	Gross returns	Net returns	Discounting factor (@12%)	Discounted cost	Discounted return	Discounted net return
0	65650	39000	-26650	1.00	65650	39000	-26650
1	40650	115000	74350	0.90	36955	104545	67591
2	40650	115000	74350	0.82	33595	95041	61446
3	40650	115000	74350	0.75	30541	86401	55860
4	40650	115000	74350	0.68	27765	78547	50782
Total					194505	403535	209030
Returns per rupee of investment							2.07
Discounted net return							209029.00
IRR							278%

The discounted cost and returns was worked out for a unit (3 goats) of goat rearing under taken by IFS farmers is presented in Table-1. The discounted cost was 1,94,505 and discounted returns was 4,03,534.50 with net discounted returns of 2,09,029. Similarly, discounted returns per rupee of investment was 2.07 implied that every rupee of initial investment yields a net returns of 2.07 from goat rearing enterprise with average number of three goats. This indicates that goat rearing is financially feasible and economically viable enterprise for small holder farmers to enhance their income and better livelihood security in the study area.

Table-5 : Comparative analysis of different IFS components

IFS components	Total cost	Gross return	Net return	Return at per rupees investment	Employment generation (Man days/ha/year)
Crop	10343	16638	6295	1.60	217
Sericulture	22080	38220	16140	1.73	229
Vermin-Compost	166309.5	208729.7	42420.2	1.25	272
Horticulture	122527.9	260506.4	137978.4	2.12	277
Dairy (2+1)	951150	1992893	1041743	2.09	253
Goat	54267.86	143209.4	88941.54	2.63	235
Sheep	46901.33	116968.4	70067.07	2.49	235

The costs and returns of the different IFS components were worked out. Through Table 2 it is easy to note that the highest profit is obtained from goat rearing as the returns per rupee of investment is high 2.63 followed by sheep rearing, dairy, sericulture, horticulture and crop were 2.49, 2.09, 1.73 and 1.63 respectively, further additional income can be obtained by vermicomposting with net return 42420.2. It is interesting to note that over all the livestock components have more profit rather than crop component, its due to the market values and high demand in the market for these products. The IFS module with goat component provided regular employment and income throughout the year, which helped in improving standard of living and livelihood security of IFS farmers.

Case Study-4 :

Integrated farming system module for livelihood security (Raichur, Karnataka, India) (Desai. 2015)

Teak planting was all along the borders. Bunds between the segments are planted with drumstick, curry leaf and fodder grasses like NB-21, Guinea grass & stylo.

Segment 1 : Bullock pair : 1

Cow : 2

Poultry birds : 60

Kitchen garden

Construction of farm pond (Fishery), farm house, Poultry cage, Cattle shed and Vermicompost unit as per the specification

Segment 2 : Horticulture crops like Mango & Fig/Guava inter-cropped with vegetables like Bhendi, Ridge gourd and Leafy vegetables

Segment 3 : Maize followed by Bengal gram

Segment 4 : Bt-cotton

Segment 5 : Part 1: Jasmine

Part 2 : Marigold

Part 3 : Watermelon

For human need, the livestock provides food, fiber, skin, traction, fertilizer and fuel. Livestock also constitutes “living bank”

providing flexible financial reserve in times of emergency and serve as "insurance" against crop failure for survival. In this system, animals are raised on agricultural waste. The animal power is for agricultural operation and the dung is used as manure and fuel.

The integration of various enterprises on 1 ha of land holding were viable. The productivity of the farming systems was based on the quantity of marketable produce obtained during all three years. The profitability of different components of IFS in the first year was comparatively less than second year and third year. During the first year net income generated from crop component was 30,570 with a B: C ratio of 2.30 while, from allied activities it was about 46,398 with B: C ratio 2.81 respectively. In second year, benefit cost ratio is in increasing trend when compared to the first year. The net income generated during the second year from the crop component is Rs. 70319 with B:C ratio of 3.69 while, Rs. 57243 with B:C ratio is 3.02 obtained from the allied sector.

Integrated Farming System method records higher net returns and benefit cost ratio in all the three years because this method comprising the components like cropping, vegetables, vermi compost, goat rearing, poultry and cattle (bullocks, cow and calves) rearing. At the end of third successive year IFS method contributed a net return Rs. 2,27,398 with 4.63 benefit cost ratio, which gives 26.5 per cent higher net returns compared to conventional method (cotton). The net income generated during third year from the crop components is Rs. 74577 with B: C ratio of 3.64 while Rs. 152821 with B:C ratio is 5.34 obtained from the allied sector. Higher net income generated during third year compared to first and second year due to proper recycling of farm resources each other through use of vermicompost, FYM and also from yielding of horticulture components like drumstick, curry leaf, adoption of floriculture and good planning of vegetables according to good seasonal demand might be contributed to good returns. Among components studied, cotton + vegetable cultivation + diary + vermicomposting unit + fodder cultivation on bunds was more profitable and recorded average net returns of Rs. 108212 with 5.41 B: C ratio than growing of single crop cotton.

CONCLUSION

From this review it is concluded that the integrated farming system (IFS) is a promising enterprise for the marginal and small tribal farmers particularly who has less farm holdings. From this study, the IFS provide progressive economic growth, employment opportunities, family nutritional requirements, optimal utilization of resources of the farming enterprises etc. Further many researchers found many types of integrated farming system models existing in the country but it has not properly documented to reach the mass farmers. Hence, measures to be taken to document such kinds of farming system models and to disseminate to the needy farmers. Although the integrated farming system has certain constraints the scientific community and research station has to initiate steps to alleviate such problems of the farmers to improve their standard of living and income. The focus of present government is on doubling farmers' income by 2022. Integrated farming system research is a multi disciplinary holistic approach to solve the problems of small and marginal farmers. Small and marginal farmers are the core of the Indian agrarian rural economy constituting 80% of the total farming community but possessing only 36% of the total operational land holdings. The declining trend of per capita land availability poses a serious challenge to the sustainability and profitability of tribal farmers. Under such situations, it is appropriate to integrate land based enterprises, *viz.,* dairy, crop production and horticulture crops within the farm with the objective of generating adequate income and employment for these small and marginal tribal farmers and thereby improve and sustain their livelihood.

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STATUS OF CORN CULTIVATION IN BIHAR : OPPORTUNITIES AND FUTURE CHALLENGES

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Maize is the highest growing cereals among all other cereals around the world especially in India after rice and wheat production. Maize is the second most important cereal crop in the world in terms of acreage and is called the 'Queen of Cereals'. Global maize production touched approx. 1040 million MT in 2016-17, wherein, US has been the leading producer, followed by China, accounting for about 38% and 23% respectively. India contributes around 2% of this production chart with a quantum of 26 million MT in 2016-17.The United States of America (USA) is the largest producer of maize contributes nearly 35% of the total production in the world and other important growing countries are China, Brazil, India, Argentina, Ukraine, and Mexico. In India, major maize growing states are Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Bihar, Uttar Pradesh,

Apart from India, US stand uniquely by securing the highest position in the production of maize surplus which also makes it a world exporter of maize. The maximum number of maize are produced are used in the practice of feed and the rest is used for other food and industrial usages among the humans.In most of the developing countries, the production of maize crop is an essential food crop not only in India but around the world as well to a large extent significantly. The food crop supports major food security in most of the fast-growing developing countries across the globe. After the cereal production of wheat and rice, maize has significantly held a strong place in the third position out of the many crops production in India. The major usage of maize is just not limited to the use of humans and animals feed but also widely used in baby corn oil, corn starch, corn oil production, and much more.

Maize is important to India as 15 million Indian farmers are engaged in Maize cultivation. Having realised the potential of maize in generating better income to farmers and providing gainful employment, maize qualifies as a potential crop for doubling farmer's income. There is a tremendous potential of growth of the Maize value chain in the country. The consumption of Maize has increased at a CAGR of 11% in last five years. Today, Maize is a source of more than 3500 products including specialised Maize like QPM "Quality Protein Maize". These trends open up vistas of opportunity for India's Maize sector. However, it's time to check if India is ready to capitalize on this opportunity. Although, India has received Maize production level of 26 Mn MT, it would require 45 Mn MT of Maize by the year 2022. The increasing interest of the consumers in nutritionally enriched products and rising demand for poultry feed which accounts 47% of total maize consumption are the driving forces behind increasing consumption of Maize in the country. As per the demand estimates, the Indian Maize production has to grow with CAGR of 15% in next 4-5 years. In the Indian context, not less than 15 Million farmers are engaged in maize cultivation and it generates employment for more than 650 million person-days at farming and its related business ecosystem levels. Importantly, maize contributes more than 2 per cent to the total value of output from all agricultural crops. The crop is less water demanding than other similar cereals and being a 'C4' as well as 'day-neutral plant', it gives higher yield per hectare in a shorter period and can be grown in any season. The multiple utilities of maize as a 'food', 'fodder' and 'feed' makes it further more demand friendly and insulates it against low demand situations. These unique characteristics of maize make the crop a suitable crop candidate for enhancing farmer's income and livelihoods in India.

Background

Bihar has a total geographical area of 93.60 lakh hectares. Gross sown area in the State is 78.82 lakh hectares, while net sown area is 57.12 lakh hectares.There are around 1.61 crore landholdings in the State of which 1.47 crore around 91.06 percent are marginal holdings of size less than 1 hectare79% population of the state engaged in agriculture. Bihar with a geographical area of about 94.2 thousand square km is divided by river Ganges into two parts, the north Bihar with an area of 53.3 thousand square km and the south Bihar having an area of 40.9 thousand square km. Based on soil characterization, rainfall, temperature and terrain, four main agro-climatic zones in Bihar have been identified. These are: Zone-I, North AlluvialPlain, Zone-II, north East Alluvial Plain, Zone-III A South East Alluvial Plain and Zone-III B, South West Alluvial Plain, each with its own unique prospects. Agro climatic zone I and II is located north of the river Ganges whereas the Zone III is located south of the river Ganges. Zone I is situated in the north western part of the state whereas zone II is located in the north eastern part.Zone I and II are flood prone whereas zone III is drought prone. Potential wise all three agro climatic zones have vast untapped potential for increasing the productivity of food grain crops. Across the state soil texture is varies from sandy loam to heavy clay. However the majority type belongs to loam category which is good for crop cultivation. The natural precipitation varies

Table-1 : Name of the districts under each Agro-Climatic Zone

S.No.	Agro-climatic zone	Districts
1.	Agro-climatic zone I (Northern West)	West Champaran, East Champaran, Siwan, Saran, Sitamarhi, Sheohar, Muzaffarpur, Vaishali, Madhubani, Darbhanga, Samastipur, Gopalganj, Begusarai
2.	Agro-climatic Zone II (Northern East)	Purnea, Katihar, Saharsa, Supaul, Madhepura, Khagaria, Araria, Kishanganj.
3.	Agro-climatic zone IIIA (Southern East)	Sheikhpura, Munger, Jamui, Lakhisarai, Bhagalpur & Banka.
4.	Agro-climatic zone IIIB (Southern West)	Rohtas, Bhojpur, Buxar, Bhabhua, Arwal, Patna, Nalanda, Nawada, Jehanabad, Aurangabad, Gaya.

from 990 to 1700 mm. Most of the precipitation is received during the month of July to September There are three crop seasons- Kharif, Rabi and Zaid. Rice, wheat and pulses are grown in all the districts. Being located between 25 to 27 degree North latitude the climate of Bihar is of mostly sub-tropical. Average temperature is 35-40 degree Celsius throughout the summer months. April and June are the hottest months of the year. December to January is the winterseason in Bihar. The winter in Bihar is mild with average temperature being 5 to 10 degree Celsius. Bihar gets its maximum rainfall during South-West monsoon season which prevails from June to September. The average rainfall of Bihar is around 120 cm. (Source: http://krishi.bih.nic.in/).

National Maize Production Scenario

Global maize production hovered around 1040 million MT of Maize in 2016- 17, however for the current year there are forecasts for a slightly lower Maize area, yield and production. In a global perspective, US has been the leading maize producer, followed by China, accounting for about 38% and 23% respectively. (Anonymous, 2018b).In last three years, in spite of drought-like conditions, the maize area has increased in Gujarat, Himachal Pradesh, Jharkhand, and west Bengal (Table 1). In addition the maize production has increased in Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Tamil Nadu and West Bengal. In spite of rought, the maize productivity has been increasing in Bihar, Jammu & Kashmir, Madhya Pradesh, Tamil Nadu, Uttar Pradesh and West Bengal (Table 2). As per the Compound Annual Growth Rate (CAGR) since 2001, the there is increase in area, production and productivity in both *kharif* and *rabi* season, however the growth rate was higher in *rabi* season than *kharif* season. Maize consumption in India can broadly be divided into three categories viz. feed, food and Industrial non-food products (mainly starch). Total corn in India utilised in poultry feed (47%), livestock feed (13%), Food (13%), processed food (7%), starch (14%) and exports & others (6%). Overall consumption of Maize in last 5 years has increased with CAGR of 11%.

Status of maize in Bihar

Bihar stands uniquely in the 6th position in the top 10 list of the largest maize producing states in India. The state also remarkably stands in a powerful position in the production maize in a huge amount significantly. Bihar is thus eventually regarded as one of the largest producers in the production of the maize crop in India. It has recently emerged as the high-yielding maize crop with high potential in playing a dynamic role as an agricultural power house. Bihar is one of the largest maize growing state and the crop was grown primarily as a subsistence crop to meet food needs for a long time till recently. But now like in non-traditional areas (Karnataka and Andhra Pradesh), it is also grown for commercial purposes (i.e., mainly to meet the raw material requirements of the animal feed sector).It is third largest maize producing state contributing around 14 percent to national production. Around 0.72 million hectare is presently under maize cultivation, which is about 7.3 per cent of Gross Cropped Area (GCA) in the state and over 15 lakh farmers are engaged in maize cultivation. During 2016-17, the state produced about 3.84 million MT. Maize can be utilized in many different forms by converting it into a variety of products, through grinding, alkali processing, boiling, cooking and fermenting, such as corn starch, corn flakes and cereals, ethanol etc. It also has many industrial applications, which can make it a profitable crop in the state. Maize processing and utilization pattern shows that in India, around 64 per cent of the total produce is for animal feed, 16 per cent for human consumption and 19 per cent is used by the industry (starch, brewery etc) seed and other miscellaneous 1%. In Bihar only 8-10% of maize (5% directly by the processors and another 3-5% is being used by road side snack joints etc.) is processed within the state despite the fact that the state has huge and rising marketable surplus. While the area under cultivation, maize

Table-2 : Maize area, production and yield statistics in Indian states from 2013-14 to 2015-16

State/ UT	Area ('000 ha)			Production ('000 tonnes)			Yield (kg/ha)		
	2013-14	2014-15	2015-16#	2013-14	2014-15	2015-16#	2013-14	2014-15	2015-16#
Andhra Pradesh	335.7	303.0	233.0	2087.5	1938.0	1414.0	6218	6396	6069
Arunachal Pradesh	47.0	48.0	*	69.0	75.0	*	1467	1563	*
Assam	24.1	28.0	25.0	21.6	93.2	64.0	898	3333	2560
Bihar	732.3	706.5	701.7	2112.1	2340.5	2397.2	2884	3313	3416
Chattisgarh	111.1	122.1	114.5	229.1	230.3	193.8	2062	1886	1693
Gujarat	461.0	382.0	387.0	681.0	631.0	572.0	1477	1652	1478
Haryana	9.0	8.0	6.0	27.0	18.0	17.0	3000	2250	2833
Himachal Pradesh	292.7	292.6	295.6	652.1	579.0	671.0	2228	1979	2270
Jammu & Kashmir	298.7	298.9	306.1	530.5	360.0	479.2	1776	1204	1566
Jharkhand	256.9	269.8	288.0	517.0	475.6	375.5	2012	1763	1304
Karnataka	1377.0	1337.0	1179.0	3984.5	4214.0	3269.0	2894	3152	2773
Kerala	0.1	0.1	0.1	0.1	0.1	0.1	2000	1000	1000
Madhya Pradesh	868.0	1132.0	1098.0	1534.0	2128.2	2580.3	1767	1880	2350
Maharashtra	1001.0	1077.0	1007.0	2729.4	2202.0	1511.0	2727	2045	1500
Manipur	26.1	26.2	*	58.6	58.8	*	2246	2243	-
Meghalaya	18.0	18.0	*	39.7	40.8	*	2200	2259	-
Mizoram	5.8	5.7	*	8.2	8.6	*	1420	1515	-
Nagaland	68.8	68.8	*	135.4	135.9	*	1969	1975	-
Orissa	95.1	91.7	55.6	263.6	188.2	110.8	2771	2053	1993
Punjab	130.0	126.0	115.0	507.0	460.0	424.0	3900	3651	3687
Rajasthan	926.7	891.5	881.1	1502.2	1551.2	1210.4	1621	1740	1374
Sikkim	39.9	39.9	*	68.8	68.9	*	1724	1727	*
Tamil Nadu	345.3	322.0	363.9	1855.1	2067.9	2383.3	5372	6423	6549
Telangana	670.3	692.0	573.0	2774.7	2308.0	1736.0	4140	3335	3030
Tripura	4.6	4.5	*	5.9	5.9	*	1279	1303	-
Uttar Pradesh	767.0	717.0	679.0	1306.2	1279.0	1255.0	1703	1784	1848
Uttarakhand	25.0	24.5	23.0	35.5	50.8	36.0	1419	2070	1565
West Bengal	128.7	152.4	156.0	522.4	663.1	720.0	4059	4350	4615
A & N Islands	0.1	0.2	-	0.3	0.6	-	2254	3529	-
D & N Haveli	0.1	0.1	-	0.1	0.1	-	1000	1100	-
Others	-	-	204.3	-	-	383.9	-	-	1879
All India	966.2	9185.3	8691.2	24259.5	24172.6	21806.5	2676	2632	2509

production & yield has increased during 1977 to 2017, there are only 10-12 maize processing units in Bihar. They are mainly into milling of flour and production poultry feed. In absence of adequate processing facility in the state, result more than 80% of Bihar maize goes outside the state and gets processed there depriving it of value addition and higher income for the people in the state. The processed maize in the form of poultry feed and seeds then come back to the state. There is potential for processing of both high & low value added products in maize sector in the state itself. There are factors contributing to increase in the demand of processed maize. Some of them are (1) growing demand for eggs and chicken leading to increased demand for poultry feed in the state; (2) the state has nearly 8 lakh hectare land under water which is suitable for fish farming; (3) increased demand for ethanol as a fuel additive; (4) growing urbanization leading to increased demand for processed food like corn flakes etc; (5) dairy sector is on growth path and this sector can provide a good market for cattle feed products. Thus there is growing demand for processed maize in the state and there is also adequate supply of good quality maize in the state.

Although maize is growing in all three seasons (Kharif, Rabi and Spring/summer) in Bihar but major area is in rabi followed by kharif and spring. Highest productivity is also in rabi followed in spring and Rabi. Bihar is the 8th populous state in India and depends primarily on agriculture. It produces a variety of crops like maize, sugarcane, potato, jute and many other vegetables and fruits due to its soil fertility and climatic conditions. The geographical location and climatic condition of eastern part of Bihar namely Purnea, Katihar, SaharasaAraria, Khagaria, districts are favourable for cultivation of rabi maize. Maize is thus an important crop in Bihar which is third largest producer of maize in the country after Karnataka and Madhya Pradesh and accounts for about 11% of national maize output (Anonymous,2017). Cultivation of maize provides livelihood to about 1.3 million farmers in Bihar, majority of who are marginal and small farmers.

On the basis of 2016-17 data the maize growing districts can be divided into :

During 2016-17 food grains production in Bihar reached a record high, both in terms of total produce and per hectare yield. The state agriculture department said in its latest report that the total production of foodgrains in the state was 18.561 million tonnes in 2016-17, which is a record. Maize also played a great role to fill the food grain basket of the state. Maize is cultivated in all the 38 districts of the state in varying measures, the state's 'maize road' covers 11 districts, including Muzaffarpur, East Champaran, Vaishali, Katihar, Purnia, Samastipur, Begusarai, Khagaria, Bhagalpur, Araria and Madhepura," said agriculture scientist Anil Kumar Jha.The six districts on the maize road where the maize coverage was relatively higher in the 2015-16 season were Samastipur (63,594 hectares), Begusarai (56,499 hectares), Khagaria (55,238 hectares), Bhagalpur (44,898 hectares), Araria (52,600 hectares) and Madhepura(45,523 hectares). The coverage in the remaining five districts was Katihar (45,603 hectares), Purnia (39,498 hectares), Muzaffarpur (39,164 hectares), East Champaran (46,507 hectares) and Vaishali (31,860 hectares).Maize produced in Bihar is being exported to Indonesia, Malaysia and Vietnam (Anonymous 2017b). Besides, Bihar is the third largest producer of maize after Karnataka and Madhya Pradesh in India, and accounts for 11% of the country's total yield(Anonymous, 2017b). According to areport of APEDA

High productivity districts (productivity >6t/ha)	Katihar , Purnia, Darbhanga, Kishanganj, Araria and Khagaria
Medium productivity districts Productivity 3 to 6 t/ha)	Arwal, Saharsa, Supaul,Madhepura , Samastipur, Jahanabad,Siwan, Nalanda, Seohar, Saran, Sitamdhi, Madubani, Vaishali, Begusarai, West Champaran, Bhgalpur,Banka and Gaya.
Loow productivity districts (productivity <3 t/ha)	Nawada, Gopalganj, Jamui, East Champaran, Aurangabad, Buxer, Patna,Bhabhua, Mungesr, Bhojpur, Muzaffarpur, Sheikhpura, Rohtas and Lakhisara.

India has exported 7,05,513.8 MT of maize to the world for the worth of Rs. 1228.5 crores/ 190.3 USD Millions in 2017-18. **Major Export Destinations in 2017-18** were Nepal, Bangladesh, Philippines, Myanmar, and Sri Lanka

Opportunitiesand Future Challenge

Maize is the major crop in Bihar, it can be grown in all three seasons in the state. To increase the production and productivity of maize in the state, opportunities to be searched and strategies to be made to meet the challenges.

Area expansion and diversification

Maize is considered to be a better alternative to wheat or *Rabi* rice due to several reasons: (a) wheat encounters several biotic stresses, and most importantly, abiotic stresses due to terminal heat stress in the IGP, wheat is often vulnerable to temperature fluctuation resulting in shrivelled grains and poor yield, (b) evidences of declining yield of *Boro*rice in eastern Bihar Wast Bengal and Orissa, and (c) water scarcity and high cost of water input in rice . In particular, maize has fewer pest and disease

Table-2 : District and Season wise maize area, production and productivity in Bihar during 2016-17.

Sl.No.	Name of Districts	Autumun(Kharif) Maize			Rabi Maize			Summer Maize			Total Maize		
		Area (ha.)	Production (M.T.)	Yield (kg /ha.)	Area (ha.)	Production (M.T.)	Yield (kg/ha.)	Area (ha.)	Production (M.T.)	Yield (kg/ha.)	Area (ha.)	Production (M.T.)	Yield (kg/ha.)
1.	Patna	4575	6598	1442	399	1127	2825	1366	6182	4526	6340	13907	2194
2.	Nalanda	2304	4274	1855	1426	6280	4404	4323	26010	6017	8053	36564	4540
3.	Bhojpur	2082	2542	1221	126	511	4056	428	2105	4918	2636	5158	1957
4.	Buxar	1022	1639	1604	0	0	0	254	1369	5390	1276	3008	2357
5.	Rohtas	74	110	1486	1	4	4059	5	19	3800	80	133	1663
6.	Bhabhua	304	471	1549	0	0	0	42	255	6071	346	726	2098
7.	Gaya	3512	9750	2776	120	898	7482	756	3059	4046	4388	13707	3124
8.	Jahanabad	178	475	2669	53	397	7482	207	1209	5841	438	2081	4751
9.	Arwal	149	397	2664	237	1773	7482	130	763	5869	516	2933	5684
10.	Nawada	1110	2604	2346	0	0	0	395	1776	4496	1505	4380	2910
11.	Aurangabad	1175	2837	2414	0	0	0	0	0	0	1175	2837	2414
12.	Saran	14576	56112	3850	5277	23013	4361	5138	30290	5895	24991	109415	4378
13.	Siwan	11875	32740	2757	4964	45788	9224	1176	6566	5583	18015	85094	4724
14.	Gopalganj	5862	13406	2287	3923	9262	2361	1493	9076	6079	11278	31744	2815
15.	Muzaffarpur	12711	19958	1570	10216	19227	1882	8454	17433	2062	31381	56618	1804
16.	E.Champaran	38805	95066	2450	4588	16219	3535	3289	10994	3343	46682	122279	2619
17.	W.Champaran	994	2913	2931	2064	8289	4016	2316	7191	3105	5374	18393	3423
18.	Sitamarhi	1086	2824	2600	4016	18369	4574	278	633	2277	5380	21826	4057
19.	Sheohar	212	552	2604	1195	5778	4835	97	346	3567	1504	6676	4439
20.	Vaishali	15202	58262	3833	6548	37022	5654	10636	28193	2651	32386	123477	3813
21.	Darbhanga	1565	5457	3487	12255	93408	7622	540	3092	5726	14360	101957	7100
22.	Madhubani	21	65	3095	5	28	5560	60	247	4117	86	340	3953
23.	Samastipur	11952	35927	3006	31580	150321	4760	18343	114143	6223	61875	300391	4855
24.	Begusarai	30770	28743	934	22997	176663	7682	2676	5997	2241	56443	211403	3745
25.	Munger	771	1163	1508	386	1098	2844	1032	2034	1971	2189	4295	1962
26.	Sheikhpur	535	362	677	76	687	9035	66	141	2136	677	1190	1758
27.	Lakhisarai	4439	1863	420	0	0	0	0	0	0	4439	1863	420
28.	Jamui	3191	4605	1443	703	6352	9035	540	1034	1915	4434	11991	2704
29.	Khagaria	16273	7992	491	38080	377563	9915	9181	19078	2078	63534	404633	6369
30.	Bhagalpur	17182	29718	1730	18448	85636	4642	5066	23134	4567	40696	138488	3403
31.	Banka	6348	17240	2716	1312	4318	3291	2714	12330	4543	10374	33888	3267
32.	Saharsa	3109	12539	4033	11684	80304	6873	14883	72260	4855	29676	165103	5564
33.	Supaul	2844	14937	5252	5258	39635	7538	7158	29215	4081	15260	83787	5491
34.	Madhepura	3730	12307	3299	18027	135599	7522	19128	66558	3480	40885	214464	5246
35.	Purnia	8574	22416	2614	11879	118042	9937	16481	145082	8803	36934	285540	7731
36.	Kishanganj	359	1547	4309	1233	9386	7612	1913	12064	6306	3505	22997	6561
37.	Araria	0	0	0	21244	124384	5855	21002	149750	7130	42246	274134	6489
38.	Katihar	11979	113889	9507	44563	534132	11986	33011	280259	8490	89553	928280	10366
	Total	241450	624300	2586	284883	2131513	7482	194577	1089887	5601	720910	3845700	5335
									Source:- Directorate of Economics & Statistics				

*Included in others; #As per Fourth Advance estimates

problems than *Boro*rice and wheat. There is a vast opportunity for intensification of winter maize in flood prone areas as tocompensate for the loss during *Kharif* season with proper planning for seeds, inputs and improved management practices and crop diversification. The medium and uplands where subsistence yield ofwheat, *Rabi* rice and other winter crops is obtained, could be substituted by winter maize in Bihar, In general, any late maturing single cross-bred variety of *Kharif* season is equally good for winter season. Winter maize (170-180 days duration) has the clear cut comparative advantages of low incidence of diseases and insect pests, is not affected by temperature rise during winter (as the wheat is) and do not suffer on account of heavy rainfall. In districts where land is kept fallow in rabi like in Lakhisarai district rabi maize cultivation can be taken up.

Improved management practices for crop production

There is huge variability in the productivity of maize from district to district in the state. For example average productivity of Katihar district in 2016-17 was 10.36t/h whereas in Lakhisarai district it was 0.42 t/ha. There are many maize hybrids are available which have high yield potential and responsive to nutrients. There are several factors that affect the productivity of maize however, the fertilizer management is one of the most important factors that affect the growth and yield of maize. Maize is an exhaustive crop requires all types of macro and micro nutrients for better growth and yield potential. Among the various nutrients, nitrogen is the principal nutrients for better harvest require approximately 150 N20 kg ha-1. However, high yielding R-M systems can also accelerate the problem of secondary and micronutrient deficiencies, not only because larger amounts are removed, but also because the application of high rates of N, P, and K to achieve yield targets often stimulates thedeficiency of secondary and micronutrients. Proper nutrient management of exhaustive systems like R-M should aim to supply fertilisers adequate for the demand of the component crops, and apply those in ways that minimise loss and maximise the efficiency of use. Of all the nutrients, N, P, and K remain the major ones for increased and sustained productivity. Various improved agronomic and management practices like water, soil, nutrient, disease, insect/pest management practices can play a key role in increasing productivity of maize in the low productivity districts. Farmers need to be made aware through training programmes or Frontline demonstration to attract the maize cultivation in these districts. Many districts have scarcity of water during rabi and summer season Water is crucial input for augmenting agricultural production towards sustainability in agriculture. Scientific watermanagement aims to provide suitable soilmoisture environment to the crop to obtain optimum yield commensurate with maximum economy in irrigation water and maintenance of soil productivity. During the winter season less water is required at early stage of crop while, at later crop growth stages waterrequirement increases due to rapid increase in evapo-transpiration demand. Amongst the various irrigation scheduling approaches, climatological approach has been found to be better, since it integrates all the weather parameters giving them their natural weightage in a given climate-water-plant continuum.in these districts water management practices or drip/sprinkler irrigation methods needs to be promoted to take up the maize crop. To improve soils, conservation agriculture is emerging as a big boost for maize production. Conservation agriculture is based on minimal soil disturbance (reduced or no tillage), combined with organic matter retention and diverse crop rotations. As well as reducingerosion and improving soil structure and soilwater dynamics, this approach also saves on labour, time, fuel and machinery wear. A good example of the effectiveness of conservation agriculture is the rapid spread of 'Zero Tillage' technology in Andhra Pradesh's rice-maize system.

Mechanization- sowing to shelling

In every crop mechanization is essentially required to increase the productivity and decrease the cost of cultivation. Maize is crop in which mechanization can be followed since sowing to harvesting/shelling. Keeping in view the small landholdings of majority of farmers in the state small machinery affordable to these farmer, should be promoted. High cost machineries like maize harvester/combine dryer should be set up or made available on custom hiring basis. In majority of areas farmers still following plough furrow sowing of maize. Utilization of seed drill for sowing of maize in lesser in comparison to wheat. Now a days irrigation is becoming costly input to every crop. Due to spacing of rows maize is suitable for drip irrigation mechanization. Sprinkler irrigation method also be useful in this crop. Weed management and inter-culture operation like earthing up have important role in the maize cultivation. Tractor run ridger provides best solution for this mechanization. Manual harvesting of maize is another costly operation in maize. Although combine harvesters are commonly used in wheat crop. But due to non-availability of such mays combine harvesters farmers still following manual harvesting. Although few maize combine harvester are available in Purnia and Katihar districts.

Drying and Storage to meet global market quality

Generally maize is harvested at a moisture level ranging 20-30% in the grain. Farmers use sun drying to lower the grain moisture but in kharif harvest maize and some time in rabi harvest this moisture is difficult to bring down from 14%. This high

grain moisture of either fetch low price to the farmers and deteriorate the quality of grain during storage due to development of aflatoxins.Therefore, to meet the global marketing standards and quality of maize and also to fetch good returns from maize crop, mechanical dryers needs to be utilized at large levels in the state. The National Collateral Management Services Limited (NCML), a leading warehouse service provider, has inaugurated its public silo complex of 36,000 tonnes for storing maize at Purnia in Bihar

Breeding for Climate Resilient Maize Hybrids

Climate change is an important challenge that threatens the long-term production growth of cereals. Climate change also creates various abiotic stresses like drought, heavy rains/flooding, heat and cold stress. Changing climate has resulted in increase of abiotic stresses which limit the crop yields worldwide (Wani *et al.*, 2013).

(a) Cold stress tolerance for rabi maize

In Indo- Gangetic Plains region and specially in Koshi regions of Bihar that includes Katihar, Khagaria, Purnia, Araria, Kishanganj and Sharsha also the regions of Samastipur and Begusarai where the winter season maize crop invariably face severe low temperature during winter months. The average minimum temperature may fall below 5°C or even less.. Adaptation of maize to winter season requires genetic improvement for cold tolerance, which implies vigorous seedling growth without suffering with cold injuries under low temperature conditions. Maize hybrid needs to be tolerant to cool temperature at pre-flowering and flowering stage. The extreme cool temperature affects the maize growth in a number of ways right from emergence till flowering and seed-setting. Low temperature at planting greatly affects germination. Prolonged exposure to low temperature during the vegetative phase results in reduction in plant height, yellowing of the leaf, chlorosis and tip firing due to the death of leaf tissues. Prolong cold stress occurring at flowering stage severely affects flowering leads to reduced tassel size, lesser tassel branches, poor tassel development, lesser anther, death of pollen which ultimately results into poor or no grain setting in the maize ear. The similar situation was faced by the farmers of koshi region of the state during early sown rabi 2017-18 maize crop.Breeding programme should be emphasized on the development of such hybrids that have in built mechanism to tolerate the cold stress.

(b) Waterlogging stresstolerance for kharif maize

Waterlogging is another abiotic stress in bihar. Many district of Bihar including gangatic area of Patna, Begusarai, Khagaria, Bhagalpur and district of Koshi regions i.e. Katihar, Saharsa, Purnia, Khagaria, Madhepura, KishanganjAraria and Supoul are flood prone. Kharif crop may face waterlogging at knee high stage, pre-flowering or flowring stage. Lack of oxygen supply for the plant is the main reason of damage in waterlogging condition, which hampers nutrient and water uptake, as a reason the plant shows wilting. In oxygen-deprived condition plants shift its metabolism to anaerobic from aerobic mode. Plants which can withstand waterlogging condition have mechanisms such as increased availability of soluble sugar, aerenchyma formation, greater activity of glycolytic pathway and fermentation enzymes. Historically large gains have been made through conventional breeding. Large volume of information is available on the responses of excessive moisture/waterlogging stress on maize; however, the major challenge is to identify the stress-adaptive traits among the various effects/changes under the stress on different stress responsive traits. The genotypes with inbuilt capacity to produce brace roots and morphological adaptation like air space (aerenchyma) formation in cortical region of brace roots on exposure to the stress, can tolerate excess water situation in rhizosphere up to some extent (Zaidi*, et al*. 2010 & 2013). Teosinte the wild relave of maize have many superior features for waterlogging tolerance. Teosinte *Z. luxurians* and *Z. mays* ssp*huehuetenangensis* have been observed to exploit a higher capacity for adventitious root formation under extreme conditions of waterlogging than maize. *Z. luxuriance* was reported to develop well-formed aerenchyma in adult plants (Ray *et al*. 1999). Qiu *et al*., (2007) Identified, several moderate effect QTLs for seedling stage tolerance to waterlogging. QTL mapping revealed five QTL on chromosomes 1, 3, 5, 7, and 10, which explained 30% of phenotypic variance for GY under waterlogged conditions and 13 QTL's were identified for various secondary traits associated with waterlogging tolerance, New genomic selection technologies have become available that allow the breeding cycle to be greatly reduced and that facilitate the inclusion of information on genetic effects for multiple stresses in selection decision (Heffner *et al* 2009). Three marker-based selection approaches are being utilized (F2 enrichment, MARS, and GWS), that aim at increasing desirable QTL allele frequencies in a population improvement context, either by utilizing the QTL information or without it, are increasingly gaining prominence.

(c) Drought and heat stress tolerance for summer maize

Summer or spring maize is planted in many districts of Bihar. Low lying areas of koshi region including Khagaria, Saharsa Bhagalpur where flood water remain stagnant and dry up in December January, farmers cultivate summer maize. It is also

cultivated in Samastipur, Vaishali and Patna districts. Summer or spring maize crop face extreame drought during April and May. Therefore, requiring water efficient plant type or drought tolerant genotypes.As early as the 1970s, the International Maize and Wheat Improvement Centre (CIMMYT) began a breeding approach for drought-tolerant maize lines and spent more than 30 years developing several drought-tolerant varieties (Ashraf, 2010). The responses to drought and/or heat stresses in plants are complex physiological and biochemical processes and involve changes in anatomic structures. These characteristics are determined by sets of genes within the maize genome. Thus, it is necessary to identify stress- related genes/proteins. A range of stress response-related proteins, such as heat shock proteins (HSPs), phyto-hormone regulators, signalling proteins, and protective enzymes, etc. (Gong *et al*., 2014; Yin *et al*., 2014; Hu *et al*., 2015a,b) contribute to drought and heat stress tolerance in maize. Proteins HSP26 improves chloroplast performance under heat stress by interacting with specific chloroplast proteins in maize (Hu *et al*., 2015b).

Fall Army Worm (*Spodopterafrugiperda*)- a new insect threat to maize production

Fall Army Worm (FAW) was first detected in a field of maize in Karnataka in May, Bangalore's National Bureau of Agriculture Insect Resource (NBAIR) confirmed presence of fall armyworm in Tamil Nadu, Karnataka, West Bengal, Telangana, Andhra Pradesh and now, in Maharashtra. Fall armyworm is native to the Americas and was first reported to have reached Africa in 2016. Centre for Agriculture and Biosciences International (Cabi) estimated in September that improper management of the armyworm could cost 10 of Africa's major maize producing economies etween $2.2 billion and $5.5 billion per year in lost maize harvests. Though known primary attacking maize fields, the fall armyworm also eats an additional 186 plant species, including sorghum and soya beans. Already, Maharashtra has detected a suspected fall armyworm attack on sugarcane in the state. "Armyworm has spread to almost all countries in sub Saharan Africa. Eradication is not feasible, so management is now required on a continuing basis to limit losses. The same situation is likely to occur in Asia. The yield of my maize crop can decline by about 25%," said Ganesh Babar, the first farmers on whose farm fall armyworm was detected in Maharashtra. However, government agencies have reported losses up to 70% in some of the fields in Karnataka. If the pestilence spreads, it is difficult to eradicate. Fall armyworm can cause significant yield losses if not well managed. Fall armyworm is a dangerous transboundary pest with a high potential to continually spread due to its natural distribution capacity and trade. Farmers will need significant support to sustainably manage fall armyworm in their cropping systems through Integrated Pest Management," said the Food and Agricultural Organisation (FAO): The incidence of FAw has been reported in some maizefields in purnia districts of Bihar

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IMPROVING FARMERS' SOCIO-ECONOMIC STATUS THROUGH RECENT EXTENSION APPROACH

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In spite of sincere and committed efforts of extension functionaries, still a wide gap has been observed between the technology generated at the research station and its adoption by the farmers at his field. Information about improved farm technology is one of the most important resources for our farmers particularly small and marginal ones which constitute a large chunk of farming community. These poor farmers possess very small and fragmented land holding. How to increase the agricultural production and income of these farmers within limited land and resource constraints is a challenging task before the agricultural scientists today. Besides imparting timely technical guidance/ recent information on diversification of agriculture, the farmers need to be motivated to adopt other enterprises like floriculture, apiculture, sericulture, dairy, poultry, piggery, pisciculture, mushroom cultivation etc. as per their agro-climatic conditions so that they can generate additional income and improve their socio-economic status. In this era of globalization and liberalization, we as social scientists will have to focus our attention on Market led extension. But, why?

Agriculture strategy should be not only to achieve higher yields by reducing cost of cultivation but also increasing the farmers' income by diversifying farming and generating employment opportunities in agro-industries in the rural areas. Efforts should be strengthened to achieve higher productivity with sustainability of soil and crop. In order to survive the competition both in domestic and international market, our focus should be on :

High quality produce
Low cost of production
High productivity

An efficient marketing system is essential for the development of agricultural sector. The Marketing system contributes greatly to the commercialization of subsistence farming

Hence, farmers should be motivated to grow only those crops which may bring maximum profit to them. Scientific agriculture is considered as a professional industry / enterprise. Emphasis should be given on location specific climate-based extension services to the farmers through training programmes, demonstrations etc. and motivating them to adopt improved technologies for higher yields and other high-tech ventures. For this purpose, the farmers need to know the answers to questions like; 'What to produce? When to produce? How much to produce? When and where to sell? At what price and in what form to sell their produce? In responding to such questions, the extensions system should be oriented with knowledge and skills related to the market with the objective to improve the quality of agricultural produce to compete in the market particularly in the global market. For this purpose, the following paradigm shift is needed from the Conventional Production-led Extension to Market-led Extension.

Paradigm Shift from Production-Led Extension to Market-Led-Extension

Aspects	Production-Led Extension	Market-Led-Extension
Purpose/Objective	Transfer of production/cultivation technology	Enabling farmers to get optimum returns out of the enterprise
Technology	Fixed package recommended for an agro-climatic zone covering very large area irrespective of different farming situations	Diverse baskets of Package of Practices suitable to local situations/farming systems, i.e., location specific technology.
Focus	Production/yields ("Seed to Seed")	Whole process as an enterprise, High returns ('Money to Money').
Farmer seen as	Progressive farmer (high producer)	Farmer as an Agricultural Entrepreneur
Expected end results	Delivery of messages, Adoption of package of practices by most of the farmers.	High returns
Extension Functionaries' interactions	Messages, training, motivating recommendations etc.	Joint analysis of issues, Varied choices of adoption, consultations etc.

Linkages/Liaison	Research-Extension-Farmer	Research-Extension-Farmer extended by Market linkages
Extension Functionaries' Role	Limited to delivery mode and feed back to research system	Enriched with market intelligence besides the TOT function, establishing marketing and agro-processing linkages between Farmer groups, Markets and Processors.
Contact with farmers	Individual	Farmers' Interest Groups (FIGs), Focused Groups (FGs)/Self–Help Groups (SHGs).
Maintenance of records	Not much importance as focus was on production	Very Important as agriculture is viewed as an enterprise to understand the cost benefit ratio; and the profits generated.
IT Support	Emphasis on production technologies.	Market intelligence including likely price trends, demands, current prices, market practices, communication network etc. besides production technologies.

In order to reach the farming community particularly the unreached, an extension worker should follow the following modern extension methods conceptual model for transfer of technology to the farming community under market-led extension (Sharma and Chand, 2015) which has been discussed as under :

The model comprises of three main components *viz*.; INPUT, PROCESS and OUTPUT. The 'Input component' includes technological package to be delivered by the extension functionaries in the form of 'What to produce', 'When to produce', 'How much to produce', 'When to harvest', 'When and Where to sell', 'At what price', 'In what form and Size to sell the product in the market'. This need to be supported with the assured supply of critical inputs (like improved variety seeds, plants, fertilizers, pesticides, agricultural implements etc.) and regular and timely supply of marketing information (market intelligence). This is the task of State Agricultural University (SAUs), Research Institutes / Stations of ICAR and SAUs, State Line Departments, KVKs, ATMA etc.

The 'Process component' consists of three aspects, namely, Government Policies, Organizational support and 'Extension Education Support for Input component'. So far as 'Government Policies' are concerned, these should be supportive and well-defined (Market Intervention Scheme, Support Price etc.) for agriculture, horticulture and forest produce with specific provision for organically produced products including simple and easy procedure for certification of organic produce. Simultaneously, the government has to ensure timely and easy availability of credit / loan to the farmers at low rate of interest so that the farmers may be encouraged to adopt the improved farm practices.

The 'Organizational Support' in the form of Market Intelligence Cell/Centre preferably at the Block level, transport facilities particularly in remote and far-flung areas and requisite manpower will be urgently needed. The linkages among the line departments, NGOs, SHGs, Village/Rural Institutions etc. need to be strengthened. Infrastructure facilities like cold storage and cool chain for farmers at subsidized rates for agri-horti produce at Block level (to avoid distress sale during the season), training and publicity etc. are required. Establishing Krishi Vigyan Kendra at Block level to test, refine and demonstrate the newly generated technologies by the research institutes, in order to reduce the gap between technology generation and its widespread adoption, may further act as catalyst in the task of technology transfer. These two aspects need to be properly examined by the policy makers and administrators of the state as well as the central governments.

The third aspect that is the 'Extension Education Support' for input component emphasizes the role of extension personnel who are required to establish proper linkages with farmers, markets and private processors. They are also required to organize FIGs / CIGs, building their capacities through training programmes, educational tours etc. and to improve the communication and instructional skills of the farmers enabling them to negotiate well with the traders / middlemen at the time of selling of their produce besides possessing of appropriate knowledge of SWOT analysis. Creation of farmer friendly websites for marketing information and setting up of KIOSKs with internet facility at Panchayat level may further add feathers in the task of TOT. Developing video films / modules on the success stories of progressive farmers (who are earning better through the use of market led extension information), may further be quite helpful in motivating the other fellow farmers.

The extension education support can further be facilitated by modern extension methods like Cyber Extension, E-mail (Electronic mail), Internet, Expert System, Internet Browsing for extension information, Video Conferencing, Agri-Clinics, SATCOM Networks, Community Radio, Kisan Call Centre (KCC) etc.

The 'Output component', as mentioned in the above model, will be measured in context with the farmers' satisfaction in terms of increased market-oriented planned production, improved quality produce and increased returns and socio-economic status etc. This feedback from the farmers will be taken by the field level extension functionaries responsible for providing technological input along with extension education support to the farmers. This feedback, in turn, will be further transmitted to the policy makers, administrators, research institutes and other agencies involved in the task of TOT in order to modify the future programmes and policies accordingly. This may certainly facilitate the extension system for the transfer of technology particularly to the marginal and unreached farming community.

A conceptual Model for TOT under Market-Led Extension (Sharma & Chand, 2015)

<table>
<tr><th rowspan="2">Input</th><th colspan="3">Process</th><th rowspan="2">Output/ Outcome</th></tr>
<tr><th>Government Policies</th><th>Organizational Support</th><th>Extension Education Support for Input Component</th></tr>
<tr><td>Technological package in the form of :
What to produce
When to produce
How to produce
When to harvest
When & where to sell
At what price & in what form to sell

Assured supply of critical inputs like improved variety seeds/ plants, fertilizers, agricultural implements/ tools etc.

Regular & timely supply of Marketing Information (marketing ntelligence).</td><td>Timely and easy availability of credit / loan to the farmers at low rate of interest.

Supportive & well defined policy for agricultural / horticultural / forest produce with specific provision for organically produced products including simple and easy procedure for certification of organic produce.</td><td>Market intelligence wing / centre preferably at Block Level.

Transport facilities particularly for remote and far-flung areas.
Requisite manpower.
Strengthening linkages among line Departments, NGOs, SHGs, Village/Rural Institutions etc.
Infrastructure facilities like Cold Storage and Cool Chain for farmers at subsidized rates for agri-horti produce to avoid distress sale during season, training, publicity etc. at Block Level.

Establishing KVKs at the Block Level to test, refine and demonstrate the newly generated technologies by the research institutes in order to reduce the gap between technology generation and its widespread adoption.</td><td>SWOT analysis
Organizing FIGs/CIGs

Establishing linkages with farmers' groups, market and private processors.

Improving communication and interactive skills of farmers.

Capacity Building of FIGs/CIGs through Extension Teaching methods.

Organizing study tours.

Creation of websites for :
- Marketing information
- Successful / progressive farmers who are earning better through the use of Market-Led Extension information.
Creation of Farmer- Friendly Kiosks at Panchayat level for farm & market related information.</td><td>Farmers' satisfaction in terms of :
Increased market- oriented planned production
Improved quality produce
Increased returns and socio-economic status etc.</td></tr>
<tr><td>SAUs, Research Institutes / Stations of ICAR & SAUs, State Line Departments, ATMA , KVKs etc.</td><td colspan="2">Policy Makers of the State as well as Central Governments</td><td>SAUs, Research Institutes / Stations of ICAR & SAUs, State Line Departments, ATMA , KVKs etc.</td><td>Feedback</td></tr>
</table>

ROLE OF AGRONOMIC PRACTICES TO MINIMIZE ANTI-NUTRITIONAL COMPONENTS IN FORAGE CROPS

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Forages are fed to the animals as such green or as hay and silage to provide protein, carbohydrate, fat, vitamins and minerals. The presence of toxic or anti-quality components in some of the forages crops may effect their nutritional value. The anti-nutritional or anti-quality components present in forage crops as listed below :

Nitrate–Nitrite
Oxalates
Cyanogenic Gylcosides (HCN)
Alkaloids
Saponins
Bloat Producing Constituents
Tannins
Coumarins
Mimosine
Selenium

The most common anti-nutritional or anti-quality components present in forages are as discussed below :

Nitrate–Nitrite

The forages like oats, maize, barley, turnip and sugar beets accumulate nitrates. Some weeds like *Trianthema* and *Amaranthus* accumulate nitrate-nitrogen above the toxic level. The stem, leaves and floral parts contain nitrate in decreasing order and the grains are less toxic than the straw. The nitrate content varies with place (in cool places nitrate accumulate more) and the stage of maturity of the plant. The nitrogen from the soil is taken up by the plant and is converted into ammonia and then into protein. The accumulation of nitrate occurs when there is an excessive supply of nitrogenous fertilizers, organic manure and shortage of water or extensive use of herbicide 2, 4-D. Nitrate as such is not toxic to animals but nitrite formed from it is toxic. Nitrate converts hemoglobin into met-hemoglobin and thus adversely affects the ability of blood to transport oxygen. It also affects supply of vitamin A, growth, milk production and reproduction. The symptoms of this toxicity are: discoloration of (vaginal) mucous membrane, labored breathing (dyspnaea), grinding of teeth, excessive salivation, uneasiness and high pulse rate (84-134 per min)

The administration of suitable reducing agents such as methylene blue, or ascorbic acid may be helpful in the conversation of met hemoglobin to hemoglobin. Four percent solution of methylene blue given intravenously can be used to treat nitrate poisoning in cattle and sheep.

Oxalates

Few plant species have soluble oxalates more than 10 percent. Such plants may be toxic and include fodder crops like guinea grass, bajra, Napier grass, setaria and some weeds like *Chenopodium, Trianthema, Amaranthus* etc. Although fodder grown in Punjab do not contain lethal levels of oxalates but the continued intake of these fodders may produce ill effects. The young plants which are more palatable have high oxalates. Nitrogenous and potassium fertilizers increase the oxalate content. Consumption of oxalates at less than 0.1 percent level of body weight is harmless but is toxic in starved animals. Forages containing more than 10 percent oxalate are harmful to animals. In monogastric animals, soluble oxalates are absorbed most rapidly as such and create renal disorders. The absorbed oxalate lowers serum ionic-calcium causing secondary nutritional hyperparathyroidism. Large concentrations of soluble oxalates in the blood can cause 'Kidney Stone'. Oxalates also interfere in carbohydrate metabolism perhaps due to non-availability of required calcium. The oxalate poisoning in sheep and cattle are characterized by rapid and labored breathing, nasal discharge, frothing at mouth, depression, weakness, coma and death Oxalate poisoning in ruminants may be prevented by supplementing calcium as di-calcium phosphate and calcium carbonate into the diet.

Cyanogenic Gylcosides (HCN)

This is present in sorghum, sudan grass, *baru* weed. The growth of the plant and the extensive use of nitrogenous fertilizers or herbicides such as 2, 4-D increases the toxicity of the plant. Glycoside concentration is highest in young plants especially under drought condition and feeding such plants produces toxic effects by releasing prussic acid (HCN). In ruminants, production of prussic acid occurs more rapidly than in monogastric animals, because the acidic conditions in the rumen and presence of microbial enzymes enhance release of HCN. The amount of cyanogenic consumed by animal, the rate of release of HCN and its absorption determines its toxicity. The intake of such tender plants and those grown under drought condition and the stress due to fasting and hard work, pre-disposes the animals to poisoning. Absorbed hydro-cyanic acid combines with hemoglobin of the blood to from cyano-hemoglobin which is unable to transport oxygen and thus produces deficiency of oxygen in tissues. This is characterized by bluish color of blood as compared to dark chocolate color in case of nitrate toxicity. The animals show excitement, profuse salivation, jerky movement of eyeball, respiratory distress and death occurs in 15 to 60 minutes after the onset of symptoms. In some cases, death may occur without showing toxicity symptoms. The detoxification of hydro-cyanic acid also take place in rumen. The minimum toxic level for hydro cyanic acid is about 0.02 percent (200 ppm) and many young forage plants in India have more than this value. It is advisable that immature, wilted and stunted plants should not be fed to animals.

In cattle a solution of 3 g of sodium nitrate and 15 g sodium thiosulphate in 20 ml water is slowly injected intravenously to prevent poisoning. In sheep, effective treatment includes slow intravenous administration of 1 g of sodium nitrate and 2 g of sodium thiosuphate in 15 ml water.

Alkaloids

About 100 spices have been found to contain (pyrrolizidine) alkaloids but is most common in pearl millet. The rumen presents as effective barrier to many unwanted chemicals and breaks down about 90% of the (pyrrolizidine) alkaloids eaten by sheep. However, the plants containing common alkaloids are harmful to animals.

The alkaloids toxicity produces chronic diseases of liver, lung, kidney and brain. A common sign of liver damage is jaundice and the carcass of dead animals shows bright yellow color on post mortem and the ammonia toxicity. Residues of these alkaloids may be present in meat, milk. The toxicity symptoms of alkaloids include gangrene of hooves, ears, tail; some time abortion, sudden collapse and death may occur. Symptoms start from ears as blood circulation in tail, hooves and ear decreases.

Agronomic practices to minimize anti-quality components

Agronomy plays an important role in minimizing the anti-nutritional components in fodder crops. The important agronomic practices which play major role in reducing the anti-nutritional components are :

Sowing time
Use of recommended dose of nitrogen
Application of phosphorus and sulphur
Irrigation
Cutting height from ground level
Stage of harvest

AGROFORESTRY FOR SOIL HELTH, CARBON SEQUESTRATION, MICRO-CLIMATE AMELIORATION AND LIVELIHOOD SECURITY

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Abstract

Agroforestry is sustainable land use system or scientific farming practice under which food crops (annuals) with tree crops (perennials) and/or livestock are maintain simultaneously on the same piece of land to increase the total yield and this management practices are economically and ecologically sustainable. It is just a compromise between these two resources of forest trees and agricultural crops to maintain the need of forest cover upto 33% as per given national forest policy. Agroforestry has the potential to alter the microclimate under the tree canopy. It plays a major role in enhancement of overall farm productivity, soil fertility through addition of litter and organic matter, climate change mitigation through carbon sequestration, phyto-remediation, watershed protection and biodiversity conservation. Upto some extent bio-drainage plantation might have improve the soil aeration, sulphide toxicity and nutrient use efficiency. Moreover, it reduces the water logging condition and maintains the soil aeration property. Under the agroforestry system multipurpose and N2-fixing trees are played a valuable and significant role for upliftment of productivity and combating the soil health problem. Generally, farmers are used N2-fixing trees like some leguminosae family comprises Acacia spp., Dalbergia sissoo etc. on their farmland for enhancement productivity with better soil health, eco-friendly, generating incomes through employment and ensured livelihood security.

Key words : Agroforesty, soil health, carbon-sequestration, farming system, socio-ecomic development.

BACKGROUND

Agroforestry may be defined as an integrated and efficient land use management system by raising of certain agricultural crops, forest tree species and or animals simultaneously or sequentially on the same unit of land with appropriate management practices which result in overall increase in the production under a particular set of climatic and edaphic conditions and socio-economic status of local people. It involves interaction of woody perennial ecologically and economically with the crop and or livestock. According to Dhyani et al. (2013) in India the current area under agroforestry is estimated at 25.32 Mha, or 8.2% of total geographical area of the country. This includes 20.0 Mha in cultivated lands (7.0 Mha in irrigated and 13.0 Mha in rainfed areas) and 5.32 Mha in other areas such as shifting cultivation (2.28 Mha), home gardens and rehabilitation of problem soils (2.93 Mha). Conventionally, farmers allow growing Acacia nilotica naturally at irregular spacing on the bunds of paddy fields or in combination with Butea monosperma and Terminalia arjuna etc. Acacia nilotica, being a multipurpose and nitrogen fixer species, is highly preferred by farmers and as a result, it is widely distributed in the field. Similarly, Jhariya et al. (2013) has concluded a large scale plantation of neem trees helps to combat desertification, deforestation, soil erosion and to reduce excessive global temperature. Tree species viz. Dalbergia sissoo, Azadirachta indica, Acacia nilotica, Grewia optiva, Morus alba, Ficus spp. etc are grown on the borders of fields for meeting demand of timber, fodder, fuel etc is common practices throughout the country. Management practices are played a major role in maintaining the identity and sustainability of agroforestry system. Management practices for agroforestry are more complex because multiple species has varied phonological, physiological and agronomic requirements. Agroforestry provides great opportunities to link water conservation with soil conservation; hence, the major focus has to be on this aspect. It is also noted that stainable agroforestry can upsurge resilience against environmental change, to enhance carbon sequestration and also to generate income, which will result in improved livelihood of small and subsistence farmers (Buchman, 2008). Moreover, the role and scope of agroforestry are also studied in way of biodiversity conservation, yield of goods and services to society, augmentation of the carbon storages in agro-ecosystems, enhancing the fertility of the soil and providing social and economic well-being to people (Pandey, 2007). Therefore, agroforestry if properly developed, have the potential to improve socio-economically more sustainable and make the landscape more better (Kittur and Bargali, 2013).

FUTURE SCOPE AND POTENTIAL

The scope and potential of agroforestry is envitable. Tree species are adopted in a large hectare of boundaries, bunds, wastelands area and permits in the field where most annual crops are growing well. As per Fanish and Priya (2013)

agroforestry has many potential, such as enhance the overall (biomass) productivity, soil fertility improvement, soil conservation, nutrient cycling, micro-climate improvement, carbon sequestration, bio drainage, bio-energy and bio-fuel etc. Moreover, the important elements of agroforestry systems that can play a significant role in the adaptation to climate change include changes in the microclimate, protection through provision of permanent cover, opportunities for diversification of the agricultural systems, improving efficiency of use of soil, water and climatic resources, contribution to soil fertility improvement, reducing carbon emissions and increasing sequestration, and promoting gender equity (Rao *et al.,* 2007).

POSITIVE AND NEGATIVE INTERACTION

In the agroforestry system the interaction between tree and crop are studied in positive, negative and neutral way. This interaction are depends upon the type of model including varying species, their nature and composition. Further, interaction is defined as the effect of one component of a system on the performance of another component and/or the overall system. Various interactions take place between the tree and herbaceous plants (crops and pasture), which are referred to as the tree-crop interface. Studying tree-crop interaction in agroforestry would help to devise appropriate ways to increase overall productivity of land. Increased productivity, improved soil fertility, nutrient cycling, soil conservation are the major positive effects of interactions and competition is the main negative effect of interaction, which substantially reduces the crop yield. It may be for space, light, nutrients and moisture. ecological sustainability and success of any agroforestry system depends on the inter-play and complementarily between negative & positive interactions. It can yield positive results only if positive interactions outweigh the negative interactions (Singh *et al.,* 2013).

AGROFORESTRY FOR SOIL HEALTH

The soil characterstics under agroforestry practices is depend on tree species and their intercropping pattern, management practices, arrangement direction and the quantity and quality of litter and their decay rate. Trees are simultaneously planted in rows sparsely in crop field and/or along the alies (bunds). These trees provide food, timber, fuel, fodder, construction materials, raw materials for forest-based small-scale enterprises and other cottage industries and in some cases, enrich soil with essential nutrients (Ghosh et al., 2011). Agroforestry fallows with Sesbania sesban, decreased soil bulk density and improved water infiltration explain better early growth of the subsequent crop. Tree roots can reach 7 m deep in 2 years and represent 1.7 to 2.9 Mg ha-1 after 2 years, i.e. about 0.6 to 1 Mg C ha-1. Plantation of tree and crops are a boost to increase or sequester the carbon content of the soil which helps to beat the problem of climate change and global warming. As per Kumar et al. (2006) increase in soil carbon through plantations may also act as an important carbon sink. Bio-drainage tree including eucalyptus played a major role to combating the water logging condition. Chowdhury et al. (2011) has reported that bio-drainage plantation might have improved the soil aeration, nutrient use efficiency and reduce sulphide toxicity. Agroforestry models are also helps in reclamation of salt affected soil. As per Ram et al., (2011) lowering of water table and associated soil improvement by Eucalyptus plantations increased the wheat grain yield by 3.4 times and resulted in reclamation of waterlogged areas. Generally, agroforestry practices increases the soil organic matter through leaf litter addition. It maintains the population dynamics of beneficial microorganism and improves biological nitrogen fixation in soil. All microbiological activity in soil contributes to cycling of nutrient and other ecosystem functions and all soil functions contributes to ecosystem services. Recycling in natural system is one of the many ecosystem services that sustain and contribute to the well being of human society (Jhariya and Raj, 2014).

AGROFORESTRY FOR CO_2 MITIGATION

Climate change is a burning issue of the world. Rise in CO2 level accelerate the global warming which necessitated the sink and sequestration of carbon. These problems are mitigated through plantation of valuable tree and crop either singly or simultaneously on same piece of land through agroforestry system. As per Nair *et al.* (2009) under the agroforestry system carbon sequestration has potential to mitigate the green house gases because of greater efficiency of resource (nutrients light and water) capture and utilization. Moreover, reforestation and agro-forestry systems offer perhaps the greatest potential to remove large quantities of carbon from the atmosphere. However, as per Sudha et al. (2007) agroforestry is an attractive option for climate change mitigation as it sequesters carbon in vegetation and soil, produces wood, serving as substitute for similar products that are unsustainably harvested from natural forests, and also contributes to farmers' income. Kursten (2000) also stated that agroforestry can, arguably, increase the amount of C stored in lands devoted to agriculture, while still allowing for the growing of food crops. According Rawat (2010) the total C content of forests has been estimated at 638 Gt for

2005, which is more that the amount of carbon in the entire atmosphere. In India total carbon storage (tC/ha) of different agroforestry systems including Silvi-pastoral system (age 5 years), Silvipastoral system (age 6 years), Block plantation (age 6 years), Agri- silvicultural system (age 8 years) and Agri-silvicultural system (age 11 years) are varies from 9.5-19.7, 1.5-18.5, 24.1-31.1, 4.7-13.0 and 26.0 respectively in different region of semi-arid (Rai et al., 2001), north western India (Kaur et al., 2002), central-India Swamy et al., 2003), arid (Singh, 2005) and semi-arid region (NRCAF, 2005). As per Yadava (2010) C sequestration ranged from 4.66 to 18.53 t C ha^{-1} in different agroforestry systems in Tarai region of Central Himalaya. Maximum value was recorded in systems S1 (Populus deltoides 'G-48' + wheat) as 18.53 t C ha^{-1}, which was followed, by systems S4 (P. deltoides + Lemon grass). Minimum C sequestration was recorded in System S3 (P. deltoids + wheat boundary plantation). Further, studied soil organic carbon and sequestration potential of agroforestry Systems in Himachal Pradesh and found average carbon stocks (t ha-1) in the decreasing order as Silvipasture (31.71), Natural grassland (19.2), Agrihorti silviculture (18.81), Horti-pastoral (17.16), Agri-silviculture (13.37) and Agri-horticulture (12.28). Thus the importance of agroforestry are not only studied in the way of sustainable productivity but also in issue related the carbon mitigation in global view.

Table 1: Total C storage under agro forestry systems in different regions of the country

Region	Agro forestry system and components	Total C storage (t C ha^{-1})	Reference
Semi–arid region	Silvipastoral system (age 5 yrs) *Acacia nilotica* + natural pasture *A. nilotica* + established pasture *Dalbergia sissoo* +natural pasture *D. sissoo* + established pasture *Harwickia binata* + natural pasture *H. binata* + established pasture	 9.5-17.0 19.7 12.4 17.2 16.2 17.0	Rao *et.al,* 2001
North – western	Silvipastoral system (age 6 yrs) Acacia/Dalbergia/Prosopis + Desmostacya	6.8 – 18.55	Kaur *et.al,* 2002
India	Acacia/Dalbergia/Prosopis + Sporobolus	1.5-12.32	
Central	Block plantations (age 6 yrs)	24.12 – 31.12	Swamy *et.al,* 2003
India	Gmelina arborea		

Table 2: Potential for C sequestration in tropical countries in Gt C by 2050

Production system	Texler and Haugen (1994)	Brown *et.al.* (1996)
Plantations	2.0 - 5.0	16.4
Agro forestry	0.7 – 1.6	6.3
Forest re- growth	9.0 – 23.0	11.5 – 28.7

AGROFORESTRY FOR MICRO-CLIMATE AMELIORATION

Trees on farm bring about favourable changes in the microclimatic conditions by influencing radiation flux, air temperature, wind speed, saturation deficit of understory crops all of which will have a significant impact on modifying the rate and duration of photosynthesis and subsequent plant growth, transpiration, and soil water use. Shade tree performs a good role to moderating the temperature, humidity, evapotranspiration of that locality on which either tree are scattered or on bund of agricultural crops under the agroforestry system. As per Beer *et al*.(1998) shade management in coffee and cacao plantations have buffer high and low temperature extremes by as much as 50C. The removal of shade trees increased soil surface temperature by about 4°C and reduced relative air humidity at 2 m above ground by about 12%. Soil temperature under the baobab and *Acacia tortilis* trees in the semi-arid regions of Kenya at 5-10 cm depth were found to be 60C lower than those recorded in open areas. In the Sahel,

where soil temperatures often go beyond 500C to 600C, a major constraint to establish a good crop, Faidherbia trees lowered soil temperature at 2-cm depth by 50C to 100C depending on the movement of shade. As per Mukherjee et al. (2008) tea under plantation of alley of seven shade tree species including *Acacia auriculiformis, Casuarina equisetifolia, Dalbergia sissoo, Gliricidia sepium, Albizia lebbeck, Gmelina arborea* and *Eucalyptus* hybrid and reported that both atmospheric temperature and Soil temperature were lowered by 2-3°C compared to a non-shaded open condition, whereas relative humidity values increased by 3-9% within the shade. The shade provided by Acacia auriculiformis and *D. sissoo* seemed to be beneficial for tea yield. Shelterbelt and windbreak are also perform protecting function in term of beneficial aspects of microclimate change are extensively used. Based on the response of crops to shade, Brenner (1996) has classified leafy horticultural crops (e.g., alfalfa, cliver) as the most responsive crops and cereals as moderately responsive (e.g., barley and millet) or less responsive (e.g., maize, and wheat). The net shade effect was reported to be more positive when the annual crop is a C_3 plant which is normally light saturated in the open.

AROFORESTRY FOR LIVELIHOOD SECURITY

Agro-forestry as a land use system that integrates trees, crops and animals in a way that is scientifically sound, ecologically desirable, practically feasible and socially acceptable to the farmers. It can improve the livelihoods of smallholder farmers as by providing fruit and nuts, fuel wood, timber, medicine, fodder for livestock, green fertilizers, additional/diversified income (WAC, 2010). Agroforestry models for different site conditions have to be developed and demonstrated under different agro-ecological regions in the country. In Chhattisgarh state, Agri-horticulture model comprises combination of horticulture tree (Aonla) and field crops (groundnut and gram) and their different parameter of economic analysis (input/output) including total expense (tree+crops) per ha (86,494 Rs.), total benefits per ha (93,903 Rs.), net Benefit per ha. (7,410 Rs.), B: C ratio (1.09). Similarly, Agri-silviculture system comprises combination of tree species (Gmelina arborea) and field crop (paddy and linseed) and their economic parameters are total expense (tree+crops) per ha (69139 Rs.), total benefits per ha (119,997 Rs.), net benefit per ha. (50,858 Rs.), B: C ratio (1.74). These economic analysis are sufficient to measure socio-economic potential of different agroforestry models and gives idea about whether this model be accepted or not (Raj *et al* 2014).

CONCLUSION

Agroforestry is not a something new. It is a relatively new name for a set of old farming practices. Agricultural crops (herbaceous plants), woody perennials (tree crops/ forest plants) and animals are the component of Agroforestry. Under the agroforestry model, a suitable combination of nitrogen fixing and multipurpose trees with field crops are played a major role in enhancement of better yield productivity, soil nutrient status and microbial population dynamics which plays a major role in nutrient cycling to maintain ecosystem. In developing countries forests and agroforestry provide substantial benefits to rural dwellers, national economies, and the environment. Therefore, Agroforestry system gives diversification, creates green cover for carbon sequestration and increases the nutrient uptake and their utilization management practices that lead to improved organic matter status of the soil will lead inevitably to improved nutrient cycling and better soil productivity.

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BIOSORPTION OF HEAVY METALS THROUGH FUNGI

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Great strides have been made towards industrial development and civilization, which has without doubt improved the living conditions and comforts of human life but, in the process, has inadvertently upset the crucial environmental balance established by nature over a millennium. Environmental pollution and human efforts for the betterment of living standards are the two sides of same coin. In the wake of industrialization, consequent urbanization and ever-increasing population, the basic amenities of life, *viz.* air, water and land, are being polluted continuously. Pollution of water resources is a common occurrence and is a major problem in the global context (Dhankhar and Hooda, 2011).

In general, water contaminants come under two broad classes, *viz.* organic and inorganic. Organic water pollutants include industrial solvents, volatile organic compounds, insecticides, pesticides and food processing wastes, etc. Inorganic water pollutants include metals, fertilizers and acidity caused by industrial discharges, etc. There are various anthropogenic point sources of metal releases into the environment, among these the following four appear as the main priority targets, particularly in the industrialized world: (i) Acid mine drainage (AMD) – associated with mining operations; (ii) Electroplating industry waste solutions (growth industry); (iii) Coal-based power generation (throughput of enormous quantities of coal); (iv) Nuclear power generation (uranium mining/processing and special waste generation).

The presence of metal ions in final industrial effluents is extremely undesirable, as they are toxic to both lower and higher organisms. Under certain environmental conditions, metals may accumulate to toxic levels and cause ecological damage (Jefferies and Firestone, 1984). As the metals are nonbiodegradable, their threat is multiplied by their accumulation in the environment through food chain. Eventually, extremely poisonous levels of toxins can migrate to the immediate environment of the public. Metals that seep into groundwaters will contaminate drinking water and harm the consumers of that water, specifically human beings, who face disastrous health effects because of heavy metal contamination.

Some heavy metals such as, mercury, lead, cadmium and chromium (VI) are regarded as toxic, whereas others, such as copper, nickel, cobalt and zinc, are not as toxic, but their extensive usage and increasing levels in the environment are of serious concern (Brown and Absanullah, 1971; Volesky, 1990). Because of the increasing application and immutable nature of heavy metals, the resultant pollution has naturally become one of the most serious environmental problems today. Therefore, the need for a complete understanding of the noxious effects caused by release of toxic metals into the environment and the emergence of more severe environmental protection laws have encouraged studies about removal/recovery of heavy metals from aqueous solution using certain eco-friendly, economic and low-tech treatment methods.

Various techniques have been employed for the treatment of industrial effluents containing heavy metals, which usually come under two broad divisions: abiotic and biotic methods. Abiotic methods include physicochemical methods such as chemical precipitation, ion exchange, evaporation recovery, membrane technologies, electrochemical technologies, solvent extraction and adsorption on activated carbon, but it can be concluded that these conventional methods have significant disadvantages, which include incomplete metal removal, high capital costs, high reagents and/or energy requirements and generation of toxic sludge or other waste products that require disposal (Cho and Kim, 2003; Goksungur *et al*., 2005). These disadvantages, together with the need for more economical and effective methods for the recovery of metals from wastewaters, have resulted in the development of alternative separation technologies. Biotic methods include living organisms and products derived from them.

In recent years, research attention has focused on biological methods, which have emerged as an effective alternative to conventional abiotic methods of metal sequestration. In biotic methods, biomass derived from various biological sources is utilized, and its property and potential of interaction with targeted pollutants have been harnessed for biotreatment. Fundamental to these biotreatment processes are the activities of living organisms, upon which transformation and detoxification of heavy metal pollutants depend. The biotreatment processes can be classified into two principal categories : the metabolically active (biomineralization, biotransformation, bioprecipitaion and bioaccumulation) and metabolically passive (biosorptive) processes. Of the different biological methods, bioaccumulation and biosorption have been demonstrated to possess good potential to replace conventional methods for the removal of metals (Volesky and Holan, 1995).

BIOSORPTION

Biosorption can be defined as the passive uptake of toxicants by dead/inactive biological materials or by materials derived from biological sources. The biological material whose adsorption potential is harnessed is termed the biosorbent. The biosorption process involves a solid phase (biosorbent) and a liquid phase (solvent: normally water) containing dissolved species to be sorbed (sorbate: metal ions). Because of the high affinity of the sorbent for the sorbate species, the latter is attracted and bound there by different mechanisms. The process continues until equilibrium is established between the amount of solid-bound sorbate and the sorbate still remaining in the solution (Dhankhar and Hooda, 2011).

The mechanisms of biosorption are generally based on physicochemical interactions between the metal ions and the functional groups present on the cell surface, such as electrostatic interactions, ion exchange and metal ion chelation or complexation (Ozer *et al*., 2004). The biosorbent behaviour of biomaterials towards metallic ions is a function of the chemical make-up of the cell wall. Functional groups most commonly implicated in such interactions include carboxylate, hydroxyl, amine and phosphoryl groups present within the cell-wall components, such as polysaccharides, lipids and proteins (Dziwulska *et al*., 2004).

MICROBIAL BIOSORBENTS

With respect to metal biosorption, microbial biomass (bacteria, fungi, algae, etc.) outperformed macroscopic materials (plant products). The reason for this discrepancy is due to the nature of the cell-wall constituents and the functional groups involved in metal binding. A large number of microorganisms belonging to various groups, viz. bacteria, fungi, yeasts, cyanobacteria and algae, have been reported to bind a variety of heavy metals to different extents (Stratton, 1987; Tsezos, 2001; Garvilesca, 2004).

Bacteria possess metal-binding properties owing to anionic functional groups present in their cell wall, which is because of peptidoglycan, teichoic acids and teichuronic acids in Grampositive bacteria and peptidoglycan, phospholipids and lipopolysaccharides in Gram-negative bacteria (Sherbert, 1978). The wide range of algal biosorbents includes microalgae and macroalgae from marine and fresh water sources. Marine algae include red, green and brown seaweeds, out of which brown seaweeds were found to be excellent biosorbent (Davis *et al*., 2003).

FUNGAL BIOSORBENTS

Because sorption is a surface reaction, the biosorption potential of a biosorbent depends on its surface area and its polarity; it can be said that the performance of the biosorbent depends on the ionic state of the biomass. Thus, fungal biomass has received much attention as a biosorbent because of the presence of a high percentage of cell-wall material, which increases the variety of functional groups involved in metal binding (Gadd, 1990) and thus increases the metal sequestration ability of fungi.

Fungus shows excellent metal-binding capacity because of the variety of functional groups present due to a high percentage of cell-wall material and compared with some biosorbents such as plant products or algal biomass, fungus is easy to cultivate at large scale as it has a short multiplication cycle. Moreover, it can be easily grown using unsophisticated fermentation techniques and inexpensive growth media (Kapoor and Viraraghavan, 1995).

Various fungi such as *Aspergillu* sp. (Mishra *et al*., 2009) Aspergillus niger (Zeng *et al*., 2015), Penicillium chrysogenum (Tan *et al*., 2004), *Rhizopus* sp. (Preetha and Viruthagiri, 2005), *Cunniughamella echinulata* (El-Morsy, 2004), *Pycnoporous sanguineus* (Yahaya *et al*., 2009), *Talaromyces helices* (Romero *et al*., 2006) *Cladosporium cladosporiodes* (Pethkar *et al*., 2001) have been used for the biosorption of heavy metals.

FACTORS INFLUENCING FUNGAL BIOSORPTION

Analysis of factors influencing biosorption is important for evaluation of the full biosorption potential of any biomaterial. The important factors include: (i) type and nature of biomass; (ii) initial solute concentration; (iii) biomass concentration (biosorbent dose/solution volume) in solution; (iv) physicochemical factors like temperature, pH, ionic strength.

The type and nature of the biomass, including the nature of its application, is quite important, as biomass can be used in many forms, for example living/dead (Kapoor and Viraraghavan, 1995), free/immobilized (Veglio and Beolchini, 1997), raw/pretreated, wild/mutant cells, engineered/non-engineered, lab culture/ waste industrial biomass and biomass from different industries (Park *et al*., 2003). The initial solute concentration seems to have an impact on biosorption, with a higher

concentration resulting in a high solute uptake (Binupriya et al., 2007). This is because, at lower initial solute concentrations, the ratio of the initial moles ofmsolute to the available surface area is low; subsequently,mthe sorption becomes independent of the initial concentration. However, at higher concentrations, the sites available for sorption become fewer compared with the moles of solute present. Hence, the removal of solute is strongly dependent upon the initial solute concentration. The dosage of a biosorbent strongly influences the extent of biosorption. In many instances, lower biosorbent dosages yield higher uptakes and lower percentage removal efficiencies. An increase in the biomass concentration generally increases the amount of solute biosorbed, because of the increased surface area of the biosorbent, which in turn increases the number of binding sites. Conversely, the quantity of biosorbed solute per unit weight of biosorbent decreases with increasing biosorbent dosage, which may be due to the complex interaction of several factors. This has been supported by Subudhi and Kar (2008), who reported that an increase in *R. arrhizus* biomass concentration from 0.15 g L^{-1} to 0.50 g L^{-1} caused a remarkable increase in uptake of copper, up to 29.83 mg, from a synthetic solution of 30 mg L^{-1}.

Apart from the above, physicochemical factors such as pH, temperature, ionic strength and pollutant solubility also have an influence on the running process. Of the physicochemical factors, pH is possibly the most important. The pH value of the solution strongly influences not only the site dissociation of the biomass' surface, but also the solution chemistry of the heavy metals – hydrolysis, complexation by organic and/or inorganic ligands, redox reactions, precipitation and speciation and biosorption availability of the heavy metals (Esposito *et al*., 2002).

Temperature seems to affect biosorption only to a small extent within the range of 20–35°C (Veglio and Beolchini, 1997). Higher temperatures usually enhance sorption as a result of the increased surface activity and kinetic energy of the solute (Vijayaraghavan and Yun, 2007); however, physical damage to the biosorbent can be expected at higher temperatures. Due to the exothermic nature of some adsorption processes, an increase in temperature has been found to reduce the biosorption capacity of the biomass (Mameri *et al*., 1999).

Another important parameter in biosorption is the ionic strength, which influences the adsorption of solute to the biomass surface (Borrok and Fein, 2005). The effect of ionic strength may be ascribed to the competition between ions, changes in the metal activity, or the properties of the electrical double layer. When two phases, e.g. biomass surface and solute in aqueous solution, are in contact, they are bound to be surrounded by an electrical double layer owing to electrostatic interaction. Thus, adsorption decreases with increase in ionic strength (Dönmez and Aksu, 2002).

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SURVEY FOR INCIDENCE AND SEVERITY OF GRAIN DISCOLOURATION OF PADDY IN NORTHERN PARTS OF KARNATAKA

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ABSTRACT

Rice (*Oryza sativa*) is an important food crop belonging to family Poaceae and is the staple food for more than half of the world population. About 90% of the world rice is produced and consumed in Asia alone. Some plant diseases, which are less significant earlier, are now gradually gaining importance and posing serious threat to the crop production .Among them the discoloration of rice grain is one, which is also known as "Glume discoloration" and "Dirty panicle" *etc.* Grain discoloration now has great importance in recent years because of changes of cropping practices into intensive system like increased fertilizer application, favorable weather condition, introduction of high yielding varieties have great impact on economically importance diseases. The yield loss was approximately estimated from 20 to 25%.It is more serious for last few year in our locality looking to its spread and severity this has invited greater interest for detailed studies. A roving survey was conducted in major paddy growing areas of northern parts of Karnataka. A total five districts *viz.,* Belagavi, Dharwad, Haveri, Koppal and Uttara Kannada were surveyed during *kharif* 2017 to record the severity and incidence of grain discolouration. In all the areas surveyed, rice was grown in black and red soils under both irrigated and rainfed condition. During the survey the disease was observed at early grain filling to maturity stage. The disease severity ranged from 06.66 to 26.23 PDI and per cent disease incidence ranged from 12.21 to 46.66 per cent. The maximum severity (26.23 %) and per cent incidence (46.66 %) was recorded in Medleri village of Ranebennur taluk on Haveri district. The minimum severity (06.66 %) and per cent incidence (15.19 %) was recorded in Gundenhatti village of Khanapur taluk on Belagavi district. The maximum disease severity and incidence was observed in black soil under irrigated conditions during maturity stage.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important crop of the world both in terms of area and production. About 90 per cent of world rice is grown and consumed in Asian countries and 60 per cent of world population also depends on rice for their half of the calorie intake from this crop. After China, India is the second largest producer of rice in the world. In India, rice crop is grown under wide range of agro-climatic conditions and is being cultivated over an area of rice contributes around 45 per cent of India's cereal production and cultivated in about 43.49 million hectares area with production of 104.40 million tones and productivity of 2.40 tonnes per hectare (Anon., 2016). The major rice growing states of India are West Bengal, Bihar, Madhya Pradesh, Odisha, Andhra Pradesh and Uttar Pradesh.

In Karnataka rice occupies an area of 1.11 million hectare with a production of 3.02 million tones and productivity of 2.72 tonnes per hectare (Anon, 2016). It is largely grown in Koppal, Raichur, Mandya, Tumkur, Kolar, Gadag and Chitradurga districts under irrigated conditions. In high rainfall areas it is being grown under drill sown conditions (Dharwad, Belagavi, Haveri and Uttara Kannada). In rice some of the diseases which were less significant earlier, are now gradually gaining importance and posing serious threat to the crop production (Gupta *et al.,* 2015). Grain discolouration is prevalent in almost all parts of the world where paddy is grown. It was earlier considered to be a minor disease and it is now gaining more importance due to its severity in tropical rice growing areas. In many regions of India particularly during wet seasons due to high humidity and warm environmental condition during flowering and post flowering stages which significantly induce the disease.

Seed discolouration is an early indication of poor seed germination or grain quality which is complex disease and cannot be diagnosed prior to harvest, in nature disease is generally associated with many pathogens, among them fungi predominates. Bodalkar and Awadhiya (2014) reported that the seed borne inoculum of *Alternaria alternata* is responsible for grey discolouration and *Cochilobolus miyabeanus* for black discolouration, these pathogens are present in seed coat and endosperm of discoloured seed, whereas *Curvularia lunata* (eye shaped spots), *Fusarium moniliformae* produces pinkish discolouration and *Sarocladium oryzae* is responsible for light brown discolouration which are found in the seed coat, endosperm and embryo of discoloured seed (Sachan and Agrawal, 1995). *Nigrospora oryzae, Aspergillus niger, Bipolaris oryzae, Alternaria*

padwickii, Burkoldaria oryzae are other pathogens which are responsible for discolouration. Although grain discolouration diseases has been a minor problem in the past. But in recent years it is becoming a serious problem if no attention is given to the disease. Keeping in view all the factors a survey was conducted for the effective management of the disease

MATERIALS AND METHODS

An intensive roving survey was conducted during *kharif* 2017 from major rice growing districts of northern Karnataka *viz.,* Haveri, Dharwad, Belagavi, Koppal and Uttar Kannada. In each districts observations were recorded from different farmer's field for both disease incidence, disease severity, stage of the crop, variety grown and other details were recorded.

The disease was scored by following IRRI recommended grading scale (0-9) scale of Standard Evaluation System for Rice, 1996).

Scale	Grains with severely discoloured glumes
0	No incidence
1	Less than 1%
3	1-5%
5	6-25%
7	26-50%
9	51-100%

Ten representative panicles from different fields at each location comprising of different cultivars were collected randomly, labeled and data on disease severity was computed by counting number of discoloured grains. The per cent disease index in the field will be assessed with the following formula given by Wheeler (1969).

$$\text{Per cent Disease Index (PDI)} = \frac{\text{Sum of the individual diseased ratings}}{\text{Number of grains assessed} \quad \text{Maximum disease grade}} \quad 100$$

$$\text{Per cent Disease Incidence (PDI)} = \frac{\text{Number of plants infected}}{\text{Total number of plants observed}} \quad 100$$

Collection of disease samples

Discoloured grains were collected from different rice growing areas, the collected samples were packed in covers, labeled and were brought to the laboratory and stored at room temperature ($25^0 \pm 2^0$C) for isolation and further investigation.

RESULTS AND DISCUSSION

An intensive roving survey was conducted in major rice growing areas of northern parts of Karnataka. A total of fourteen taluks in five districts (Belagavi, Dharwad, Haveri, Koppal and Uttara Kannada) were surveyed during *kharif* 2017.

In all the areas surveyed, rice was grown in black and red soils under both irrigated and rainfed condition. During the survey the disease was observed at early grain filling to maturity stage. The disease severity ranged from 06.66 to 26.23 PDI and per cent disease incidence ranged from 12.21 to 46.66 per cent. In different districts surveyed, the maximum disease severity (17.69 %) as well as maximum per cent disease incidence (25.84%) was noticed in Haveri district. Least disease severity (11.84 %) and per cent disease incidence (19.05%) was observed in Belagavi district. In taluka surveyed, the mean severity (21.56 %) and mean per cent incidence (35.55%) was maximum in Ranebennur taluk and mean severity (10.21%) as well as mean per cent disease incidence (17.40) was minimum in case of Khanapur taluk. Among the villages surveyed the disease severity (26.23%) as well as per cent disease incidence (46.66 %) was maximum in Medleri village of Ranebennur taluk %). Minimum per cent disease index (06.66 %) as well as per cent disease incidence (12.21%) was recorded in Gundenahatti village of Khanapur taluk. Observations revealed that disease was more prominent in Haveri and Uttara Kannada districts. It is clear that the disease incidence was noticed in all localities because of use of same variety and congenial environmental conditions prevailing over the locality. Sharma and Vaid (1989) reported that the grain discolouration of rice in Himachal Pradesh where the overall incidence of the disease ranged from 3.17 to 78.36 per cent.

Disease severity and incidence was maximum in black soil (14.65% and 20.94%), irrigated condition (13.47% and 21.30%) and maturity stage (15.11% and 22.48%). Across the locations, the maximum per cent disease severity and incidence was observed in varieties *viz.*, MTU-1010, MTU-1001, Mugad Sunganda, RNR Sona, Tirumal gold and Sirsi local. Further, Haveri, Uttara Kannada and Koppal areas are identified as hot spot for grain discolouration of paddy in northern Karnataka. The grain discolouration was more predominant in MTU-1010 variety when compared to Sirsi local and RNR sona varieties. The disease incidence and severity was more noticed in Haveri district, this may be due to high temperature and low soil moisture coupled with dry weather conditions prevailed during later part of the crop stage. Environmental conditions like high temperature, high relative humidity, high rainfall and consequently congenial weather for the pathogen infection and survival.

CONCLUSION

The present investigation included a roving survey conducted during *kharif* 2017 revealed that, incidence and severity of grain discolouration was noticed in most of the rice cultivated areas of northern Karnataka *viz.,* Belagavi, Dharwad, Haveri, Koppal and Uttara Kannada. Maximum disease severity (26.23%) as well as maximum per cent disease incidence (46.66%) was recorded from Medleri village of Ranebennur taluk. Least per cent disease index (06.66 %) as well as per cent disease incidence (12.21%) was noticed in Gundenahatti village of Khanapur taluk. Out of five districts surveyed, the mean maximum per cent disease index (17.69%) as well as mean maximum per cent disease incidence (25.84 %) was noticed in Haveri district, followed by Uttara Kannada (17.30%) and (21.17%) respectively.

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SUSTAINABLE INTEGRATED MANAGEMENT APPROACHES FOR EARLY BLIGHT OF TOMATO UNDER CLIMATE CHANGES

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Tomato [(*Solanum lycopersicum* L.) Krust] is considered as "Protective food" both because of its special nutritive values and wide spread cultivation. The French referred to the tomato as "Pommes d'amour", or "Love apples", as they thought them to have stimulating aphrodisiacal properties. The crop is considered to be a native of South America probably the Peru-equator region from where it was brought to Europe by the Spaniards in the early 16th century. Initially, it was grown as garden ornament but in 1860, it was noticed that tomato was as good as any other fruits and vegetables. Now-a-days , it is one of the most important vegetable as well as fruit crop cultivated across all continents in the fields as well as in protected conditions.

Tomato plant requires warm season for successful cultivation. Being a day-natural plant, it can be grown throughout the year, if climate is suitable. Tomato is susceptible to cold winds and frost. Though tomato is a summer vegetable but high temperature adversely affects its growth and development. Flowering, fruit setting, fruit retention, pigmentation and nutritive value of fruit are largely affected by temperature and light intensity. Flowering as well as fruit setting is occurred best at a day temperature of 25°C and night temperature of 18°C. The optimum temperature for pollination is 21°C. The day temperature above 32°C or below 15°C and night temperature above 22°C or below 12°C, affect fruit set adversely. At temperature below 10°C, fruits are unable to develop red colour and above 30°C, red colour starts to disappear and fruits become yellowish red. The temperature goes to above 40°C, lycopen is completely destroyed. The optimum temperature for good colour development is 15-20°C.

Tomato can be grown on a wide variety of soils from sandy to heavy clay. However, the high yield can be obtained from well drained, rich in organic matter loamy soils having a pH of 6.0 to 7.0. The soil should be ploughed thoroughly to bring fine filth before planting. Generally, 4-5 ploughings are needed to make the soil friable followed by planking.

The major tomato growing countries in the worlds are China, India, United States, Turkey, Egypt, USA, Italy, Philippines, Indonesia, Central East and West Africa, Tropical America and throughout tropics (FAOSTAT 2015). 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. But largest productivity come out from USA which is 88.85 tons/ha (Anonymous, 2017a).

In India, the major tomato growing states 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 hectors of land in 2013-14. It contributions about 2.46% of total world production . 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).

Yield Losses

Datar and Mayee, (1981) reported that among the different fungal diseases infecting tomato crop, early blight caused by *A. solani* was most destructive causing heavy losses in yield of tomato sometimes as high as 78 per cent of fruit loss. Karla and Sohi (1985) conducted regular surveys in Chandigarh markets during 1980-84 which revealed that 78 post harvest diseases on 36 hosts including tomato caused by different fungi and maximum damage was attributed to *Fusarium sp.* and *Alternaria sp.* among 23 isolated pathogens.

The survey of field and post-harvest diseases of hybrid and desi cultivars of tomatoes in West Bengal, India, revealed that among fungal diseases, blight caused by *Alternaria* sp. was the most predominant with the crop loss in the field ranging from 70-100% (Kanjilal *et al*., 2000)

Symptomatology

The symptom of early blight on tomato was characterized by the appearance of brown to dark leathery necrotic spots first on leaves, leaflets, stems and fruits 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. Sometime cankerous like spots are developed 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).

Datar and Mayee (1981) showed that *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.

Favourable factors

The fungus is extremely resistance to hot and dry condition. The mycelium remains viable in dry infected leaves for a year to 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 disseminating by wind, rains and insects.

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.

Mode of perpetuation

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 (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 18ºC .

Management : The management of disease can be done through the cultural practices, chemical measures, biological and use of resistant varieties.

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. Another method of disease management strategy is biological control. In this context, *Trichoderma harzianum*, *Trichoderma viride*, *Chaetomium globosum*, *Gliocladium virens, Pseudomonas fluorescens* 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 cheep 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. 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.

The presence of antifungal compounds in higher plants has long been recognized as an important factor for disease control (Mahadevan1982). Such compounds being biodegradable and selective in their toxicity are considered valuable for controlling plant diseases (Singh and Dwivedi, 1987). The pesticidal compounds of plant origin are more effective and have little or no side effects in human beings in comparison to synthetic compounds (Kumar *et al*., 1995).The natural compounds provide less phytotoxic, more systemic and easily biodegradable fungitoxic compounds (Saxena, *et al*., 2005).

Natural plant products have played a significant role in discovery of a new germicide, nematicide and to certain extent of viricide, either by their direct application to diseases or through their exploitation in the resilienting plant with optimum biological and physical properties.

However, there are also have some drawbacks of botanicals control like loss of immediate killing action, higher dosage is require, some plant oils show phytotoxicity of lighter doses, for eg. *Azadirachta indica, Cymbopogon* sp., problems in preparation of formulation of spraying, some oils are non-edible, so their equipped toxicity problem also needs investigation, shelf life is comparatibely less etc.

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.

In the present investigations FYM, bio-fertilizers, bio-agents, plant extracts, fungicides have been used as an integral part for management of early blight of tomato. Besides, disease management approaches, the plant growth parameters likes Plant height, shoot length, root length, shoot & root weight etc. have also been recorded to find out the effect of IDM approaches under climate changes.

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BACTERIOCIN PEPTIDES OF PROBIOTICS AND GUT HEALTH

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Human Gut is a complex ecosystem that is composed of more than 1000 different bacterial species inhabiting the gastrointestinal tract. This ecosystem of microbiota' is acquired soon after birth and persists throughout life. These microbes play an important role in the physiology of their host, including the digestion and assimilation of nutrients, protection against pathogen colonization, modulation of immune responses, regulation of the fat storage, and stimulation of intestinal angiogenesis. The human gut microbiome is highly variable and differs from individual to individual and across GI tract in an individual, suggesting that the resident microbes are affected by the diet, environment and gentic relatedness.

Consumers are aware of the importance of food safety, as many of the chemical additives used in food may raise issues of health risks. Commercially available preservatives may cause certain health discomforts. Moreover the use of antibiotics or residues in food is illegal. Antimicrobial peptides have been gaining attention as antimicrobial alternatives to chemical food preservatives. Unlike chemical preservatives, bacteriocins are "generally recognized as safe" (GRAS) and promises safe use as food preservatives in vegetables, dairy, processed cheese, meats, and other food products, as they inhibit microorganisms contamination (Deggan *et.al.,* 2006; Settanni and Corsetti, 2008). Bacteriocins which are antimicrobial peptides, are a kind of ribosomal synthesized antimicrobial peptides produced by bacteria, which can kill or inhibit other bacterial strains closely-related or non-related. The term "bacteriocins" was originally coined in 1953 by Jacob.

One of the major concerns is the emergence of multi-drug resistant bacteria over the past decades. Under such conditions. Lactic acid bacteria and their metabolites are good alternatives as a source of antimicrobial agents. Probiotic which include *Lactobacillus* and *Bifidobacterium* species are found in many dairy foods and are normal inhabitants of the human gut. Their use as health supplements are currently attracting keen interest from both consumers and researchers due to the awareness of the beneficial links between health, nutrition and diet (Stanton *et al.,* 2001)

It is important that these probiotics are able to survive passage through the GIT (i.e. low gastric pH and bile acids) and adhere to the intestinal mucosa to colonize the host. The beneficial effects of probiotics are manifested by modulation of the intestinal bacterial flora, adherence to the mucosa thus preventing pathogens from adhering, production antimicrobial metabolites such as organic acids, H_2O_2, bacteriocins, changes of total enzyme activities in the colon contents, influence on the immune system of the host and competing for nutrients (Goossens et al., 2003)

LAB produces lactic acid and other organic acids thus lowering the pH of the environment and consequently inhibit the growth of bacterial pathogens. The cell free *L. casei subsp. rhamnosus* Lcr35 supernatant inhibited the growth of human pathogenic bacteria: *Enterotoxigenic Escherichia coli* (ETEC), enteropathogenic *Escherichia coli, Klebsiella pneumoniae*, *Shigella flexneri, Salmonella typhimurium, Pseudomonas aeruginosa, Enterococus faecalis,* and Clostridium difficile as reported by (Forestier, *et al.*, 2001). *In vitro* antimicrobial activity of *L. acidophilus* against clinical isolates of Helicobacter pylori is attributed to lactic acid (Bhati *et al.,* 1989). In another report, in vitro anti-H. pylori by different Lactobacilli strain are associated with production of lactic acid and other organic acids (Midolo *et al.,* 1995). Alokomi *et al.,* (2000) observed that the lactic acid produced by *Lactobacillus* acts as a permeabilizer of the Gram-negative bacterial outer membrane, allowing other antimicrobial substances produced by the host to penetrate and thereby increasing the susceptibility of pathogens to these antimicrobial molecules.

Hydrogen peroxide inhibits both Gram-positive and Gram-negative organisms. Recent findings and trials by many workers have revealed that some of the intestinal lactobacilli and bifidobacteria produce antimicrobial substances that are active against enteropathogens. Many microorganisms, such as bacteriocin producing LAB, are used to start cultures or co-cultures in food production processes for increasing flavor and prolonging shelf-life. Tagg in 1991 proposed the term "bacteriocins-like inhibitory substance" for designating the antimicrobial protein from Gram-positive microorganisms, to tell them apart from colicins which is produced by *E. coli.* Today, however, most antimicrobial peptides are named "bacteriocin', irrespective of Gram-positive or Gram-negative origin. The bacteriocin family includes a wide variety of peptides and proteins in terms of their size, microbial targets, and mechanism of action and immunity.

Classification of bacteriocins are as follows :

Bacteriocins from Gram-Negative Bacteria

Colicins

Colicins are antibacterial proteins produced by bacteria, which can kill bacterial strains closely related to a produced species, in order to reduce environmental competitors for acquiring nutrients and living space. Colicins are organized in three specific domains, an amino-terminal translocation (T) domain, which is implicated in the transfer across the outer membrane via the translocator protein; a central receptor-binding (R) domain, which is bound with a bacterial outer membrane receptor; and a carboxy-terminal cytotoxic (C) domain, which has antibacterial activity (Cascales *et.al.,* 2007; Kleanthous, 2010). When a bacterial outer membrane surface has the colicins recognition receptors protein and the translocators protein system, the colicins are transported into the bacteria, which kills it, and are known as sensitive strains. For a particular colicin, non-receptor protein bacteria are classified as resistant strains. Bacteria with a deficiency of translocator protein system are classified as tolerant strains, which produce immunity proteins are classified as immune strains. Resistant, tolerant, and immune strains of bacteria would not be killed by corresponding colicins. When colicins enter the target cell, they can be divided into three categories based on bactericidal mechanisms: (1) Pore-forming type colicins: the formation of pores or channels in the inner-membrane cause (2) leakage of cytoplasmic compounds, destruct electrochemical gradient, ion loss, (3) and cell death.

Microcins

Microcins predominantly produced by Enterobacteriaceae are low molecular weight ribosomal synthesized hydrophobic antimicrobial peptides (<10 kDa), which is distinguished by 25–80 kDa high molecular weight colicins protein. Microcins are produced as precursor peptides, including N-terminal leader peptide and core peptides. Microcin precursor peptides may or may not undergo a post-translational modification process in the course of maturation to an active microcin. Microcins are show great tolerance to heat, extreme pH, and proteases (Rebuffat, 2012).

Bacteriocins from gram-positive bacteria

Unlike colicins from Gram-negative bacteria, which are plasmid or chromosome encoded 25–80 kDa proteins, the Gram-positive bacteria bacteriocins exert similar characteristics to microsins. These gene-encoded bacteriocins are low molecular weight antimicrobial peptides with less than 60 amino acids. In Gram-positive bacteria, lactic acid bacteria (LAB) are the typical bacteria producing a variety of bacteriocins of different sizes, structures, physicochemical properties, and inhibitory spectrum. Due to the large diversity of bacteriocins, some investigations show different ways to classify bacteriocins from Gram-positive bacteria

Classification of bacteriocins from Lactic acid bacteria

I. Lantibiotics	Ribosomally produced peptides that undergo extensive post-Translational modification
	Small (<5 kDa) peptides containing lanthionine and methyl lanthionine
	Ia. Flexible molecules compared to Ib
	Ib. Globular peptides with no net charge or net negative charge
II. Nonlantibiotics	Low-molecular-weight (<10 kDa), Heat stable peptides
	Formed exclusively by unmodified amino acids
	Ribosomally synthesized as inactive peptides that get activated by posttranslational
	Cleavage of the N-terminal leader peptide
	IIa. Anti-listerial single peptides that contain YGNGGVXC amino acid motif near heir N termini
	IIb. Two peptide bacteriocins
	IIc. Bacteriocin produced by the cell's general sec-pathway

III. Nonlantibiotics	High-molecular-weight (>30 kDa), heat labile proteins
IV Complex bacteriocins	carrying lipid or carbohydrate moieties, which appear to be required for activity such bacteriocins are relatively hydrophobic and heat stable (Pithva *et al.,* 2011)

Bacteriocins are now widely used in food science to extend food preservation duration and pharmaceutical industry and medical society

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SIGNIFICANCE OF INTELLECTUAL PROPERTY RIGHTS IN INDIAN AGRICULTURE

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Intellectual property (IP) is a category of property that includes intangible creations of the human intellect, and primarily encompasses copyrights, patents, and trademarks. It also includes other types of rights, such as trade secrets, publicity rights, moral rights, and rights against unfair competition. Artistic works like music and literature, as well as some discoveries, inventions, words, phrases, symbols, and designs, can all be protected as intellectual property. It was not until the 19th century that the term "intellectual property" began to be used, and not until the late 20th century that it became commonplace in the majority of the world.

The main purpose of intellectual property law is to encourage the creation of a large variety of intellectual goods. To achieve this, the law gives people and businesses property rights to the information and intellectual goods they create – usually for a limited period of time. This gives economic incentive for their creation, because it allows people to profit from the information and intellectual goods they create. These economic incentives are expected to stimulate innovation and contribute to the technological progress of countries, which depends on the extent of protection granted to innovators. The intangible nature of intellectual property presents difficulties when compared with traditional property like land or goods. Unlike traditional property, intellectual property is "indivisible" – an unlimited number of people can "consume" an intellectual good without it being depleted. Additionally, investments in intellectual goods suffer from problems of appropriation – a landowner can surround their land with a robust fence and hire armed guards to protect it, but a producer of information or an intellectual good can usually do very little to stop their first buyer from replicating it and selling it at a lower price. Balancing rights so that they are strong enough to encourage the creation of intellectual goods but not so strong that they prevent the goods' wide use is the primary focus of modern intellectual property law.

Intellectual property rights include patents, copyright, industrial design rights, trademarks, plant variety rights, trade dress, geographical indications, and in some jurisdictions trade secrets. There are also more specialized or derived varieties of *sui generis* exclusive rights, such as circuit design rights (called mask work rights in the US) and supplementary protection certificates for pharmaceutical products (after expiry of a patent protecting them) and database rights (in European law). Legal protection for the products of human intellectual effort and ingenuity is granted not because of a moral commitment to compensating creators or innovators, but because the products they create enrich a society's culture and knowledge and thus increase its welfare. New plant varieties are afforded legal protection under this approach to encourage commercial plant breeders to invest the resources, labor and time needed to improve existing plant varieties by ensuring that breeders receive adequate remuneration when they market the propagating material of those improved varieties.

The Protection of Plant Varieties and Farmers' Rights Act, 2001

India as a member of WTO and signatory to the TRIPS enacted the "Protection of Plant Varieties and Farmers' Rights Act, 2001" (herein after referred as Act), for which Rules were notified in 2003 (The Gazette of India Extraordinary, 2001 and The Gazette of India, 2003). For the purpose of this Act, in exercise of the power conferred under sub-section (1) of the Section 3, the Central Government established the "Protection of Plant Varieties and Farmers' Rights Authority" (herein after referred as Authority) on 11th November, 2005 (The Gazette of India, 2005). The PPV&FR Authority is a body corporate under the Ministry of Agriculture with Chairperson as the Chief Executive. Besides the Chairperson, the Authority has 15 members, notified by the Government of India (GOI). The functioning of the Authority is based on the following major objectives of the Act:

(a) To provide an effective system for protection of Plant varieties and rights of farmers and plant breeders.

(b) To recognize and protect the rights of farmers in respect of the contribution made at any time in conserving, improving and making available plant genetic resources for the development of new plant varieties.

(c) To accelerate agricultural development in the country, protect plant breeders' rights, stimulate investment for research and development in public private sector for development of plant variety and

d)To facilitate the growth of seed industry to ensure the availability of high quality seeds and planting material to the farmers.

Registration of plant varieties

Under Section 29 (2) of the Act, the Central Government by notification in official Gazettes specifies the genera and species eligible for the purpose of registration of varieties. So far, Central Government has notified 54 crop species for the purpose of

registration. PPV&FR Authority has developed crop specific "Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability" which have been published in various issues of the Plant variety Journal of India (PVJI) published by the Authority and can be downloaded from the website of the Authority. The purpose of these Guidelines is to provide detailed practical guidance for the harmonized examination of DUS of the candidate variety and, in particular, to identify appropriate characteristics for the examination of DUS.

Application for registration of plant varieties should be accompanied with the fee of registration notified by the Authority [new and essentially derived variety (Individual-Rs. 5,000/-; Institutional-Rs. 7,000/-; Commercial-Rs. 10,000/-), extant variety notified under the Seeds Act, 1966-Rs. 1,000/- and variety about which there is a common knowledge (Individual-Rs. 2,000/-; Institutional-Rs. 3,000/-; Commercial-Rs. 5,000/-)] (The Gazette of India, 2008 and 2009e). No fee is to be paid by a farmer for registration of a farmers' variety.

Criteria for registration of different types of plant varieties

New variety

A new variety should conforms to the criteria of novelty [not been sold or otherwise disposed of in India, earlier than 1 year and outside India (in case of trees and vines earlier than six years, or, in any other case, earlier than four years)], distinctiveness (for at least one essential character from all varieties of common knowledge), uniformity (sufficiently uniform in its essential characteristics) and stability (if its essential characteristics remain unchanged after repeated propagation, on, in the case of a particular cycle of propagation, at the end of each cycle).

Essentially Derived Varieties (EDV)

In respect of a variety (the initial variety), shall be said to be essentially derived from such initial variety when it is predominantly derived from such initial variety, or from a variety that itself is predominantly derived from such initial variety, while retaining the expression of the essential characteristics that results from the genotype or combination of genotypes of such initial variety; is clearly distinguishable from such initial variety; and conforms (except for the differences which result from the act of derivation) to such initial variety in the expression of the essential characteristics that result from the genotype or combination of genotype of such initial variety. The application for registration of an EDV shall be accompanied by the relevant documents, along with other details specified in section 18 of the Act.

Extant Varieties

Extant varieties which have been notified under the Seed Act, 1966 are registrable under this category. The Authority constituted seven-member Extant Variety Recommendation Committee (EVRC) to examine the suitability for registration of such varieties (The Gazette of India, 2006b). On the basis of the recommendations of the EVRC, extant varieties shall be registered as per the provisions of the section 28 of the PPV & FR Act, 2001. No field tests are conducted for evaluating DUS. The passport data of recommended plant varieties are published in the Plant Variety Journal of India of the Authority for calling objections if any, within a specified time frame. The varieties for which no objections are received are accepted for registration. The applicant is required to submit 2/10 quantity of seed material/ planting material specified for new varieties of same crop species before the issue of certificate of registration of plant varieties.

(a)Farmers' variety

A variety which has been traditionally cultivated and evolved by the farmers in their fields; or is a wild relative or land race or a variety about which the farmers possess the common knowledge are covered under this category. The criteria for distinctiveness, uniformity and stability for registration of a farmers' variety and variety about which there is a common knowledge has been notified by the Central Government (The Gazette of India, 2009c). Any person who applies for registration under clause (c) of Section 14 of the Act shall submit half of the quantity of seed material specified for a new variety in the respective crop species, divided into five equal numbers of packets for the purpose of field test and also for storing in the National Gene Bank and the seed supply procedures shall be such as may be specified in the Journal. Field test is conducted for confirming distinctiveness, uniformity and stability at the test Centers. The farmers' variety along with reference varieties and other similar variety are evaluated in the paired row test. The length of the row and plant population is kept such as specified in the Journal. A replicated trail is conducted for one season at two locations with limited purpose of confirming the distinctiveness, following the descriptors such as specified in the Journal. The uniformity levels for Farmers' variety for the respective species shall not exceed double the number of off-types such as specified in the Journal. If the variety meets the uniformity criteria, it is deemed to have met the stability criteria.

(b) Variety of common knowledge (VCK)

A variety which is not released and notified under the Seeds Act, 1966 but is well documented through publications and is

capable of satisfying the definition of 'variety', or have an entry in any official register of varieties or in the course of being made, or finds inclusion in a reference collection or is having a precise description in a publication, or has become a matter of common knowledge and the variety is under cultivation or marketing during the time of filing of application for registration (candidate variety should have been sold or otherwise disposed of in India one year prior to the date of filing of the application and it should not have been sold or otherwise disposed of 13 years prior to the date of filing of application and in case of trees and vines it should not have been sold or otherwise disposed of 16 years prior to the date of filing of application). The true representative seed of the variety should be available at the time of filing of application. The DUS shall be determined by conducting a field test for one season at two locations for the purpose of confirming the distinctiveness, uniformity and stability following the descriptors and plot size as may be specified in the Journal. Any person who applies for registration under clause (b) of Section 14 of the Act shall submit half the DUS test fee prescribed for new variety and half the quantity of seed material specified for a new variety in the respective crop species, as divided into five equal numbers of packets for the purpose of field test and also for storing in the National Gene Bank and the seed supply procedures shall be such as may be specified in the journal.

CONCLUSION

Intellectual Property Rights has been recognized as universal and its importance has been acknowledged by both developed and developing world. The drive towards stronger worldwide IP protection has intensified as a result of changes that have taken place in the global technology system. To provide an international frame work for the protection of IPRs, WTO introduced TRIPS Agreement which gave a strong impetus for the globalization of PVP regimes. Plant variety protection has become established as an instrument of protection of plant variety innovations in developed countries over the decades. Developing countries, with their diversity of farmers and seed systems, present special challenges for designing a supportive IPR system. The goal is to provide incentives for seed sector development while not creating unnecessary or unrealistic limitations on the practices and livelihoods of smallholder farmers. This needs to have a balanced approach towards protecting the interests of the plant breeders in the formal sector and the traditional farming communities. After initial reluctance, many developing countries have accepted the TRIPS Agreement and have already revised or are in process of revisiting their IPR laws considering their specific conditions and needs. India has opted for a *sui generis* system of protection of plant varieties and has provided rights to farmers, breeders, researchers and equity concerns in the PPV & FR Act. All these provisions make it a unique Act, when compared to similar legislations in other countries. In a very short span of time the Authority has effectively progressed in implementing most of the provisions made under the Act for framing criteria of testing and registration of different types of plant varieties. It has also opened branch offices, national gene bank and field gene banks, identified agro-biodiversity hotspots and recognized and rewarded farming communities for their contributions in conserving genetic resources.

The Indian PVPFR Act is an effective *sui generis* system providing a balance between plant breeders' rights along with farmers' rights and researchers' rights. Its implementation will catalyze the availability of quality seeds of registered varieties and thereby contributing to the enhanced agricultural production and lead to the national food and nutritional security. At the same time, provisions for social recognition and economic reward made under the Act will support and promote the farm families to continue conservation, nurturing and enhancing agro-biodiversity of the country.

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PLANT BREEDING : A NEW PROSPECTIVE AND CHALLENGE

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Abstract

Plant breeding has been define differently by no number of scientist and this definitions are keep on changing with new concept and ideology however the main them " technology use for making plant more effect to convert the solar energy in food, feed, fodder, fiber, medicine" is remain same. Unlike in early 19th century agriculture research is trailing the focus from world politician and policy maker for resource allocation and facilitation. Involvement of private investments in crop improvement and plant protection has increase which is supporting the overall system to have the sustainable agriculture and food security. Breeding community has played a novel role for producing enough food for the god creation. Changing climate, food habits, globalization, and excess to information and increasing pollution continually opening the new challenges for the breeding community. Sporting sciences are continually evolving with faster speed and helping the breed community to breed the new kind with high precession and with much faster speed. Current state of plant breeding is change where breeding are force to use the tall clams of modern science and huge amount of data which take out his lot of time form field which he used to develop the relationship with plant and make selection which were skilled base. Way of plant breeding and overall system of plant breeding is much more efficient in European world and learning form there can help Asian breeding community to develop the more efficient pant type with faster speed.

INTRODUCTION

Plant breeding is the process by which humans change the characteristics of plants over time to make them better crops by increase their photosynthetic efficiency which lead to produce more nourishing food. In its most simple form, breeding consists of selecting the best plants in a given field, growing them to full seed and then using that seed to grow further generations. I think there was a clarity in the find of farmers that "performance of crop and plant will exhibit the traits and feature very similar to seed plant. Successful commercial plant breeding concerns were founded from the late 19th century. Gartons Agricultural Plant Breeders in England was established in the 1890s by John Garton, who was one of the first to commercialize new varieties of agricultural crops created through cross-pollination. The firm's first introduction was Abundance Oat, one of the first agricultural grain varieties bred from a controlled cross, introduced to commerce in 1892.

In the early 20th century, plant breeders realized that Mendel's findings on the non-random nature of inheritance could be applied to seedling populations produced through deliberate pollination to predict the frequencies of different types. Wheat hybrids were bred to increase the crop production of Italy during the so-called "Battle for Grain" (1925–1940). Heterosis was explained by George Harrison Shull. It describes the tendency of the progeny of a specific cross to outperform both parents. The detection of the usefulness of heterosis for plant breeding has led to the development of inbred lines that reveal a heterotic yield advantage when they are crossed. Maize was the first species where heterosis was widely used to produce hybrids. Statistical methods were also developed to analyze gene action and distinguish heritable variation from variation caused by environment. In 1933 another important breeding technique, cytoplasmic male sterility (CMS), developed in maize, was described by Marcus Morton Rhoades. CMS is a maternally inherited trait that makes the plant produce sterile pollen. This enables the production of hybrids without the need for labor-intensive detasseling.These early breeding techniques resulted in large yield increase in the United States in the early 20th century. Similar yield increases were not produced elsewhere until after World War II, the Green Revolution increased crop production in the developing world in the 1960s.

Last phase of 20th century was the golden era of plant breeding, where hybrid technology for crop improvement was used successfully in cross pollenated, often cross-pollenated and self-pollenated crop. On the other hand molecular science has start helping to increase the precision in plant breeding and DH technology has start helping to increase the speed in breeding and product delivery. GM technology was another breakthrough which helps in minimizing the production losses cause by insects and weeds. It was unnoticed when plant breeding has completely transformed as a division of product designing in crop improvement. However the basic fundamentals forcreating genetic variability through crossing and recombination and then selection is remain same.

Breeder and commercial breeder

Farming is approaching towards commercial business from the livelihoods and farmers are keeping the account of inputs cost and its benefit. This can be witness by seen seed replacement ration in almost of the crops weather they are self-pollinated or cross pollinated has increased significantly. Farmer has completely transformed and has very strong clarity on the selection of variety which can give the best return on investment (ROI) to him. It's really a time for plant breeding community to understand the change in his customer (farmers) behavior and transformed the complete process and approach of breeding from breeding to commercial breeding. This pointed can be disputed when one is trying to challenge the process which working well since more than 100 years I feel tis the right time to challenge this process in order the deliver the products which can be appreciated by farmers in large and can help us the increase the resource use efficiency .

This change in process will also help the breeder to develop a tailor made product which may not be a mega verity but help in healing up the pain point for our farmer at given location. Product evaluation prior to commercialization is very critical and its required to have a very strong understanding on the fundamentals of experimental designs, and analysis of multi-environment trials (METs), including BLUEs and BLUPs &heritability etc.Scope of plant breeders understanding has go beyond selecting the cultivar and getting it notified or registered to the concept of product which include the customer satisfaction and seed economics. In summery plant breeding process methodologies are the tolls to be used for developing the commercially viable product which can be produced and serve to the framer and then famer can make the use of it to increase their profitability. This is the main difference between breeder and commercial breeder.

Demand–Led Plant breeding

Demand–led plant breeding combines the best practices in market- lead new variety design with innovative plant breeding methods. Considering the known facts that breeding a new cultivar takes time for incorporating and bringing the desirable traits together and validating the phenotypic expression these traits in given climate take 5-6 year to come up with commercially useable product. This realty indicate that time has come from random breeding to demand–lead breeding where clarity are required on :

Predicting the future trained and requirements of framer and farming system.

Visioning the foresight the product or cultivar

Understand the germplasm requirements

Equip the breeder with methodology, tolls to speeding the breeding cycle and tolls increase the precision in selection.

Screening system and sight to insure the adaptation and tolerance to different biotic and a biotic stress.

A system and matrix to evaluate the progress for breeding project

Risk management and time line

These requirements in understanding are very close to the statement where breeder required the support from agronomist, pathologist, entomologist, Genetics, molecular breeder, economist, extension and statistics. Coordinated Research projects for crop improvement in ICAR are one of the best modules where all of these required function work under one unit and can really demonstrate the Demand–Lead plant breeding.

Use of Advance tools -to manage the breeding funnel

It's often stated that the breeding is a number game; it was valid until we have enough time to breed and our customer (farmer) was satisfied with whatever has been given to him to sue. Expensive input cost, erratic climatic condition and awareness at farmer level had made plant breeding work more challenging where farmers are very particular for their needs and like to realize the label clams and also like see the new cultivar in their field on regular basis. Uses of advance tools in breeding is the reality of today where breeder can manage its breeding funnel more effective and deliver the product to farmer with high precision, more predictable performance and within less time.

NEED TO DEVELOP SAFE AND EFFECTIVE MASTITIS VACCINE IN COUNTRY

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Mastitis is characterized by an inflammation in one or more quarters of the udder and can have an infectious or a traumatic origin. Mastitis is the major cause of economic loss by disease in dairy cattle in developed countries worldwide. These include losses in actual and potential production, shortening of productive life, losses in milk quality, medicine costs, costs of veterinary care and potential implications in the general health of the animal including reproductive performance. Mastitis is the only disease where there is a clear relationship between milk yield and risk of infection. Mastitis is not simply inflammation of udder rather it is a disease condition which has multiple etiology along with changes in structure and functions of udder leading to changes in milk quality and quantity. As India is having largest dairy animal population in world, the economic losses due to mastitis are also up to a great extent. The overall morbidity rates of mastitis were approx 15.5% in cattle and buffaloes. Total losses due to mastitis per lactation in nondescript (ND) cow, crossbred (CB) cow and buffalo were INR 868.34, INR 1, 314.10 and INR 1, 272.36, respectively.

Mastitis, being one of the most important hurdles in the growth of dairy industry and the economy of dairy and livestock owners, it is a challenge to prevent mastitis particularly in heavy milk producer cattle. Depending upon the geographical conditions, climatic changes and husbandry practices in a particular area the microorganism profile vary and over 135 different microorganisms have been isolated from bovine intramammary infection with the major etiology of bacterial origin. Thus it is important to use local culture to develop vaccine for its better protection. The most frequent bacterial agents of infection in dairy cattle are *Staphylococcus aureus, Escherichia coli, Streptococcus agalactiae, Streptococcus uberis* and *Streptococcus dysagalactiae*. Mastitis caused by the first of these agents is classified as contagious, and by the others environmental. *Staphylococcus aureus* is a main etiological cause of mastitis in cattle, sheep and goats. As per the studies conducted in India the major bacterial pathogens involved in mastitis is *Staphylococcus* sp. The high prevalence of *Staphylococcus* sp. is followed by *E. coli*. *Streptococcus* sp. are reported to be third most involved bacteria in mastitis not only in India but all over the world.

To prevent mastitis vaccination is only alternative. and the research into vaccines against *Staphylococcus aureus* started in the early 1990s, and with regards to mastitis, several vaccines have been tested and advances have been made but there are doubts with regards to the efficacy of the commercially available vaccines. There are several types of vaccines that have been tested, and with regards to *S. aureus* these include whole organism (cellular lysates, inactive and attenuated vaccines) and sub-units (toxins, surface proteins and polysaccharides). Commercially available *S. aureus* vaccines against bovine mastitis have shown limited efficacy under field conditions. The various strains of *S. aureus* can produce a number of potential virulence factors such as hemolysins (K, L, Q or N), coagulase, leukocidin, enterotoxins (A-E), toxic shock syndrome toxin 1 (TSST-1), etc..

E. coli is second most bacterial pathogen involved in mastitis and its increasing incidence and the severe symptoms like milk drop and fever are possible explanation for this increase in economic losses of farmers. Most probably, the number of nonpathogenic bacteria is diminished by various methods that lead to a low concentration of polymorphic nuclear cells in the milk. This would render cows more susceptible for mastitis caused by environmental bacteria like *E. coli*. Based on epidemiological studies, it was hypothesized that cows are infected with *E. coli* strains from their environment (faeces or straw). The reason for this hypothesis was the wide range of serotypes observed in clinical mastitis strains and the absence of long-term *E. coli* udder infections that might have led to cow-to-cow infections. *E. coli* was also found as major pathogen following to *Staphyloccus spp*., in clinical cases of mastitis.

Mono and polyvalent vaccines have been tested: S. *aureus, E. coli, S. aureus / E. coli, S. aureus / Streptocccci*; these were tested in adult cows exposed before to the disease and in heifers not exposed to the disease; and also different inoculation protocols were followed using, none, one or two boosters. These all revealed limited success in control of mastitis. Further the cost of imported vaccine also a barrier in its mass vaccination.

The difficulties with the development of a vaccine against mastitis were identified a long time ago. Due to multiple etiology

subunit vaccines do not work effectively. Moreover, change in antigenic structures or variation among strain in different geographical region restrains the possibility of a universally adopted vaccine. Therefore, there is an urgent need to have localized vaccine with locally involving strains of pathogens. Failure and limitations of subunit vaccine insist the use of whole cell antigens. However, it may have compromise in the duration of protection leading to use of booster vaccination. The newly designed quality adjuvants can be the answer of this problem as these not only extend the duration of protection, but also provide nonspecific cellular immune response. However, the selection of adjuvant should be based on risk- benefit analysis of adjuvant in enhancing the immunogenicity as well as duration of immunogenicity against the risk of inducing adverse local and systemic untoward reactions. The polyvalent adjuvant vaccine might be the answer of these questions and can prevent the loss of money.

INTEGRATED DISEASE MANAGEMENT (IDM)–A MODERN APPROACH IN PRESENT SCENARIO OF SUSTAINABLE CROP PROTECTION

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Plant diseases caused by cluster of biotic constraints viz, fungi, bacteria, viruses, phytoplasmas and nematodes have led to significant economic losses worldwide. It has been estimated that, out of 36.5% of total crop losses, 14.1% are caused by diseases, 10.2% by insects, and 12.2% by weeds (Agrios 2005). In developing countries, from tropical to sub-tropical to Mediterranean and temperate climates , yield losses are frequently privileged than in the developed countries, mostly as farming communities be short of most suitable solutions and resources committed to their revision. Approximately, 10-15% of the already low yields in developing countries are lost due to aggression of infection, and losses can be higher if post harvest diseases are deliberate.

The record of pathogens harmful to crops is hefty and tremendously diverse. Crops can be attacked at a different growth stages: At seedling establishment (root and seed rots), young seedlings (root and collar rots, seedling blights, and wilts), pre-flowering (wilts, leaf blights, yellowing and mottling of the foliage, stunting), flowering (bud rots, flower blight), post flowering (rusts, blights) and post harvest (fruit rots). The similar disease can bring about varied symptoms at altered growth stages. Man made actions such as crop growth and introduction of crops or new cultivars of existing crops to new regions as well as changes in cropping practices, freshly includes plant breeding led to the progress of severe epidemics around the earth , mainly for this reason such activities will possibly agitate the balance, which physically existed for many generations (Buddenhagen, 1977).

Initial management strategies that have been developed to combat the devastating plant disease include the use of cultural, physical and chemical control. None of these strategies have been able to give the best results of completely ameliorating the situation due their own limitations. To overcome the prevailing hurdles "Integrated Disease Management" has provided a ray of hope to the farming community in crop protection.Integrated disease management (IDM), which combines biological, cultural, physical and chemical control strategies in a holistic way rather than using asingle component strategy proved to be more effective and sustainable. Wide range adoption of IDM practices improves the overall field management including, Disease management, reducing costs and increasing production efficiency (Khoury and Makkouk, 2010).

IDM is defined as "a sustainable approach to managing diseases by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks".

Major components IDM

The major components of Integrated disease management summarized here are Host-plant resistance, cultural practices, biological control and chemical control. These components will be dealt independently, and frequently that diverse components are complementary to each other as mentioned with tough interface among them and the environment and that it is important to split away from relying on a single-technology and to implement more ecological approach. (Thomas,1999)

Host-plant resistance

Host-plant resistance is an important means to control diseases of most important food crops. The utility of resistant varieties is very much welcomed by resource poor farmers as it does not need supplementary cost and it is environment-friendly. Rice varieties resistant to rice blast (Bonman and MacKill, 1988), bacterial blight (Mew et al., 1992), rice tungro (Azzam and Chancellor, 2002) and brown spot (Ou, 1985) are widely used. The resistance is often resilient, gratitude to proper supervision of genetic diversity by employing gene rotation. The cultivar mixtures, are proved efficient in reducing disease break in natural ecosystems (Wolfe, 1985).

In Latin America, which is considered as the centre of origin for potato crop where late blight is considered as one of the most significant biotic constraints for potato production which is conventionally controlled by numerous fungicide spays, but the emergence of fungicide resistance in various locations and the increasing cost of their application, encouraged the search for other control strategies. The improvement of high yielding varieties resistant to late blight with tolerable quality such as 'Amarilis' 'ChataRoja' and 'Kori' was very much welcomed by the farming society in Peru. Such success unmitigated to other Latin American countries (e.g. Equador and Bolivia) and then to Asian and African countries (Nelson et al., 2001).

Since, domestication rust has been identified as severe disease on wheat. The use of genetic resistance is still cost-effective

and reasonable mode of disease control. Genetic resistance is frequently based on a limited number of main genes that voluntarily rise above by developing pathogen races. With the decrease of genetic diversity in the wheat cultivars planted over large areas worldwide, sowhenever new antagonistic virulent rust races emerge severe rust epidemics are being recorded. For example, during 1980s and 1990s, the yellow rust epidemics spread from East Africa to Central and South Asia and North Africa. At present the break of Yr27, a gene used to replace Yr9, 80-90% of commercial wheat varieties grown globally are threatening to emerging stem rust race Ug99 (Hodson and Nazari, 2010)

The two major destructive foliar disease s of peanut globally are, Late leaf spot caused by *Phaeoisariopsis personata* and rust caused by *Puccinia arachidis.* Host plant resistance has been used in recent times as one control constituent and a numerous peanut cultivar such as ICGV 89104 and ICGV 91114 now exist. These cultivars yield 55-60% additional than local cultivar, and the severity of both diseases is considerably lower in these than in the local cultivar as per field trials conducted in India (Pande et al., 2001). Similarly, in Africa they have been developed peanut varieties resistant to peanut rosette virus disease which causes serious losses (Reddy, 1998).

Cultural practices

Cultural practices (CPs) can be harnessed for the management of foliar and soil borne diseases by creating an environment which is favourable for the crop and unfavourable for the pathogen. CPs are potential component in integrated disease-management programs (Katan, 2010). Cultivation techniques, mulching, intercropping, plant density, planting date, crop rotation (Neshev, 2008), strip farming, timing of harvest, barrier crops, crop mixtures, rouging, healthy planting material, soil solarisation (Katan, 2017), soil amendments and fertilizer management, and water management are the cultural practices that have been used individually or in combination as implements for disease management. For few crops in developing countries, such control practices may be the only efficiently feasible methods are available. Cultural control methods not only contribute in promoting the healthy growth of the crop, but also effective in directly reducing the inoculum potential (pruning, rouging, crop rotation, ploughing, etc.) and in enhancing the biological actions of antagonists in the soil. (solarization, crop rotation, mulching, etc.).

Control Measures Before Planting

Crop rotation

Avoiding crop rotation effects in the enrichment of pest populations, the build-up of poisonous substances, the depletion of mineral nutrients, deprivation in soil fertility and damage of soil configuration. Crop rotation deals with plant condition in general moderately than with observing a specific infection, although a certain crop arrangement might be more active in reducing the incidence of a specific disease than others. It is regarded as insurance against the rise of unidentified pathogens (Bruehl, 1987; Katan, 2003).

Deep ploughing

In tomatoes, the occurrence of the southern blight disease was minor after deep ploughing (25 cm depth), associated with shallow ploughing by means of a harrow (Worley et al., 1966). Deep ploughing effects in acquaintance of propagules to eminent infections and physical killing of the pathogen. This is known as dry soil solarization. Summer ploughing was effective at decreasing inhabitants of cyst nematodes and growing wheat yield (Mathur et al., 1987).

Sanitation

The two major aims of sanitation are to inhibit the overview of inoculum, into the field, greenhouse, farm or community, and to decrease or diminish the inoculum that is already present at these sites (Palti, 1981). This can be achieved by flooding, flaming, solarization, ploughing, chemical treatments to destroy unseen structures, mechanical removal of residues, controlling alternate hosts (weeds, volunteer plants), roguing, pruning and other funds.

Flooding

This preparation somewhat be similar to soil disinfestation. The detrimental effect on soilborne pests may be correlated to lack of O_2, improved CO_2 or various microscopic events under anaerobic conditions, e.g. production of constituents that are poisonous to the pathogen (Bruehl, 1987). In the Near and Far East this practice was known in ancient cultures. A classic case of mechanism on a large scale was demonstrated with the Panama wilt disease of bananas triggered by *F. oxysporum f. sp. cubense* (Stover, 1962). Abundance also casually destroys *Pseudomonas solanacearum,* and the nematode *Radopholus similis* (Stover, 1962). Long-term summer soil flooding, with or without paddy rice culture, diminished populations of *Verticillium dahliae* and the incidence of Verticillium wilt in cotton, and increased produce (Pullman and DeVay, 1982).

Fire and flaming

Hardison (1976) defined this approach as thermosanitation and noticeable by many examples of controlling diseases by fire and flaming. The basic idea is to accomplish existing killing of the pathogens' resting structures. This can be done by either scorching the dry plant residues in the field or flaming the rests with unusual occurrence. Although fevers may extent high ranks (500^0C or more), inoculum decrease will depend on the interval of the heating methods and on the depth of the heat's penetration into the soil. The combined practice all over the world is burning of rice stubble and straw.

Other preplanting CP measures : These include: soil solarization (Gamliel and Katan, 2009), Altering plants date to avoid the disease, modifying crop density, biofumigation, namely, incorporation of organic amendments which volatiles under plastic mulch, and others (Palti and Katan, 1997). Plasticulture, and the use of unusure.

Pre- and Postplanting Cp Control Measures

These include water management plastic or net covers in protected agriculture, and irrigation are providing new options for decreasing insect invasion by adversely manipulating their behaviour. Most of the light range in the range of 280-380 nm eradicates UV absorbing polyethylene films or nets. This results in reduced invasion of crops by a variety of insect pests. These optical barriers affect the insects' alignment and navigation and can play an important role in pest management. Coloured polyethylene soil mulches reduced penetration by *Bemisia tabaci* and infection of tomato by *Tomatoyellow leaf curl virus* (Antignus, 2000). The development of technologies to harvest plastic films with specific spectral properties will enable the use of "optical means" of vision and behaviour of insects (Antignus, 2010).

Chemical control

There is no doubt that chemical control is the best for plant disease management .in india, most of common varieties are susceptible and fungicides are frequently used to control diseases Fungicides played a key role in disease control for several decades. The systemic fungicides started slowly to substitute the older non-systemic chemicals with more efficacy and specificity in disease control in 1960s. Triazole fungicides gained 24% of the total fungicides market very quickly (Hewitt, 1998). Especially in developing countries because of their lower cost the non-systemic fungicides such as mancozeb and chlorothalonil plus copper and sulphur-based products are sustained to have a high-quality share of the market. New classes of fungicides were developed with major impact on disease control more recently. These include anilinopyrimidines, phenoxyquinolines, oxazolidine- diones, spiroketalamines, phenylpyrroles, strobilurins and activators of systemic acquired resistance. To many of the newly developed products posed a serious challenge that the traditional fungicides the growth of pathogen populations showing compact sensitivity (*e.g.* sulphur, folpet, etc.) did not face. The availability of a variety of new products, with narrow and broad specificity, offer chief disease control. Their practical application continues to face the risk of selection of resistant pathogen populations (Gullino *et al.*, 2000). Experience accumulated over the last few decades clearly showed that fungicidal application had a better impact when used within an IDM strategy (De Waard *et al.,* 1993).

Biological control

Biological control offers a better alternative to the use of chemicals. It is the use of natural incompatible organisms to battle pests or overwhelmed plant diseases (Lugtenberg and Kamilova, 2009) The control of crown gall with *Agrobacterium radiobacter* K84 is achieved in using micro-organisms in opposition to plant pathogen(Kerr, 1980), and that of seedling blights caused by *Pythium* and *Rhizoctonia* with *Trichoderma harizanum* (Harman and Bjorkman, 1998), *Gliocaladium virens* (Lumsden and Walter, 1995) and *Streptomyces griseus* (Cook *et al.,* 1996). *Trichoderma harzianum* and *Trichoderma viride*are the widely used species and have been exploited on about 87 different crops and about 70 soilborne and 18 foliar pathogens, respectively. (Sharma *et al.,* 2014). *Bacillus* spp. have received muchattention as biocontrol agents as they are able to produce several broad spectrum antibiotics and have a longer shelf life as a result of their ability to form endospores (Cavaglieri *et al*., 2005). This allows them to resist adverse environmental conditions and permit the easy formulation and storage of the commercial products (Schallmey *et al.*, 2004; Francis *et al.,* 2010). In addition to their antibiotic properties, *Bacillus* spp. exhibit antagonistic behaviour against fungal pathogens by competition or exploitation, which leads to predation and direct parasitism.

The use of naturally occurring bio-control agents (antagonists) of plant pathogens can be traced back to several centuries all the way through the conventional practice of crop rotations that mostly permit the decrease of pathogens, inoculum potential in the soil below injury level. This move towards the most important single constituent, in both developed and developing countries used to control root pathogens. This process is frequently accelerated by adding up composts or manures, which enrich the soil with antagonistic microflora. (Baker and Cook, 1974).

Advantages of Integrated disease management over conventional methods :

IDM approach incorporates preventive and curative measures to keep pathogen from causing major problems, with minimum hazards to human and desirable constituents of them.

Advantages of IDM approaches over conventional methods are as follows :

Stimulates wide-ranging structures and healthy plants

Promotes the sustainable bio based disease controlling alternatives.

Reduces the environmental risk associated with management

implementation of more naturally benign control tactics

Decreases the potential for air and ground water pollution

Protects the non-target species by condensed impact of plant disease controlling activities.

Decreases the use of pesticides and fungicides by using numerous managing methods

Reduces or eliminates issues correlated to pesticide residue

Reduces or eliminates re-entry interval restrictions

Decreases workers, residents and public acquaintance to chemicals

Improves concern of the public about pest & pesticide related practices.

Maintains or rises the cost-effectiveness of disease controlling programs

The Successful Implementation of IDM Strategies by the Enabling Environment :

In economical and sustainable agricultural production with long-term positive impacts on poverty and human and environmental health the ultimate aim of promoting IDM is to allow its users to fit into place. The impact of successful execution of IDM approaches away from pilot scale cannot be achieved if IDM is not strategically placed within national policies for agricultural production and protection, and within the broader perspective of agricultural and rural development, and human and environmental health (SP-IPM, 2008). The national policies and related regulations that have direct impact on IDM (and generally IPM) and scaling up, with special importance on the developing countries.

Disease/Pest management policies

Disease/Pest management policies are implemented by the Ministries of Agriculture is a challenge to decrease crop losses both in quality and quantity. some of these policies could be more harmful for the execution of IDM or IPM or may help form more resurgent pest problems and environmental and health hazards to the weak ecosystems in some developing countries. A typical example would be the appliance of aerial sprays of pesticides. Especially, when done on a regular basis (e.g. wheat rusts, or Dubas bugs in date palms) or the free non-monitored allocation of pesticides and contribution to farmers upon the incidence of an epidemic or pest outbreak. Examples of IDM-promoting policies consist of those supporting disease surveillance, or early warning systems or those promoting decision support systems and information sharing, or the establishment of national and regional forecasting.

Policies for Pesticide management.

Pesticide registration and labelling, testing pesticide value and remains levels on produce for the local market and in trade, guidelines and regulations correlated to application methods, authorized personnel, clothing and equipment and pesticide disposal are associated to the rules. The needed skills, laboratories, equipment, financial means and political will to execute these regulations are required for majority of developing countries. Schillhorn van Veen *et al.* (1997). Where the regulation authority is subjugated by producer concern, or where the regulation or the execution of regulation is fragile, or where public require information access to different technologies comprise these cases. Policies of banning or demanding harmful pesticides should be accompanied by the condition of unusual control methods to avoid prohibited trade or enlarged liability of farmers (Shcillhorn van Veen, 1999). some countries have implemented policies of pesticide subsidy or exclusion of import tax on pesticides (SP-IPM, 2008) with the endeavour of promoting agricultural productivity. Such policies would directly demoralize the increased adoption of IDM approaches.

Plant quarantine

Quarantine systems are the source for trans-boundary pest and disease hindrance through control of the sources of pest introductions and incursions. Pest and disease surveys as well as pest risk analysis (PRA) studies are critical for prepare and updating quarantine pest lists. Majority of developing countries enclose quarantine regulations in consign, their usefulness is very inadequate a lot due to insufficient financial, human and infrastructural resources. Field surveys and PRA are sporadic when prepared and pest lists are commonly based on narrative reviews and information from researchers. The introduction or emergence of a new disease through regular surveys is indispensable for checking disease spread before it reaches epidemic levels by early detection and reporting. Citrus tristeza virus (CTV) which affect citrus production in many countries, including the multiply of a disease where not only the pathogen, but also its vector is enclosed by quarantine regulation and control is good example in Mediterranean region. (Moreno *et al.,* 2008).

Seed certification, including vegetative propagation material

Pests and diseases are transmitted through seeds or vegetative material and the use of fresh planting material would be a key element of any IDM programme. National policies interrelated to the quality control, availability and price of material to farmers is critical for IDM implementation. This encompasses systems for inspection and certification of seeds and vegetative material and nursery control. Such policies, if not properly assessed and deliberated in terms of their economic viability, practicality and accessibility to farmers could be a barrier to IDM programmes. Where subsistence farmers may not be able to afford the cost of certified seeds and seedlings or include inadequate transportation access to sources of seeds is particularly true in developing countries. In East Africa, virus-free cassava cuttings are transported to farmers from large multiplication centres lose most of their capability by the time they accomplish the farmer due to the rough and long journey to the remote villages (Akoroda, 2010). Seed policies allowing for GMO or hybrid seeds that cannot be multiplied by resource poor farmers, a common tradition within the informal seed system, can also harmfully affect the implementation of IDM programmes.

Implementation of IDM Practices

IDM and IPM approaches are information intensive and location-specific. Accordingly, practitioners, whether farmers or extensionists , would need to realize the agro-ecological processes affecting the disease and how best to control crops to avoid/prevent pest infestation or disease occurrence, as well as how to control these pests and diseases once they turn out to be a problem. This will require a high level of logical skill and intensive training in crop monitoring and ecological principles. (Kenmore, 1991; van de Fliert *et al.*, 2000).

IDM activities are scaled up for a wider impact remains a challenge. IDM projects and programmes would require to make out and establishing an early stage of implementation linkages with organizations or individuals that can afford mechanisms for future scaling up (van de Fliert *et al.*, 2000). Institutions should be involed throughout the implementation of the programme in the design, planning and evaluation of the programme, as well as in critical events key persons. Assessment of their mandates, roles and responsibilities and capacities and analysis of potential organizations (public, private, NGOs, etc.) are critical for scaling-up. Raising the knowledge of decision makers at the nationwide and district levels is also the key to ensure the political support for sustainability of activities. Decision makers should be able to visit and see an FFS first hand and talk directly with farmers as reporting is not enough .(Pontius *et al.,* 2002)

CONCLUSIONS

The resource poor farmers greatly depends on their association in helping produce locally precise techniques and solutions appropriate for their particular farming systems and integrating control components that are economically sound and voluntarily available to them is the success and sustainability of IDM strategy. For the successful implementation of IDM strategies, training and awareness raising of farmers, disease survey teams, agricultural development officer for the successful implementation of IDM strategiess, extension agents and policy makers remains to be an important factor. A practical understanding of the ecology, etiology and epidemiology of the major diseases of the crop should be there as all direct stakeholders including farmers, extension workers, and local crop protection technicians should contain. The farmers empower with the suitable information to become better managers of their own fields translating this information into proper decision-making implements and practical-control strategy by using the training using intensive participatory approaches should be used to. In Africa, Asia, and Latin America but also from developed countries in scaling up of implementation activities of IPM and IDM approaches, two strategic elements could be considered critical at the national level based on experiences from developing countries. (Schillhorn van Veen *et al.*, 1997) :

Environmentally unsustainable pest and disease management techniques and strengthening regulatory institutions are the policies which are supposedly eliminated.

Below measures are complementary and both are needed since each separately is necessary but not sufficient on its own to promote and scale-up the IPM and IDM implementation. Execution of positive measures to uphold IDM for public awareness, research, extension and training with emphasis on decentralized, farmer-centred initiatives.

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CROP RESIDUE MANAGEMENT FOR COST EFFICIENT NUTRIENT SUPPLY SYSTEM AND RESOURCE CONSERVATION

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Increased in crop productivity with the adoption of chemical fertilizer is at the cost of loss in soil productivity and sustainability. The boost in crop yields from modern farming techniques have reached a plateau and is now sustained with diminishing return and falling dividend. The increase in production cost to maintain the present level of productivity under changing climatic condition may decrease the farmers net return and consequently that will discourage the farmer for further investment in agriculture sector. According to NITI Aayog "Doubling real income of farmers till 2022-23 over the base year of 2015-16, requires annual growth of 10.41 per cent in farmers income". Hence the present compulsion is not only to increase agriculture production in sustainable manner but also lower down the expenditure involved so as to increase farmers net income and prosperity.

Production cost trend of crops

The cost of production of major crops has increased from 1.7 to 2.5 fold in cropping year 2015-16 over 2009-10. It increased significantly in sugarcane, jowar, groundnut, paddy, rapeseed/mustered and soybean i.e. 151, 140, 123, 105, 104 and 102 per cent higher than the cropping year 2009-10, respectively (Anonymous, 2016[a]). Out of these crops sugarcane, paddy and jowar are more fertilizer demanding crops. The increasing fertilizer use in these crops to maintain the level of productivity under changing climatic condition might be the reason for rise in cost of production.

Strategies to reduce cost of production

The saving in cost of production is possible by use of locally available, low cost/ cost effective alternate input sources. The farming practices that are governed by the principles of ecology have proved to be highly productive and sustainable in several parts of the world. Among the agriculture inputs chemical fertilizer, micronutrients, growth regulators, intensive tillage, chemical pesticides and hybrid seed are cost intensive inputs. Whereas, locally available organic sources of nutrients, biofertilizers, green manuring, crop rotation, minimum tillage, bio-pesticides, GM crops and improved seed could act as cost effective inputs in agriculture and may help to reduce the cost of production.

Need of cost effective nutrient supply system

The fertilizers consumption in India in terms of NPK has increased substantially from a mere 1.1 million tonnes in 1966-67 in the pre-green revolution period to 26.7 million tonnes in 2015-16 to boost the productivity of crops so as to fulfil the demand of increasing population. The all India average consumption of fertilizers has increased from 69.84 kg per ha in 1991-92 to 130.66 kg per ha in 2015-16 (Anonymous, 2016[a]).

A wide gap of 10 million tons exists between annual nutrient removal and addition under intensive cropping and irrigated farming. Motsara (2002) reported that among the 3.6 million analyzed soil samples 63% are low, 26% are medium and 11% are highly deficit in N. Whereas, 42% are low, 38% medium and 20% highly deficit in P. In case of K 13% are low, 37% are medium and 50% are highly deficits. Micronutrients and secondary nutrients deficiencies are also increasing under intensive cropping systems because of alone use of NPK in production system. Singh (2001) found that 49, 12, 5, 3, 33 and 13 per cent of analyzed soil samples are deficit in Zn, Fe, Mn, Cu, B and Mo, respectively. Chemical fertilizers are estimated to contribute on an average to the tune of 30% among critical inputs. Hence, deficit of nutrients to meet the crop demand has to come from low cost sources other than chemical fertilizers so as to increase total factor productivity and farmers income.

Components of cost effective nutrient supply system

Several organic materials such as farmyard manure, green manure, city refuse, compost, forest litter, sewage sludge, industrial waste water, domestic waste water *etc*. can be used as component of cost effective nutrient supply system. However, many of them have one or the other limitations for their purposeful use. In India, sizeable proportion of the animal dung used as domestic fuel in rural India and transportation need limits desired quantity of FYM. Specific efforts are involved in the production of green manuring crops costing the land, labour and a crop season, which could have been utilized otherwise. Even the production of good quality compost involves lot of efforts on the part of the farmer. Foul smell is very common in

such wastes. Sewage sludge especially from industrialized area may pose a toxicity hazard due to heavy metals like nickel, zinc, lead, copper and cadmium. In such situations, field crop residues in one or the other forms constitute the next largest source of recyclable low cost nutrient source after livestock waste for the use in agriculture.

Crop residues

Crop residues are the parts or portion of a plant or crop left in the field after harvest, or that part of the crop that is not used domestically or sold commercially or discarded during processing. Crop residues are excellent source of plant nutrients for the reasons: They benefit the soil physically, chemically as well as biologically; required little or no transportation and can be applied in situ; do not cost since they are produced along with the grains/produce and have no health hazard problem like heavy metal contamination, salinity, sodicity or nitrate contamination.

Need of crop residue recycling

Crop residue recycling is necessary to improve the soil health, maintain the sustainability in crop production, bridge the gap between demand and supply of fertilizers, dispose off agro-wastes in an eco-friendly way, reduce the cost of production, conserve the natural resources and reduce the health hazards.

Availability and resource benefits of crop residues

Estimated crop residue based on 2015-16 yield data is 662.80 Mt of which 374.59 Mt is available for utilization, having potential of supplying 6.93 Mt of (NPK) nutrient (on the basis of their availability) and fertilizer replacement value 3.46 Mt. Out of total crop residue production, more than 2/3rd comes from wheat (24.02%), rice (23.61%), and sugarcane (22.77%) and less than 1/3rd from other crops. However, out of available crop residue for utilization major share comes from sugarcane (40.29%), wheat (14.15%) and rice (13.91%). Thus these are the most important crops contributing maximum to crop residue production in India (Table 1).

Table-1 : Estimated crop residues from different crops, their nutrient content, nutrient available for utilization and their fertilizer replacement value (Mt = million tons) based on 2015-16 crop yield data (All India)

Crop	Production* (Mt)	Harvest Index#	Total crop residues (Mt)[1]	Crop residues available for utilization (Mt)[2]	Nutrient content** (% on oven dry basis)			Nutrient potential (Mt)	
					N	P	K	Total N+P+K[3]	Fertilizer replacement value[4]
Rice	104.32	0.40	156.48	52.11	0.70	0.09	1.15	1.011	0.505
Wheat	93.50	0.37	159.20	53.01	0.48	0.07	0.98	0.811	0.406
Sorghum	4.41	0.40	6.62	2.20	0.85	0.12	1.21	0.048	0.024
Pearl millet	8.06	0.40	12.09	4.03	0.44	0.10	1.14	0.068	0.034
Maize	21.81	0.40	32.72	10.89	0.82	0.09	1.25	0.235	0.118
Pigeonpea	2.46	0.21	9.25	3.08	1.07	0.16	1.55	0.086	0.043
Lentil	1.04	0.24	3.29	1.10	0.88	0.30	1.15	0.026	0.013
Gram	7.17	0.20	28.68	9.55	0.50	0.14	1.39	0.194	0.097
Groundnut	6.77	0.41	9.74	3.24	1.65	0.12	1.23	0.097	0.049
Soybean	8.59	0.38	14.02	4.67	1.40	0.25	1.48	0.146	0.073
Rapeseed & Mustard	6.82	0.25	20.46	20.46	0.42	0.28	1.69	0.489	0.244
Sugarcane	352.16	0.70	150.93	150.93	0.45	0.08	1.20	2.611	1.306
Cotton	30.15	0.50	30.15	30.15	0.90	0.31	1.06	0.684	0.342
Potato	43.76	0.60	29.17	29.17	0.52	0.09	0.85	0.426	0.213
Total	—	—	662.80	374.59	—	—	—	6.932	3.466
*Crop production data from Anonymous (2016a).									

#Harvest index of rice, wheat, gram, pearl millet, maize, cotton, sugarcane, rapeseed & mustard, potato and sorghum from Bandyopadhyay et al. (2001); lentil from Layek et al. (2014) ; pigeonpea from Gimhavanekar et al. (2017); groundnut from Meena et al. (2014) and soybean from Jassal et al. (2017).
1. Total crop residue production calculated by formula = (Economic yield/ Harvest index) - Economic yield
2. Assuming that 2/3rd of the residue is used as feed for animal and other purposes and only 1/3rd is available for utilization except rapeseed & mustard, sugarcane, cotton and potato residue.
**NPK content in residues of rice, wheat, sorghum, maize, groundnut, sugarcane and potato from Singhal and Atreja (1985); soybean from Jain (2015); cotton from Thakur (2011); pigeonpea from Patil and Padmani (2007); pearl millet from Pawan Kumar (2004); lentil from Ohari (2017); gram from Roy et al. (2014); rapeseed & mustard from Singh (2003).
3. Based on residue yield at (2).
4. Based on assumption that half of the total N+P+K is mineralized in a season.

Utilization of crop residues

Crop residues are utilized for different purposes since the inception of agriculture. During early days, rice and wheat straw were used for various agricultural and horticultural uses, as feedstuffs, for pulp and paper industry, as fuel and chemicals, for building and allied purposes and for craftwork and packaging. As the civilization advanced, scenario of utilization pattern also changed. The uses for various residues are different in different states. Rice straw and husk is used as domestic fuel or in boilers for parboiling rice in West Bengal. In Punjab and Haryana where rice residues are not used as cattle feed, large amount of rice straw is burned in field. Sugarcane tops in most of the areas is either used for feeding of dairy animals or burned in field for raising ratoon crop. Residues of groundnut are burned as fuel in brick kilns and lime kilns. Cotton, chilli, pulses and oilseeds residues are mainly used as fuel for household needs.

Crop residue management

Crop residue management (CRM) is a cultural practice that involves fewer and/or less intensive tillage operations and preserves more residues from the previous crop, is designed to protect soil and water resources and provide additional plant nutrients and environmental benefits. CRM is generally cost effective in meeting conservation requirements and reducing fuel, machinery, and labor costs while maintaining or increasing crop yields.

Practices of crop residue management

A. *In-situ* burning

With the wide adoption of combined harvesters, large quantities of crop residues are left in the field, which are rather difficult to remove. For quick preparations of field for the next crops and for pest, disease and weed management farmers generally prefer to burn the residues in field. Burning of crop residues causes substantial and immediate decrease in population of beneficial bacteria and fungus in soil. Long-term burning permanently diminished the soil bacterial population by more than 50%, reduced total N and C and potentially mineralized N in the 0-15 cm soil layer. Burning increases the short-term availability of some nutrients (e.g. P and K) and reduces soil acidity, but leads to a loss of other nutrients (e.g. N and S) and organic matter.

Approximately 80–90% N, 25% of P, 20% of K and 50% of S present in crop residues are lost in the form of various gaseous and particulate matters due to burning. About 131.86 Mt of crop residues are burnt in different states of India every year. To which largest contributors are Uttar Pradesh (22.38 Mt), West Bengal (14.85 Mt), Punjab (13.30 Mt), Andhra Pradesh (12.60 Mt) and Maharashtra (10.96 Mt). In India burning of crop residues leads to loss of 0.70 Mt of nutrients per year (i.e. 0.394 Mt N, 0.014 Mt P and 0.295 Mt K per year). Maximum loss of nutrient is occurred due to burning rice straw (0.45 Mt) followed by wheat straw (0.14 Mt) and sugarcane trash (0.11 Mt). Among the different crop residues burned rice, wheat and sugarcane contribute together 82% (40, 22 and 20 %, respectively) followed by cotton (8%), maize (3%), jute (3%), millets (2%), groundnut (1%) and rapeseed & mustard (1%) (Jain *et al.*, 2014).

It is estimated that 11.5 billion tons of CO_2 is released from biosphere to atmosphere by normal burning on site. Of this crop residue shares 1.83 billion tons of CO_2 /annum (Perry, 1982). Enhanced CO_2 emission contributes to global warming. Incomplete burning of organic material produces carbon monoxide, a poisonous gas. Its inhalation may sometimes be fatal. India released 149240.6 Gg CO_2, 9062.8 Gg CO, 6.9 Gg NO_x, 246.2 Gg SO_x and 128.0 Gg NH_3 in atmosphere through crop residue burning per year. Besides this, 39.4 Gg of NMVOC (non-methane volatile organic compounds), 1546.5 Gg of NMHC (non-methane hydrocarbon), 14.7 Gg HCN, 2.4 Gg PAH (polycyclic aromatic hydrocarbons), 384.1 Gg $PM_{2.5}$ and 1280.6 Gg

TPM also released in year due to residue burning (Jain *et al.*, 2014). Ash production due to burning of crop residue decreases effectiveness of applied herbicides in burnt plot because burnt residue absorbs the herbicide (Ramusseen & Smiley, 1989).

B. *In-situ* incorporation

Crop residue can be incorporated in the soil with tillage before sowing of succeeding crop. However, their decomposition is highly influenced by soil properties, temperature and moisture regime. Immobilization of N in crop residue by soil microbes during decomposition leads to decline in availability of N. Under water logged conditions decomposition of crop residue leads to the formation of volatile acids (acetic and propionic acid), which can be phytotoxic. Besides the C: N ratio, other biochemical characteristics like initial N concentration, lignin, polyphenols and soluble C compound present in residues are also the key indicators of decomposition.

Similarly method of placement also affects the rate of decomposition of crop residue and nutrient release. Yadvinder-Singh *et al*. (2010) described the rice residue decomposition by first-order exponential. According to them incorporated rice residue lost about 80% of its initial mass at the end of decomposition cycle (140 days), leading to a decomposition rate (k) of 0.21-0.24 day^{-1} that was about three times as fast as that in the surface-placed residue (0.078 day^{-1}). About 50-55% of the rice residue placed at the soil surface not decomposed at the time of wheat harvest. Soil incorporation of crop residue is beneficial in recycling of nutrients. But residue having high C:N ratio needs to be corrected by applying extra fertilizer N at the time of residue incorporation during initial years until the required pool of N in soil not maintained.

Further, size reduction of crop residue is also the option to hasten the rate of decomposition. The smaller the size of crop residues, the greater the surface area for microbes to act more efficiently. Most crop residues need some kind of shredding or chopping for convenient incorporation in the soil and proper microbiological decomposition; such as rice straw, sugarcane trash, sunflower and safflower stover *etc*. At the same time, effective mechanical means to accomplish this task is required in order to make plant residue recycling a popular practice.

A crop grown immediately after the incorporation of residues suffers from N deficiency caused by microbial immobilization of soil and fertilizer N in the short term. The duration of net N immobilization and the net supply of N from crop residues to a subsequent crop depend upon decomposition period prior to planting next crop, residue quality, and soil environmental conditions. Hence for proper management of soil incorporated crop residues, the type (decomposition rate) and quantity of crop residue, nutrient requirement of subsequent crop, available nutrient in soil and soil moisture need to be consider.

Das *et al*. (2001) in his two year study observed that incorporation of either rice or wheat crop residue to rice field in rice-wheat sequence cropping positively affects the bulk density, hydraulic conductivity, CEC, organic carbon and available NPK status of soil. Kachroo and Dixit (2005) found that recycling of residues significantly increase the soil microbial count over no residue incorporation. They also reported that addition of biological decomposer (*Trichoderma viride*) and or N along with residue hasten the rate of decomposition and reduce the immobilization of nutrients and improve its availability in short span of time.

C. Compost from crop residues

Composting is the biochemical breakdown of organic substances to humus like substance with narrow C: N ratio, less bulky and comparatively stable than the parent compound. In situations, disallowing adequate decomposition period for the soil incorporated residues; the residues should be managed through composting during the crop season. The rate of composting is faster in crop residue having low (< 30) C: N ratio (Yadav *et al*. 2005). Sarma *et al*. (2013) reported that composting of crop residues for 90-100 days considerably reduced C: N ratio and make it feet for application in intensive cropping system where period between sowing windows of two crops is less. Further, composting makes the crop residue a important source of N and replace fertilizer N to considerable extent and thus reduce farmers expenditure.

D. Crop residue as surface mulch

The reflectivity of heat and water transmission characteristics of mulched soil are quite different than its bare counterpart. Proper use of crop residue is an effective mean for reducing runoff, erosion, nutrient loss and transport of sediment to stream. The beneficial effect of crop residue mulch on soil moisture and temperature changes, influences different plant process like seed germination, seeding emergence and root growth which in turn determine growth and yield of crops and farmers income. Rana *et al*. (2006) found that application of FYM @ 5 t/ha + Dust-mulch + Straw mulch to maize + green gram intercropping system increased the maize equivalent yield by 25.43 per cent over no mulch condition. Similarly, Gupta and Bhan (1997) reported that application of paddy straw as mulch @ 3 t ha^{-1} to maize in maize-mustered sequence, significantly increased the yield of both maize and mustered.

Adequately managed residue

Adds organic matter, which improves the quality of the seedbed and increases the water infiltration and retention capacity of the soil. Fixes carbon by capturing carbon dioxide from the atmosphere and retaining it in the soil. Buffers the pH of the soil and facilitates the availability of nutrients. Feeds the carbon cycle of the soil. Captures the rainfall and thus increases the soil moisture content, protects the soil from being eroded and reduces the evaporation of soil moisture.

Badly managed Residues

Provoke an unequal drying of the soil and thus a delay in the warming-up of the seedbed or uneven germination of the crop. Interfere with sowing, fertilizing activities and hinder the emergence of seedlings.

CONCLUSION

Crop residue are important source of nutrients and has fertilizer replacement potential to considerable extent if properly managed beside its positive effect on soil physical, chemical and biological properties and environment. Crop residues, either partly or entirely should be used for resource conservation for ensuring the country's food security, making agriculture sustainable, soil resource base healthy and raise farmers income.

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IMMUNOSUPPRESSIVE DISEASES OF POULTRY: A THREAT TO POULTRY INDUSTRY

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Poultry in an environment of production can be exposed to different infectious diseases or non infectious agents that impair the immune status and thus erode general health and welfare, and reduce their genetic and nutritional potential. Innate immunity can be affected by different physiologic events related to hatching and to environmental factors during the initial stages of life like ammonia exposure, foodborne mycotoxins, and suboptimal nutrition etc. Infectious bursal disease (IBD), chicken infectious anemia (CIA), and Marek's disease (MD) are major infectious diseases that increase susceptibility to viral, bacterial, and parasitic diseases and interfere with acquired vaccinal immunity. Enteric viral infections can be accompanied by atrophic and depleted lymphoid organs, but the immunosuppressive features are modestly characterized. Some reoviruses cause atrophy of lymphoid organs and replicate in blood monocytes. Other virulent fowl adenoviruses have immunosuppressive capabilities. Newcastle disease can damage lymphoid tissues and macrophages. Concurrent infection with avian pneumovirus hinders the mucociliary functions of the upper respiratory tract and increases the opportunistic bacterial pathogens. Identification of immunosuppression involves detection of specific diseases using various diagnostic tests such as serology, etiologic agent detection, and histopathological procedures. Controlling spread of immunosuppressive diseases in poultry farms can be achieved mainly by minimizing stress, reducing exposure to infectious agents through biosecurity, and increasing host resistance to infectious immunosuppressive diseases by vaccination (Hoerr, 2010). Apart from these short term measures genetic selection for resistance to immunosuppressive diseases can be practiced against all infectious agents and it has been found useful in reducing Marek's Disease outbreaks.

INFECTIOUS BURSAL DISEASE

Infectious bursal disease is a highly contagious disease which affectsthe immune system of young chickens. Infectious Bursal Disease Virus (IBDV) belongs to Birnaviridae family and causes the destruction of the lymphoid organs in particular the bursa of Fabricius, where B lymphocytes mature and differentiate. The target cell of the virus is the B lymphocyte in an immature stage, and the infection, when not fatal, causes an immunosuppression (Sharma *et al.*, 2000).Mortality usually begins on the third day of infection, reaches a peak by day four, then declines rapidly, and the surviving chickens recover a state of apparent health after five to seven days. The severity of disease relies on the age and breed sensitivity of the birds, the virulence of the affected strain, and the degree of passive immunity. In acute infection, the birds are exhausted, prostrated, dehydrated, suffer fromdiarrhea, and feathers are ruffled. Although the other lymphoid organs are affected the principal target of the virus is the bursa of Fabricius, which is the reservoir of B lymphocytes and the viral infection causes cytolysis of actively dividing B cells in birds. Due to high mutation rate Infectious bursal disease virus may give rise to viruses of modified antigenicity with increased virulence subsequently. Interference by parental antibodies in vaccinated birds has reduced the efficacy of the control programmes in poultry industry.

CHICKEN INFECTIOUS ANEMIA

Chicken Infectious Anemia Virus (CIAV) is a Gyrovirus belonging to the Circoviridae family and is extremely resistant to disinfectants and can withstand temperatures of 80°C (174°F) for 15 minutes. CIAV impairs the thymus activity thus affects immune status in young chickens and cause major production losses in broiler industry. The infection occurs naturally when breeder flocks without any previous exposure to CIAV become infected just before or during egg production (Dhama *et al.*, 2008). CIAV is transmitted vertically to next progeny under these circumstances and develop the disease symptoms, including atrophy of thymus, hemorrhages and "blue wing disease", from 10-14 days of age (Wani *et al.*, 2014). CIAV can also spread horizontally to broiler progeny of immune broiler breeders if environment becomes contaminated. Both clinical and subclinical CIAV infections remarkably affect the performance and profitability of commercial broilers. CIAV infections flares up other secondary infections and increase the losses (McNulty *et al.*, 1991). Chicken infectious anemia in modern times is largely controlled by exposing the hens to CIAV prior to the onset of lay. The hen develops antibody to CIAV that is transferred to subsequent chicks and protects them, even though the hen may continue to shed CIAV through the reproductive tract.

MAREK'S DISEASE

Marek´s disease, a multifaceted disease most widely recognised by the induction of a rapid and extensive malignant T-cell lymphoma is caused by highly oncogenic alphaherpesvirus that causes high economic losses in poultry production. Besisde

acute death or extensive tumor formation, this virus induces immunosuppression thus increasing the susceptibility of chickens to other pathogens (Biggs and Nair, 2012). The sequence of various events after infection with an oncogenic MDV in susceptible birds can be divided into the following stages; a) early cytolytic infection, b) latent infection, c) late cytolytic infection with immunosuppression, and d) neoplastic transformation. Marek's Disease Virus (MDV) replicates in chicken lymphocytes and establishes a latency infection within $CD4^+$ T cells and results in immunosuppression (Payne and Venugopal, 2000). Besides being an issue of animal health and welfare, it increases the need for treatments and also for the frequency of vaccination against multitude of pathogens, as MDV infection was shown to strongly reduce vaccine responses against other viruses. Prevention of MD involvesthe vaccination with monovalent or multivalent live virus vaccines belonging to various species or serotypes. Vaccines are administered as injections either during the hatch or, increasingly, in ovo at 17–19 days of incubation.

REOVIRUS INFECTION

Among the variety of disease conditions which are caused by avian reovirusesin chickens the most important is viral arthritis/tenosynovitis which is predominantly a disease of broilers and is an important cause of leg weakness and lameness due to swelling of one or both hock (tibiotarsal-tarsometatarsal) joints, which are main load-bearing joint in the birds. The condition is more common in the birds of sixteen weeks of age, with a higher incidence among birds of approximately seven weeks of age. Morbidity is variable but usually below 10% and mortality is low. Affected joints are swollen and inflamed and in the most severe cases, rupture of the gastrocnemius tendon and erosion of the articular cartilage occur. Reovirus infection in chickens does not compromise the functional capabilities of T-cells, but induces suppressor macrophages that inhibit T-cell function and lead to immunosuppressive effect because reoviruses can replicate in monocytes but not in lymphocytes (Pertile *et al.*, 1996).

RETROVIRUS INFECTION

Retroviruses (REV) cause syndromes such as leukaemia, acquired immunodeficiency syndrome and neurodegenerative disorder in birds (Nakamura *et al.*, 2014). Avian leukosis virus and reticuloendotheliosisvirus avian species cause various problems such as tumours, immunosuppression with reduced productivity, and other production related problems in affected birds.The myeloblastosis straininduces theosteopetrosis caused atrophy of lymphoid organs, and reduced macrophage function and bacterial clearance, whereas erythroblastosis strain cause thymus atrophy and decreased T-cell functions (Payne and Nair, 2012).Reticuloendotheliosis virus (REV) causes a number of disease syndromes in poultry like 1) Runting disease syndrome involving atrophy of bursa of Fabricius and thymus resulting in cellular and humoral immunosuppression, 2) Chronic lymphoid neoplasms which involves lymphoid organs and 3) Acute reticulum cell neoplasia (reticuloendotheliosis) occurs due to defective strain of REV which is highly oncogenic, inducing a widespread proliferation of primitive mesenchymal or reticuloendothelial cells (Payne and Venugopal, 2000). Vaccines are not used against REV infection and no genetic resistance to infection has been recognized for control measures.

ENTERIC INFECTIONS

Enteric diseases tend to predominantly affect young birds, however, they may occur in all age groups, which increases susceptibility to other diseases, decreases feed conversion efficiency and prolongs the time to market. Viral enteritis syndromes in chickens and turkeys (runting stunting syndrome (RSS); poultry enteritis and mortality syndrome (PEMS)) involve one or more etiologic viruses, and contributing management issues, such as short down time between flocks (De Wit *et al.*, 2011). Astrovirus, rotavirus, parvovirus and others have been identified in young broilers (aged seven to 14 days) and young turkeys exhibiting the signs of diarrhoea and growth reduction, although pathogenesis is not known. Interference with normal feeding behaviour and interrupted nutrition could contribute to atrophy of the lymphoid tissues. Hepatotoxic effects of certain toxins contribute to immunosuppression in affected chicks. Lymphocyte depletion in lymphoid tissues occurs in turkeys with PEMS (Jindal *et al.*, 2010). Turkey enteric coronavirus is associated with PEMS and turkeys inoculated with coronavirus and E. coli cause necrosis of lymphocytes and their depletion in the bursa. Thymus atrophy with lymphocyte necrosis and depletion of lymphoid organs, and corresponding reductions in lymphocyte subpopulations in circulating blood is associated with PEMS, and it occurs in turkeys inoculated with Astrovirus. Infection of chickens and turkeys with parvoviruses may have a role in naturally occurring enteric infections.

OTHER DISEASES

Among other viruses of chickens New Castle Disease virus causes necrosis and depletion of lymphocytes from lymphoid organs, and apoptosis of peripheral blood lymphocytes and mononuclear cells, that increases the susceptibility to secondary

bacterial infections. Avian Pneumovirus impairs the protective clearance mechanism of upper respiratory tract of birds by replicating and causing cytopathology in the upper respiratory epithelial cells. The mechanism of immunosuppression appears to affect innate respiratory immunity primarily than acquired immunity. Pneumovirus infection increases the bacterial infection of the lung and air sacs, and worsens the condition of birds (Hoerr, 2010). Chickens with pneumovirus infections become more susceptible to E. coli and Ornithobacteriumrhinotracheale (Majo *et al.*, 1997). This can manifest as swollen head syndrome with rhinitis, sinusitis, facial cellulitis and edema, and inflammation of the cranial air spaces. E. coli infections alone can cause the depletion of lymphocytes from bursa and thymus in affected chickens (Hoerr, 2010).

Certain non infectious agents also lead to immunosuppression in the birds like feed imbalance (deficiency of Vitamin E, A and C), presence of certain mycotoxins (Aflatoxin B1, Ochratoxin A and Trichotecene mycotoxins), increase ammonia content in the poultry house and stress due to change in climate, transportation etc. (Glaser & Kiecolt-Glaser, 2005). These factors alone may be responsible for immunosuppression, but most of the time several of them may act synergistically (Hoerr, 2010).

CONCLUSION

In recent scenario, MD, IBD and CIA are three major diseases in poultry which causes immunosuppression. MD outbreaks are under control by the use of vaccines. However, controlling IBD and CIA infections in poultry flocks is still a big challenge due to their subclinical nature and areusually detected along with other secondary infections during diagnosis. Characterization of the new emerging immunosuppressive agents (e.g. enteric viruses), their pathogenesis single and/or in combination and methods for prevention and control should be the future target.Strategies to control immunosuppression in broilers and commercial layers are largely based on vaccination programs for breeders and broiler progeny, management to minimize stress during rearing, genetic selection for resistance against opportunistic pathogens and strict biosecurity measures.

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MANAGEMENT OF INSECT PESTS OF RICE IN MEDIUM LAND IN PALAMAU REGION OF JHARKHAND

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Rice cultivation is supposed to exist from 7000 years ago in the Chang Jiang delta of China. It requires high temperature 27-30°C and high rainfall about 1000 mm. Ninety percent of the world's rice is grown in East and South Asia. Rice is principle food crop half the population of the world. Thailand and Myanmar are the traditional leader in rice exports in the world.

Rice (*Oryza sativa* L.) is the major staple food in Asian country including India and Jharkhand. Rice particularly in India remains on the lower side due to many abiotic and biotic constraints (Behura et.al. 2011).Insect pests attack the rice crop from the time nursery bed is prepared until harvest. The pest incidence occur least on early transplanted rice as compared to late transplanted. Rice is attacked by more than one hundred insect pests, and twenty of them cause economic damage (Pathak, 1977; Arora and Dhaliwal, 1996).rice is mainly grown during the kharif season in Palamau region of Jharkhand. The major insect pests that cause significant yield losses in India and Jharkhand are rice stem borer, leaf hoppers, plant hoppers, leaf folder, gall midge, hispa, gundhi bug, green leaf hopper, case worm and army worm. Hoppers cause direct damage as well as transmit viruses also. The yellow stem borer (*Scirpophaga incertulas*, Walker) Lepidoptera; Pyralidae is generally considered the most serious pest of rice worldwide, occur and infest plants from seedling stage to maturity. It is reported throughout India and is consi It is the predominant species in many countries including India and Jharkhand. Scirpophaga incertulas is also major pest of deep water rice in eastern India, Bangladesh and Thailand causing more than 20 % yield loss in many fields. Twelve percent of pesticides sold worldwide are applied to rice crop, no other single crop accounts for as much pesticide use (Wood burn, 1990).

Major pests of rice in India and Jharkhand

Common Name	Scientific Name	Family	Order
Yellow rice stem borer	*Scirpophaga incertulas*	Pyralidae	Lepidoptera
White rice stem borer	*Scirpophaga innotata*	Pyralidae	Lepidoptera
Striped rice borer	*Chilo suppressalis*	Pyralidae	Lepidoptera
Dark headed rice borer	*Chilo polychrysus*	Pyralidae	Lepidoptera
Pink borer	*Sesamia inferens*	Noctuidae	Lepidoptera
Green Leaf hopper	*Nephotettix virescens*	Cicadellidae	Hemiptera
Zigzag leaf hopper	*Recilia dorsalis*	Cicadellidae	Hemiptera
White rice leaf hopper	*Cicadella spectra*	Cicadellidae	Hemiptera
White backed plant hopper	*Sogatella furcifera*	Delphacidae	Hemiptera
Brown plant hopper	*Nilaparvata lugens*	Delphacidae	Hemiptera
Green stink bug	*Nezara viridula*	Pentatomidae	Hemiptera
Rice bug	*Leptocorisa acuta*	Coreidae	Hemiptera
Rice grasshopper	*Hieroglyphus banian*	Acrididae	Hemiptera
Whorl maggot	*Hydrellia philippina*	Ephydridae	Diptera
	Leaf feeder		
Rice gall midge	*Orseolia oryza*	Cecidomyiidae	Diptera
Rice case worm	*Nymphula depunctalis*	Pyralidae	Lepidoptera
Rice leaf folder	*Cnaphalocrocis medinalis*	Pyralidae	Lepidoptera
White leaf hopper	*Cofana spectra*	Cicadellidae	Hemiptera
Rice hispa	*Diladispa armigera*	Chrysomelidae	Coleopera
	Root Feeder		
Rice root weevil	*Echinocnemus oryzae*	Curculionidae	Coleopera
Rice root aphids	*Tetraneura nigriabdominalis*	Aphididae	Homoptera

Major insects becoming less important in India :

Rice stem borer, Swarming caterpillar, Brown planthopper, Rice gall midge

Minor insects becoming more important in India :

Whitebacked planthopper, Rice leaffolder, Rice root weevil, Rice bug, Rice whorl maggot, Rice hispa, Rice case worm

Integrated approach for management of insect pests of rice in Jharkhand and India :

Selection of Varieties : Rice varieties should be selected as resistant to major insect paste and diseases. If multiple resistant varieties are not available, local variety resistant or tolerant should be selected to most severe pest of the area.

In absence of resistant or tolerant, early-maturing varieties should be selected for cultivation. It may escape the damage of late coming pests.

The resistant/tolerant varieties of rice against major insects and diseases are mentioned in tabular form as below :

Resistance/Tolerance varieties of rice suitable for cultivation of Jharkhand and India

Variety	Duration (days)	Released & Notified	Productivity (Q/ha)	Resistance/ Tolerance (against)	
				Insects	Diseases
Sahbhagidhan	100	2008 & 2011	38-45	SB, LF	LB, BS,SR
Kamesh	110	2008	30-35	GM, WBPH, SB, LF	BS, B
Vandana	90-95	1992 & 2002	35	-	B & BS
Satyabhama	105-100	2012	28-47	HSB, LF, WM, WBPH, BPH, GM, RH, RT	LB, RTV
Pyari	115-120	2011	40	YSB, LF	LB, NB, BS, B
CR Dhan 201	110-115	2012	38	SB, LF, WM, RT	LB, SR
CR Dhan 202	110	2012	37	SB, WM, RT	LB, BS, SR
Satabdis	120	2000	40-50	-	BLB, SB, SR
Naveen	115-120	2005 & 2006	40-50 in Kharif 50-60 in Rabi	SB	B, BS
Rajalaxami	125-135	2005-2006	70-75	SB, BPH, WBPH, GM	LB, BLB
Ajay	125-135	2005 & 2006	70-75	SB, BPH	B, RTV, BLB
Satya Krishna	135	2008 & 2011	50-60	GM, LF, YB, BPH, WBPH	LB, SR, RTV, BS, SB
Improved lalat	130	2012	45-50	GM, SB	BLB, LB, SR, RTV
Improved Tapaswini	130	2012	40-50	BPH, SB	BLB
Chandan	125	2008	55-60	YSB	B, BLB, SB
Swarna Sub-1	143	2009	50-55	All insects	All disease
Durga	155	2000	45	BPH	BLB, SR
Varshadhan	160	2012	33	WBPH	NB, BLB, SR
CR Dhan 500	160	2012	33	RT, LF, GM, XSB	LB, NB
Jayantidhan	160	2011 & 2012	46	XSB, LF, WM, RT	SBB, SR, RTV
CR Sugandha Dhan 907	150	2012 & 2013	45-50	GM, XSB	NB,SR
Purnabhog	140-145	2012	45-50	GM, YSB	NB,SR
Jaldi Dhan-13	90-95	2006	60	Tolerance against major insects and diseases	
PNR-546	110	2006	66		

* YSB-Yellow stem borer, GM - Gall midge, LF-Leaf folder, BPH -Brown Plant hopper, SB-Stem borer, WBPH-Whitebacked plant hopper, RT-Rice thrips, RH-Rice hispa, WM-Whorl maggot, BLB-Bacterial leaf blight, LB-Leaf blast, SR-Sheath rot, RTV-Rice Tungro Virus, BS-Brown spot, SB-Sheath blight, NB-Neck blast.

Raising Insect free nursery : Nursery should be raised away from light source. Nursery beds should be prepared with smaller width so that insects or their egg mass could be detected by sitting on the bunds and destroyed mechanically.

Transplanting at right time : Transplanting of seeding at recommended time for the area have been found very effective in reducing the menace of stem borer. Staggered planting help insects to multiply fastly due to availability of favorable stage of crop for longer duration.

Cultural control

The Wide spread practice of clipping the seedlings before transplanting greatly reduces the carryover of eggs from the seed bed to the transplanted fields.

This method is effective only when older seedlings are transplanted.

Optimal rates of application of Nitrogenous fertilizer in split doses should be applied.

In case of rice bug, weed sanitation and eradication of alternate hosts should be done.

Staggered planting should be avoided.

Early-maturing varieties should be selected.

Very early or vary late planting should be avoided.

Biological control

Most biological control of stem bore in India comes from indigenous predators, parasites and entomopathogens. The most common egg parasitoid is Trichogramma japonicum

Five to six releases of egg parasitoid, Trichogramma japonicum @ 1, 00,000 adult parasites per hectare starting from 15 days after transplanting, in a crop season is effective and economical also.

The adult moths are attacked by several spiders while resting on foliage or are caught in webs while flying. Dragon flies and birds are also effective daytime predators, bats are active at dusk.

Chemical control

Before sowing apply fipronil 0.3 G @ 25.0 Kg/ha in the soil. When ETL reaches up to 5-10 % dead heart in vegetative stage, 5 % chaffy earhead per square meter in reproductive stage or one adult/egg mass, spraying should be applied with chlorpyriphos @ 2.0 ml/L. of water twice at 10 days interval.

Dipping the seedling root in 0.02% chlorpyriphos + 1% urea for 4 hours also protect it from stem borer.

Seed soaking in 0.05% imidacloprid emulsion before sowing followed by nursery drenching with imidacloprid emulsion @ 75 g a.i./ha 5 days before pulling seedling or

Drenching with emulsion of fipronil @ 100g or thiomethoxam 75 g a.i./ha 5 days before uprooting of seedlings is known to check the infestation several insects in nursery and early stage.

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POLLINATION BIOLOGY, REPRODUCTIVE SUCCESS AND DORMANCY STUDIES IN AFRICAN SPIDER PLANT OR CAT'S WHISKER (*GYNANDROPSIS PENTAPHYLLA*) (CAPPARACEAE) AND ITS POTENTIALITY IN PHARMA INDUSTRY AND FUNDAMENTAL SCIENCE

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African Spider Plant (*Gynandropsis pentaphylla* (L.) Brig.); syn to *Cleome gynandra* (L.) Brig., Capparaceae member is an emerging eukaryotic plant with immense fundamental research potentialities surpassing several areas such as population ecology; seeds germinate following first rains in most areas and colonize earliest. In almost a fortnight, it starts flowering and disappear in about two month's period. In fact, the seeds which are dispersed to soil are viable and dormant up to 8 months. Temperature dependent dormancy has been hypothesized which needs substantiation. However, preliminary studies on dormancy indicated that older seeds germinate better (70%) as against fresh seeds (20%). Fresh seeds (2 months) proved to possess more physiological dormancy when compared with the older seeds (12 months). The fresh seeds also showed a much erratic pattern of germination. These seeds were primed with different treatments. The treatments to successfully break dormancy in fresh seeds of *Gynandropsis pentaphylla* were; GA_3 (250ppm), Ethrel (50ppm and 100ppm) and water. For matured seeds, a higher germination percentage was obtained when the seeds were primed with KNO_3 (0.1 and 0.2%), GA_3 (50 and 250ppm), H_2SO_4 (30 mins) and oven (12 hours). Seed dormancy linked to pollination; self or cross can have a dramatic influence on the survival of the species. Intriguingly, owe to such a behaviour, it was anticipated that the seeds of *Gynandropsis* must possess antifungal property to safeguard the seeds in the soil. Interestingly, out of 45 plant extracts tested on yeast, the seed extracts of *Gynandropsis* have given maximum inhibition upholding the hypothesis. Further, a 20 KD protein was isolated; it is believed that it has a high utility in pharmacology more precisely in preparation of ointments against skin diseases. The sequencing of the protein is in progress with a hypothesis of isolating geographical variant which has best inhibition.

In Pollination Biology, it serves as a unique model of pollination system where the plant tries to exploit selfing and crossing by altering the sex expression in flowers producing bisexual first than males than protogynous again followed by male flowers, spatial and temporal sequence, thus creating two clear zones of pod bearing of which the basal pods arise due to autogamy while the upper zone pods arise from allo/xenogamy thus exploiting selfing first followed by siring through xenogamy at a later stage in a temporal mode. Stressed plants exhibit an altered pattern of emergence of flowers where bisexual homogamous flowers proportion will reduce followed by unisexual male flowers; the protogynous flowers will disappear completely. This further clarify that the seeds are set through only autogamy. Probably this is the reason that plants, in a locality, are uniform hence it is believed that they might have originated through selfing. Additionally, these plants are associated absolutely with human habitats; the reasons are obscure. But requirement of some microorganisms which are found/associated with human waste or sewage cannot be precluded. The adaptive significance can be realized through reproductive assurance and also linked to dormancy. For instance, autogamous seeds help in continuity of the generation but those that arise due to xenogamy shall increase the variability. Our study showed that the flowers in *G. pentaphylla* open in the evening at around 17:00 hours up until the early morning hours. The plant is pollinated predominantly by wind, but it is also pollinated by insects, which include: the Apis cerena indica (honey bee) and anthophorid bee, which visit both the anther sand petals of the flowers. Flower manipulative experiments indicated that the selfing flowers may not be solely dependent on self pollen, but there is, to some extent, a possibility of geitenogamy or even xenogamy, which could be further investigated. And from comparisons of the reproductive success components a germination media with 15% sucrose concentration was found to be optimum for pollen germination, while there was no difference between the pollen from the different mechanisms, also with the pollen deposition patterns on the stigma of different flowers. Even though the protogynous mechanism may have had a higher success rate in terms of pod formation, but the number of seeds per pod produced by the selfing mechanism was a threefold when compared to those produced by the protogynous mechanism. Using SSR primers, it was established that the seeds produced in basal zones arise due to autogamy while upper zone are due to xenogamy. However, the dormancy linked to selfing and crossing is poorly understood; nevertheless the fresh seeds are dormant while older seeds are less dormant has been established. One of the hypotheses that are being tested is the level of dormancy between seeds sired through autogamy *vs* xenogamy as a survival strategy; crossing induces seed dormancy than selfing or *vice versa*. Intriguingly, the differential

sex expression patterns, in a temporal way, can also serve a good model for molecular study in the form of SAGE: Sequential Analysis of Genome Expression which can have a high significance in understanding male sterility systems in crop plants.

Except stem, most parts (leaves, tender pods, roots, flowers and whole plants) have several medicinal properties such as anti-inflammatory, anti-cancer, anti-fever, anti-malarial, anti-HIV, anti-bacterial, anti-mycotic/fungal, anti tick, anti-mosquitoes and anti-insecticidal *etc. Gynandropsis pentaphylla* is known to have many medicinal properties and is known to produce several compounds such as alkoids, flavanoids, sugars, amino-acids, steroids, sapponins and essential oils which are of high value in both folk and traditional medicine. In fact, the anti-mycotoxin/fungal, anti bacterial, anti insecticidal properties shall have usage in Agriculture to solve problems of crops by transferring the genes conferring resistance against bacterial/fungal diseases. On the other hand the anti tick property can have application in veterinary science while anti mosquitoes property can be used in community health care.

Nutritionally it has high levels of ß-Carotene and Vitamin C and moderate levels of Calcium, Magnesium, iron, Zinc. The plant contains high crude protein, lipids and phenolic compounds. The amino acid profile of spider plant is better than groundnut owing higher content of all amino acids. Even the trypsin inhibitor activity is low (0.45 and 0.32 µg/mg dry weight of plant respectively before and after boiling for 5 min) compared with the soybean (1.32 and 1.03 µg/mg dry weight). Another very interesting fact about spider plant is that it retains Vitamin C even after cooking; the reason is obscure. One possibility could be the enzymes responsible in Vitamin C metabolic pathway could be heat stable. Human body has an antioxidant defence system that is believed to be strengthened by antioxidant –rich-diets. ß-carotene (pro-vitamin A caretonoids) and Vitamin C which are high in Spider plant can contribute to the total dietary antioxidant capacity if it is supplemented with human diet more so infants, lactating and pregnant women.

The expected utility of *Gynandropsis* would be in its intrinsic ability of C_4 pathway belongs to the NAD-ME C_4 subtype and drought resistance nature. Intriguingly, ***Gynandropsis*** or ***Cleome*** is the closely related genus to *Arabidopsis thaliana* that is known to contain C_4 species and a few *Cleome* species also are of C_3 and some that appear to be intermediate between the two forms of photosynthesis. In addition, it is genome size of *Gynandropsis* and *Arabidopsis* are almost same; phylogenetically closely related. In the light of new sequencing technologies, it is expected to generate insight into C_4 photosynthesis; functional analysis will still be needed to validate candidate genes. Even transformation system, in a C_4 plant like *Gynandropsis pentaphylla,* has already been reported hence the possibility of gene transfer underlying C_4 photosynthesis machinery has increased because it would allow gene transfer precisely candidate genes to be over-expressed, silencing and knocked down. It would also allow meaningful comparative analysis of genes and proteins recruited into C_4 photosynthesis in both *A. thaliana* and a closely related C_4 plant. This will help to determine how gene expression and protein functions have altered during the evolution of the C_4 pathway.

With advent in genome sequencing, reduction in cost it is expected that whole genome sequencing of *Gynandropsis pentaphylla* and its closely related species can throw light on isolation of candidate genes responsible for anti fungal, anti bacterial, anti tick, anti insecticidal in addition to C_4 path ways. Comparison of genome sequences with cereals, pulses and oil seeds can also throw light on proteomics, metabolomics and transcriptomics through bioinformatics.

ROLE OF BIOTECHNOLOGY TO COMBAT AGAINST DIFFERENT ABIOTIC STRESSES

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At present, climatic changes aggravate the conditions of growth less favorable. These developments will result in a significant increase in problems caused by biotic and abiotic stresses, which will inevitably limit yield levels. One way out will be improvement of cultivars. Breeding programmes are currently set up to meet the new challenges. In this context, application of plant breeding in association with molecular biology and biotechnology offer great opportunities for improvement of Indian agriculture. The developments in plant molecular biology and biotechnology including tissue culture have been inspiring in the last three decades. Unravelling the genomes of Arabidopsis and several other crops, the ability to decode various genetic networks under different circumstances and the advent of New Generation Sequencing (NGS) technologies have opened up totally new avenues for enhancing genetic potential of crop varieties. Molecular marker aided breeding has resulted in improved varieties in several crops though Marker Assisted Selection. Recent advancements in the field of genomics, transcriptomics, proteomics and bioinformatics promise touchable solutions towards increased oil, nutritional and livelihood security. Intelligent use of these technologies are likely to help in the identification of genes and genomic regions responsible for governing various traits of agronomic and commercial importance which can be harnessed for improved crop productivity and protection.

PRIME ABIOTIC FACTORS

Abiotic stress is a broad term, which includes multiple stresses such as heat, chilling injury, excessive and low light, drought, flooding, wounding, ozone exposure, UV-B irradiation, osmotic shock, salinity, acidity, fog and frost. It has been estimated that only 10% of arable land can be classified under the non-stress category, which implies that crops grown on the other 90% of arable lands experience one or more environmental stresses. Some of these stresses like drought, extreme temperature, and high salinity dramatically limit crop productivity. The prediction is that water deficits will continue to be the major abiotic factor likely to affect crop yields globally. On the other hand, water logging due to a combination of unfavorable weather conditions and suboptimal soil and irrigation techniques can result in severe yield losses. To face the threat represented by these stresses several genetic improvement strategies are available, from classical breeding to a more direct physiological genetic approach. However, only with an understanding of the mechanisms underlying a specific stress, will the later strategy be feasible. In general for the stresses mentioned above, low yields in developing countries are primarily due to a lack of effective management practices, particularly the availability of resistant cultivars.

In this milieu, crop biotechnology is a authoritative device that has potential to contribute to sustainable agriculture. Biotechnology approaches such as tissues cultures, in vitro mutagenesis, genetic transformation and molecular breeding (MAS) can contribute to speed up classical breeding and overcome major problems such as lack of natural sources of resistance and sexual cross-incompatibility.

BIOTECHNOLOGICAL METHODS

Plant cell tissue and organ culture : In recent decades, the use of biotechnological techniques based on in vitro plant tissue culture and genetic engineering, has made possible for addressing the critical problems of crop improvement for sustainable agriculture. In vitro regeneration is a major tool in transgenic plant production, since advances in molecular genetics, e.g. gene over-expression, gene suppression, promoter analysis and TDNA tagging, require efficient transformation systems. Efficient tissue culture is therefore a vital step, required for both the validation and exploitation of data generated by these powerful molecular tools. Implementation of robust protocols for regeneration is therefore a necessary condition for both genetic transformation and other tissue-culture derived techniques to generate genetic diversity such as somaclonal variation, in vitro mutagenesis, doubled haploids culture and wide hybridization.

Somaclonal variation and in vitro mutagenesis : Tissue culture generates a wide range of genetic variation in plants, which can be incorporated in plant breeding programmes. Somaclonal variation is defined as the genetic and phenotypic variation among clonally propagated plants of a single donor clone. It is well known that genetic variations occur in undifferentiated cells, isolated protoplasts, calli, tissues and morphological traits of regenerated plants. The cause of variation is mostly

attributed to changes in the chromosome number and structure. Generally, the term somaclonal variation is used for genetic variability present among all kinds of cells/plants obtained from cells cultured in vitro.

Plants regenerated from tissue and cell cultures show heritable variation for both qualitative and quantitative traits. Somaclonal variation caused by the process of tissue culture is also called tissue culture-induced variation to more specifically define the inducing environment. The occurrence of uncontrolled and spontaneous variation during the culture process is an unexpected and mostly undesired phenomenon when plants are micropropagated at the commercial scale. However, apart from these negative effects, its usefulness in crop breeding through creation of novel variants has been extensively reported. Induced somaclonal variation can be used for genetic manipulation of crops with polygenic traits. The new varieties derived from in vitro tissue culture could exhibit disease resistance and improvement in quality as well as better yield.

Somaclonal variants can be detected using various techniques which are broadly categorized as morphological, physiological biochemical and molecular detection techniques. There are two main approaches for the isolation of somaclonal variants: screening and cell selection. Screening involves the observation of a large number of cells or regenerated plants for the detection of variant individuals. Mutants for several traits can be far more easily isolated from cell cultures than from whole plant populations. This is because a large number of cells can be easily and effectively screened for mutant traits. Screening of as many plants would be very difficult, ordinarily impossible. Mutants can be effectively selected for improvement of nutritional quality, adaptation to stress conditions, e.g., saline, soils, low temperature, toxic metals, resistance to herbicides and to increase the biosynthesis of plant products used for medicinal or industrial purposes. Screening has been profitably and widely employed for the isolation of cell clones that produce higher quantities of certain biochemical.

Many studies have reported that the in vitro culture or combined with mutagenesis, induced with physicochemical or biological agents, can be exploited to increase genetic variability and mutants, as a potential source of new commercial cultivars. In vitro culture environments can be mutagenic and plants regenerated from organ cultures, calli, protoplasts and via somatic embryogenesis sometimes exhibit phenotypic and/or genotypic variations. It is important to point that tissue culture increases the efficiency of mutagenic treatments and allows handling of large populations and rapid cloning of selected variants. The similarities of the effects induced by the stress in - the plant cultured in vitro and in vivo conditions suggest that the in vitro system can be used as alternative to field evaluations for studying the general effect of water-stress on plant growth and development. The most widely used method for the selection of genotypes tolerant to abiotic stress is the selection pressure technique. This is based on the in vitro culture of plant cells, tissues or organs medium supplemented with selective agents, allowing electing and regenerating plants with desirable characteristics.

In vitro selection makes possible to save the time required for developing abiotic stress tolerant lines. Mutants obtained from somaclonal variants can be effectively selected for tailoring salt tolerance/ resistant in many crop species. Screening has been profitably and widely employed for the isolation of cell clones that produce higher quantities of certain mutants. In the cell selection approach, a suitable pressure is applied to permit the preferential survival/growth of variant cells. Selection strategies have been successfully developed for the recovery of genotypes resistant against higher salt concentration and drought. When the selection pressure allows only the mutant cells to survive or divide, it is called positive selection. On the other hand, in the case of negative selection, the wild type cells divide normally and therefore are killed by a counter selection agent. The mutant cells are unable to divide as a result of which they escape the counter selection agent. These cells are subsequently rescued by removal of the counter selection agent. This approach has being done using a number of plant materials (callus, suspension cultures, somatic embryos, shoot cultures, etc.) which has been screened for variation in their ability to tolerate relatively high levels of salt in the culture media. Besides salt and drought, reports are also available for the development of plants tolerant to other abiotic stress (metal, chilling, UV and frost) through in vitro selection.

TRANSGENICS

Transgenic approaches are among the available tools for plant improvement programs based on biotechnological methodologies. Nowadays, many mechanisms and gene families, which confer improved productivity and adaptation to different abiotic stresses are known. These gene families can be manipulated into novel combinations, expressed ectopically, or transferred to species in which they do not naturally occur. Therefore, the possibility to transform the major crop species with genes from any biological source (plant, animal, microbial) is an extremely powerful tool for molecular plant breeding. To date, successes in genetic improvement of environmental stress resistance have involved manipulation of a single or a few genes involved in signaling/regulatory pathways or that encode, enzymes involved in these pathways (such as osmolytes /compatible solutes, antioxidants, molecular chaperones/osmoprotectants, and water and ion transporters. The disadvantage of this approach is that there are numerous interacting genes involved, and efforts to improve crop drought tolerance through manipulation of one or a few of them is often associated with other, often undesirable, pleiotropic and phenotypic alterations.

More efficient and reproducible regeneration and transformation protocols may be developed in major crop plants, which will facilitate transfer of useful genes. For development of transgenics resistant against various abiotic factors, isolation and characterization of novel genes from bacteria and higher plants, host mediated signal transduction in response to attack, study of physiological, genetic and molecular mechanisms underlying different abiotic stress tolerance, and identification, fine mapping and cloning of genes responsible for imparting abiotic stress (drought, heat and salinity) tolerance may be extended in future.

Development of transgenic plants using biotechnological tools has become another important in plant-stress biology. Previous works on genetics and molecular approaches have shown that most of the abiotic stress tolerant traits are multigenic. Therefore, to improve stress tolerance several stress related genes need to be transferred. More recently manipulation of single transcription factors has provide the same effect as manipulation of multiple genes. This has become a promising approach to get abiotic stress tolerant crops. To date, successes in genetic improvement of environmental stress resistance have involved manipulation of a single or a few genes involved in signaling/regulatory pathways or that encode enzymes involved in these pathways (such as osmolytes/ compatible solutes, antioxidants, molecular chaperones/osmoprotectants, and water and ion transporters. The plant hormone abscisic acid (ABA) regulates the adaptive response of plants to environmental stresses such as drought, salinity and chilling via diverse physiological and developmental processes. The ABA biosynthetic pathway has been deeply studied and many of the key enzymes involved in ABA synthesis have been used in transgenic plants in relation to improving abiotic stress tolerance. Transgenic plants over expressing the genes involved in ABA synthesis showed increased tolerance to drought and salinity stress. Similarly, many another mechanism involved in plant protection to osmotic stress associated to drought and salinity involves the up regulation of compatible solutes that function primarily to maintain cell turgor, but are also involved in avoiding oxidative damage and chaperoning through direct stabilization of membranes and/or proteins. Many genes involved in the synthesis of these osmoprotectants have been explored for their potential in engineering plant abiotic stress tolerance. The cellular and metabolic processes involved in salt stress are similar to those occurring in drought-affected plants and are responses to the osmotic effect of salt. As described above, the use of genes related to osmoprotectant synthesis has been successfully used in developing drought-tolerant crops and the transfer of glycine betaine intermediates have improved the drought and salt tolerance of transgenic plants in many cases. The amino acid proline is known to occur widely in higher plants and normally accumulates in large quantities in response to environmental stresses. The osmoprotectant role of proline has been verified in some crops by over expressing genes involved in proline synthesis. Other approaches successfully developed in a variety of crops to obtain abiotic-stress tolerant plants by transgenesis, have been manipulation of transcription factors (TFs), late embryogenesis abundant (LEA) proteins, and antioxidant proteins.

GENE EXPRESSION

As already mentioned, the efficiency of both MAS and transgenic approaches will be improved by using the information from gene expression studies. Understanding the mechanisms employed by plants to defend themselves against stresses and a more complete knowledge about the genes involved, will allow a more precise use of MAS and transgenic. Sequence information, while valuable and a necessary starting point, is insufficient to answer questions concerning gene function, regulatory networks and the biochemical pathways activated in response to stresses. To address these questions, more comprehensive approaches, including quantitative and qualitative analyses of gene expression products are necessary at the transcriptomic, proteomic, and metabolomic levels.

FUNCTIONAL ANALYSIS

To date the completion of the many plant genomes including mustard have been achieved and the genome of some other plant sequencing projects is underway. The traditional pursuit of a gene starting with a phenotype (forward genetics), has given way to the opposite situation where the gene sequences are known but not their functions. The challenge is now to decipher the function of the thousands of genes identified by genome projects, and reverse genetics methodologies are key tools in this endeavor. The ability to knockout genes or suppress their expression are powerful tools to determine the function of a gene. This can be done by anti-sense RNA suppression, targeted gene replacement, insertional mutagenesis, gene silencing and targeted-induced local lesionin genome (TILLING) approaches. Anti-sense RNA suppression requires considerable effort for any given target gene before even knowing whether it will be successful and targeted gene replacement i.e. via homologous recombination has not yet been reproducibly achieved for higher plants. Collections of random T-DNA or transposable element insertion mutants are currently available for some crop plants. While such a collection does not exist yet for all plants, insertional mutagenesis has been successfully used. However, although collections of TDNA mutants may be very useful, they produce a limited range of allele types. and do not always produce nullalleles.

The term RNA silencing has been adopted to describe phenomena such as post-transcriptional gene silencing in plants, quelling in fungi and RNA interference in animals. Researchers have developed different RNA silencing strategies as tools for selective knockout of targeted genes. Despite the successes of this technique in several species, RNA silencing has several drawbacks, i.e. phenotypic instability in later generations and the requirement for a reliable plant transformation followed by in vitro regeneration system. RNA silencing is believed to be a natural plant defense against viruses. Following this principle, another technique, Virus-induced gene silencing (VIGS) has been developed to suppress plant gene expression through infection with virus vectors that harbor a target region of the host gene. There are vectors with the ability to support VIGS in plants. The limitations of RNA silencing or insertional mutagenesis can be overcome by TILLING. This technique combines chemical mutagenesis with a powerful screening method for potential mutations. The generation of phenotypic variants without introducing foreign DNA in the plant makes TILLING very suitable not only for functional analysis, but also for agricultural applications. The TILLING facility for a number of crops for mutant collections is available. The diversity of species for which this technique will be available, opens up new possibilities for crop researchers both for the functional analysis of genes preriously_identified by the "omic" technologies, as well as the generations of new varieties.

RNA INTERFERENCE (RNAI)

RNAi has recently been identified as a natural mechanism for regulation of gene expression in all higher organisms from plants to humans and promises greater accuracy and precision to plant improvement. The expression of any gene can be down-regulated in a highly explicit manner exclusive of affecting the expression of any other gene by using RNAi technologies. Manipulating new RNAi pathways generates small RNA molecules to alter gene expression in crops with new quality traits and having better potentiality of protection against abiotic stresses. Modem progress in molecular biology has generated elevated prospects for the potential role of RNA-mediated trait for plant improvement and RNAi has become the technology for investigating gene function and manipulating plants to create novel characteristics.

MOLECULAR BREEDING

The use of genetic and genomic analysis to help identify DNA regions tightly linked to agronomic traits in crops, the so-called molecular markers, can facilitate breeding strategies for crop improvement. The use of molecular markers for the indirect selection of improved crops speeds up the selection process by alleviating time-consuming approaches of direct screening under greenhouse and field conditions. Molecular markers are particularly useful when targeting characters controlled by several genes. The potential to map different Quantitative Trait Loci (QTL) contributing to an agronomical trait identify linked molecular markers opens up the possibility to transfer simultaneously several QTLs and to pyramid QTLs for several agronomical traits in one improved cultivar.

Numerous molecular marker-related techniques have been used in relation to abiotic stresses. Random Amplified Polymorphism (RAPD), Restriction' Fragment Length Polymorphism) Amplified Fragment Length Polymorphism (AFLP), Simple Sequence Repeat (SSR) and derivatives have been reported for different abiotic stresses. An array of new SSR markers has been designed. As a result, genetic maps for many species were established in which potential resistance and/or tolerance loci or QTLs have been located. The knowledge of the genetic control of specific resistance and/or tolerance in many crops " information on the number, chromosomal location and individual or interactive effects of the QTLs involved. More importantly, these technologies have identified specific molecular markers that may be used in breeding programs through Marker-Assisted Selection (MAS) to enhance stress tolerance. Although the use of MAS may be helpful for crop improvement, its practical application for the genetic improvement of resistance or tolerance to stress has been limited, being mainly hampered by lack of investment and the genetic complexity of most stress related traits. Breeding for abiotic stress is much more complicated due to the complexity of the traits involved. Nevertheless, MAS is being used to select several drought tolerant crops.

CONCLUSIONS

Modern biotechnology is already making significant contributions and poses significant challenges to agriculture, health and environment. Successful development and application of biotechnology are possible only when a broad research and knowledge base in several subjects such as, microbiology, biochemistry, molecular biology, bioinformatics, plant physiology, phonemics, comics, soil science and plant breeding exists. Biotechnological programs must be fully integrated into a research background and a continued commitment to basic research is a must to fulfill benefits offered by the emerging technologies to combat against various abiotic stresses.

FEASIBILITY OF SYSTEM OF RICE INTENSIFICATION (SRI) AND ITS EFFECT ON THE PRODUCTIVITY OF RICE (*ORYZA SATIVA*) IN CHAMBAL COMMAND OF RAJASTHAN

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ABSTRACT

System of rice intensification (SRI) has attracted attentions because of its apparent success in increasing rice yields with less water use. SRI management involves many departures from the methods conventionally recommended for rice cultivation. SRI practices are reported to increase the yields of irrigated rice by 25-50% or even more (Thakur *et al.* 2010) while reducing water requirements (Satyanarayana *et al.* 2007). An experiments was conducted during *kharif* season of 2010-2011 at the research farm of ARS, Kota and demonstrations at farmers fields to evaluate the feasibility of SRI and best suited fertility levels for this and saving of water in the rice growing area of Chambal command. The maximum paddy yield was observed under SRI(56.85q/ha) and among fertility levels 100 % RDN (75% N by inorganic + 25% N by organic) gave maximum paddy yield. Water expense efficiency was more under SRI as compared to conventional method.

METHODOLOGY

The experiment were laid out in split plot design in four replications comprising of 2 methods of crop establishment viz., conventional transplanting (CT) and system of rice intensification (SRI) and 4 fertility levels i.e. 100% RDN by inorganics; 75% RDN (75% N by inorganics + 25% organics);100% RDN (75% N by inorganics + 25% organics) and 100% RDN by organics using variety-Pusa basmati-1. After puddling twenty-five days old seedlings of rice were transplanted under conventional transplanting at 20 cm x 10 cm spacing keeping 2-3 seedlings/hill and for SRI, 12 days old 1 seedlings/hill were transplanted. In conventional method 5-7 cm water was maintained from transplanting to grain filling stage of crop and in SRI, alternate wetting and drying conditions were maintained in early crop growth period and 2 cm water was maintained between panicle initiation stage and grain filling stage.

RESULTS AND CONCLUSION

Growth and yield parameters at harvest was significantly higher in SRI as compared to conventional transplanting. This can be attributed to more space, sunlight and nutrients available in SRI due to the wider spacing (Thakur et al 2010). Higher root volume in top 15 cm soil depth was recorded in SRI followed by CT. Higher root growth and activity under SRI relates to increased root oxidation activity and root-sourced cytokinins (Zhang et al. 2009). This might be due to lesser tiller mortality in SRI due to water management through alternate drying and wetting than conventional flooding method. Heaviest panicles, significantly higher than which in turn produced significantly heavier panicle than . Significantly more filled grains/ panicle were recorded in SRI than in CT. Significantly higher grain yield was recorded in SRI (56.85 q/ha) as compared to CT (48.41q/ha). It revealed that paddy yield is significantly influenced by the various treatments. The maximum paddy yield was observed under the treatment system of rice intensification (56.85 q/ha) and among fertility levels 100% RDN (75% N by inorganic + 25% N by organic) gave maximum paddy yield. Water expense efficiency was more under SRI as compared to conventional method. Application of 100 % RDN (75% by inorganics + 25% N by Organics) gave higher water expense efficiency. Nissanka and Bandara (2004) reported 7.6 t/ha grain yields in SRI and it was 9% greater than the conventional transplanting. Higher grain yield production in the SRI might be attributed to the vigorous and healthy growth, development of more productive tillers and leaves, ensuring greater resource utilization in the SRI compared to conventional transplanting. Overall, combined effect of SRI and fertility gave higher yield and resulted in increased net return as compared to CT. The reduction in seed rate and irrigation requirement in SRI were the main benefits of SRI.Based on two years study, it is concluded that system of rice intensification is better than conventional and may be the next best alternative to grow with less water in south-eastern Rajasthan.

Table-1 : Effect of method of cultivation and fertility levels on the yield and WEE in Rice.

Treatments	Grain Yield (q/ha)			Water Expense efficiency (kg/ha/cm)		
	2010	2011	Pooled	2010	2011	Mean
Method of cultivation						
SRI method (SRI)	54.58	59.13	56.85	47.5	50.5	49.0
Conventional method (CT)	47.75	49.06	48.41	29.7	33.2	31.4
CD (P=0.05)	5.54	7.36	5.38			
Fertility levels						
100% RDF by Inorganics	53.87	57.18	55.52	39.0	43.2	41.1
100% RDF by Organics	41.96	46.08	44.02	30.4	34.8	32.6
100% RDF (75% N by Inorganics + 25 % N by Organics)	58.29	60.63	59.46	42.2	45.8	44.0
75% RDF (75% N by Inorganics +25 %N by Organics)	50.54	52.50	51.52	36.6	39.6	38.1
CD (P=0.05)	2.71	2.59	2.27			

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EFFECT OF GAMMA RAYS ON YIELD AND YIELD CONTRIBUTING TRAITS OF SOYBEAN IN M2 AND M3 GENERATION

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ABSTRACT

The effectiveness and efficiency, yield parameters and statistical analysis for M_2 and M_3 generation of Soybean cultivar TAMS-38 was studied using gamma rays treatment. Effectiveness and efficiency was recorded at increase for low concentration and decrease for high concentration level. The most of the treatment were exhibited positive and negative shift. The statistical analysis such as high phenotypic coefficient of variation (PCV) and genotypic co-efficient of variation (GCV) and high to moderate heritability (h^2) and high genetic advance as a percentage of mean was recorded for all five characters studied i.e. plant height, number of branches plant^{-1}, number of pod plant$^{-1,}$ 100 seed weight and seed yield plant^{-1} in M_3 generation. This indicated that all these traits where influenced by additive gene action operating in the expression of these traits in M_3 generation and hence help as a criteria for making selection.

Key words : **Soybean, Mutation, Effectiveness, Efficiency, Frequency**

INTRODUCTION

Soybean (*Glycine max* (L.) Merrill) is referred as "Golden bean'' and "Miracle crop" of 21th century. It is one of the important oilseed as well as legume crop. It contributes more than 50% to the global production of edible oil. Soybean contains 20% oil and 40% protein. Soybean protein is rich in all essential amino acids vitamin A, B and D; health promoting phytochemicals like isoflavones. Hence, soybean referred as "Wonder crop" or "Golden bean". The soy protein stands unique by supplying all sixteen essential amino acids. Soybean oil is used as edible oil in Indian diet. Soybean originated in North Eastern China. It

Table-1 : Frequency of induced mutants in different gamma rays treatments in M_2 generation.

Sr. No.	Type of mutation	T_1	T_2	T_3	Total
1.	Chlorophyll Deficient	0.08	0.11	0.16	0.35
2.	Early flowered	0.11	0.14	0.16	0.41
3.	Late flowered	0.05	0.08	0.16	0.29
4.	Early matured	0.05	0.08	0.16	0.29
5.	Late matured	0.08	0.08	0.16	0.32
6.	Dwarf	0.17	0.14	0.24	0.55
7.	Tall	0.14	0.17	0.16	0.47
8.	Root length increased	0.08	0.14	0.16	0.38
9.	100 seed weight above 13 g	0.11	0.14	0.08	0.33
10.	Small leaf	0.11	0.08	0.08	0.27
11..	Wrinkled leaf	0.08	0.05	-	0.13
12.	Viney type	0.05	0.02	-	0.07
13.	Sterile	0.08	-	-	0.08
14.	High yielder	0.14	0.20	0.24	0.58
15.	More pods	0.11	0.20	0.08	0.39
16.	More branched	0.14	0.17	0.24	0.55
Total		1.58	1.80	2.08	5.46

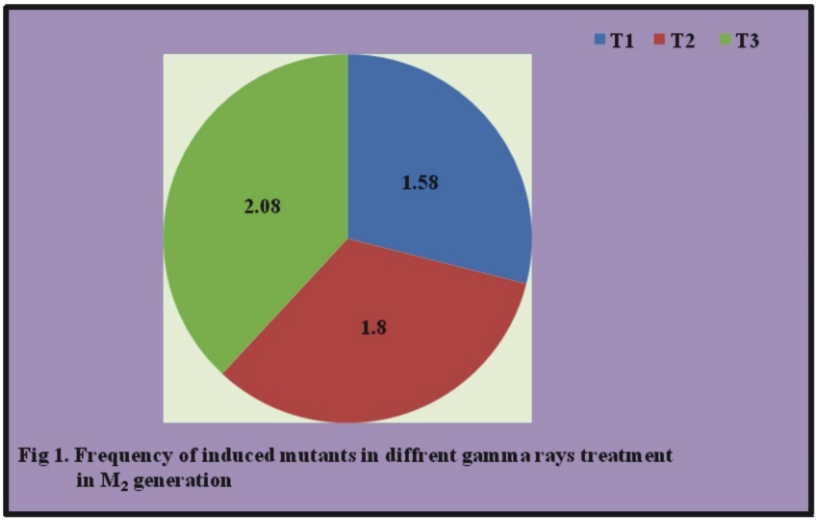

Fig 1. Frequency of induced mutants in diffrent gamma rays treatment in M_2 generation

Table-2 : Mutagenic efficiency and effectiveness of gamma rays treatments in soybean (*Glycine max* (L.) Merrill)

Sr. No.	Treatments	Per cent Lethality	Per cent mutant 100 M2 plant^{-1}	Mutagenic efficiency	Mutagenic effectiveness
1.	T_1 (200gy)	4.49	1.58	0.35	0.0079
2.	T_2 (250gy)	5.43	1.80	0.33	0.0072
3.	T_3 (300gy)	6.75	2.08	0.30	0.0069
4.	T_4 (Control)	3.09	-	-	-

Table-3 : Effectiveness of gamma rays on yield and contributing traits in soybean (*Glycine max* (L.) Merrill)

Doses of mutagen	Seed yield plant^{-1} (g)		100 seed weight (g)		No. of pod plant^{-1}		No. of branches plant^{-1}		Plant height (cm)	
Generations	M_2	M_3	M_2	M_3	M_2	M_3	M_2	M_3	M_2	M_3
200 Gy	4.98	5.47	11.63	8.21	22.62	29.36	3.50	3.15	40.34	37.23
250 Gy	5.41	10.19	10.73	8.36	22.95	56.49	4.12	3.30	46.13	36.59
lmult1300 Gy	5.00	2.3	10.08	9.01	26.73	11.33	3.69	2.33	43.24	30.66
Control	7.2	9.24	7.8	6.56	38.12	39.43	3.00	2.90	41.10	39.75

entered in India during 6th century AD. USA, Brazil, China, Argentina and India are the major soybean producing countries in the world. These countries accounts for 90% of the world production. India ranked 5th position in respect to area and production.

The concept of inducing mutation and utilizing them in plant breeding was first given by Hugo de vries (1903) for generating variability and achieving the goal of generating of new strains of cultivated crop plants. Gamma rays a ionizing physical mutagen capable of inducing mutation in plants. The present research work was, therefore, undertaken using seeds of soybean cultivar TAMS-38 subjected to treatment of different doses of gamma rays and hence improve its production.

MATERIALS AND METHODS

Dry healthy and genetically pure seeds of TAMS-38 was used in this study. Four different lots of soybean seed cultivar TAMS-38 were made. Every lot was of 500 g seed weight. The three lots of seed were sent to Bhabha Atomic Research Centre, Trombay, for irradiation with three different doses of gamma rays treatment. These seed were treated by three different doses of gamma rays *i.e.* 200 Gy, 250 Gy, 300 Gy (Co^{60} at BARC Trombay, Mumbai) and used for raising M1 during kharif

Table-4 : Genetic parameters estimates for different characters in M_3 generation

Parameters	Seed yield plant^{-1} (g)	100 seed weight (g)	No. of pods plant^{-1}	No. of branches plant^{-1}	Plant height (cm)
GCV (%)	45.59	37.18	45.03	39.45	38.71
PCV (%)	62.43	50.78	64.17	57.63	51.15
Heritability (%)	53.34	53.60	49.23	46.85	57.26
G.A(per cent of mean)	50.09	41.05	45.67	38.08	45.65

2016 and individual plant in each treatment were harvested separately. The harvested seed were used to raise M2 generation in rabi 2016 and (62) mutants were identified.

In *kharif* 2017 all the harvested seed from each (62) mutants of M_2 generation along with 2 checks (TAMS-38 and JS-335) were sown to raise M3 generation in replicated trial using Randomized Block Design replicated thrice.

All the parameters were recorded in mean value, phenotypic coefficient and genotypic co-efficient of variation, heritability and genetic advance as per cent of mean were used for ANOVA for RBD method.

Mutation frequency was estimated on M_2 plant basis. Mutagenic effectiveness is a measure of the frequency of mutation induced by unit of mutagen, whereas mutagenic efficiency gives an indication of the proportion of mutation in relation to undesirable change like lethality and injury.

RESULTS AND DISCUSSION

Mutation frequency, effectiveness and efficiency

Mutation frequency of each visible mutant in M_2 generation was calculated as suggested by Gaul (1958) and is represented in table 1 and graphically in fig 1. The table revealed that the treatment T_3 induced the highest mutation frequency (2.08%) followed by T_2 (1.80%) and the lowest in T_1 (1.58%). The frequency of mutation was comparable in all the treatments. The present results confirm these earlier reports in soybean (Khan and Tyagi 2010).

The efficiency and effectiveness of mutagens were estimated as suggested by Konzak *et al*. (1965) and are presented in table 2. From the table, it is noticed that T_1 exhibited the highest mutagenic efficiency (0.35), while T_3 (0.30) showed the lowest. It was observed that the mutagenic efficiency increased in low doses and decreased in high doses of gamma rays. Among the treatments the highest mutagenic effectiveness was observed in T_1 (0.0079) followed by T_2 (0.0072), while the lowest was noticed in T_3 (0.0069). Further it was noticed that the mutagenic effectiveness reduced with the increase in the dose of gamma rays. Pavadai *et al.* (2010) observed that increase in effectiveness and efficiency in low concentration and decrease in high concentration level in soybean. Satpute and Fultambkar (2012) also reported that mutagenic effectiveness and efficiency reduced with the increase in concentration dose of mutagen in two cultivar of soybean (MAUS-71 and JS335).

Mean performance in M_2 and M_3 generation

The effectiveness of plant breeding programme is depending upon the amount of genetic variability present in the segregating generation. Therefore, for increasing variability in segregating generations, improvements in the quantitative characters have to be made through accumulation of genes affecting their expression in a positive and negative direction. So, in the present experiments, it is observed that the mean for different quantitative characters shifted both in positive negative direction due to mutagenic treatments. The most of the treatment were exhibited positive and negative shift the maximum values were recorded in 250 Gy gamma rays treatment for M_2 and M_3 generation (Table 3). Similar findings were also observed by previous workers in soybean (Dhole *et al*., 2003 and Pavadai, 2006).

Statistical analysis

In the present study shows high phenotypic coefficient of variation (PCV) and genotypic co-efficient of variation (GCV) and high to moderate heritability (h^2) and high genetic advance as a percentage of mean was recorded. In accordance to these results high genotypic coefficient of variation and phenotypic coefficient of variation for number of pod plant^{1}and seed yield plant^{-1} were also reported by Malek *et al.* (2014) and Patil and Sharma (2016), high heritability for yield and yield components were also reported by Pavadai *et al.* (2010) and Patil and Sharma (2016) and high genetic advance as a percentage of mean was also reported by Malek *et al.*(2014) and Pavadai *et al.* (2010) in Soybean.

When all the genetic parameters for five characters where considered, it was found that Seed yield plant^{-1} and its contributing characters *viz.,* 100 seed weight, Number of pods plant^{-1}, Number of branches plant^{-1} and Plant height exhibited high genotypic and phenotypic coefficient of variation, moderate heritability along with high genetic advance as percentage of mean (Table 4). This indicated that all these traits where influenced by additive gene action operating in the expression of these traits in M_3 generation and hence help as a criteria for making selection.

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LAND USE AND LAND COVER CHANGE DETECTION OF MPKV (EAST WATERSHEDS) USING REMOTE SENSING AND GIS

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Abstract

The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority. Over the past years, data from Earth sensing satellites has become vital in mapping the Earth's features and infrastructures, managing natural resources and studying environmental change. Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and change at local, regional and global scales over time; such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity. Therefore, attempt was made in this study to map out the status of land use land cover with a view to detect the land consumption rate and the changes that has taken place in this status particularly in the built-up land so as to predict possible changes that might take place in this status in the next 14 years using both Geographic Information System and Remote Sensing data. The study has been undertaken to create a land use land cover classification scheme and to determine the trend and magnitude of land use land cover change.

MATERIALS AND METHODS

Study area : The study area of the research was Mahatma Phule Krishi Vidyapeeth, East watershed, Central Campus, Rahuri, Ahmednagar district of Maharashtra state, situated in between17º24' to 17º50' N Latitude and 73º46' to 74º0'E Longitudes.

Data Collection and Pre-processing : The following data were collected as per the need of the rudy.

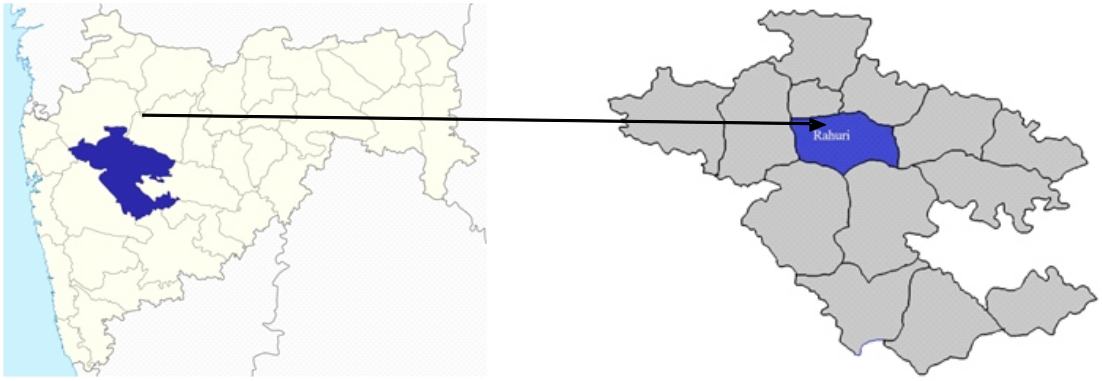

Fig.-1. Location map of study area

1. Satellite images were downloaded from LANDSAT imageries (ftp.glcf.umd.edu) and used for land use land cover preparation.

2. Toposheets of study area were obtained from GIS unit cell, Commissionorate of Agriculture, Ahmednagar, which were used for the validation of boundary of watershed.

Software and System

Arcs-GIS 10.2 and MS-Office suit were used for data creation, data analysis and output generation. Arc-GIS 10.2 is advanced

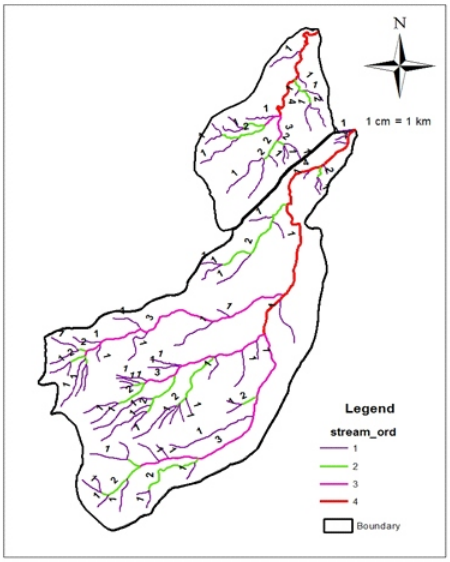

Fig.-2. Drainage map and boundary showing M.P.K.V. watershed (East)

tool used for mapping, geographic analysis, spatial analysis, hydrology, overlay analysis, data editing etc. MS-Office was used for documentation and analysis purpose.

Preparation of thematic maps

Various interpretation techniques and methodologies were adopted for thematic maps.

Land use/Land cover

Land use/Land cover map was derived from satellite images downloaded from LANDSAT imageries (ftp.glcf.umd.edu) and earth explorer. Interpretation of multi-season satellite data had been carried out to generate the land use land cover map of study area. Thematic mapping of the different land use/ land cover classes was achieved through supervised classification. Processing was done by EDRISI-SELVA software.

RESULTS AND DISCUSSION

Land Use/Land Cover in 2000

The land use and land cover characteristics of the study area described using land use/land cover (LU/LC) maps and the statistics generated on this aspect. The LU/LC in the study area was classified in to six classes: (i) Water bodies (ii) Settlements (iii) Dense forest (iv) Cultivated land (v) Barren land and (v i) Cultivable fallow land.

Table 1 Spatial coverage of LULC classes of M.P.K.V. watersheds (East) in 2000

Sr. No.	LULC Class	Area (ha)
1	Water bodies	15.21
2	Settlement	140.31
3	Dense vegetation	175.14
4	Cultivated land	652.5
5	Barren land	3290.85
6	Cultivable fallow land	286.74
		4560.75

In 2000, Land use land cover pattern of M.P.K.V. Central campus East watersheds revealed that majority of land was comes under Barren Land class (3290.85ha). It was 72 percent of the total area of watershed. Next dominate class was Cultivated

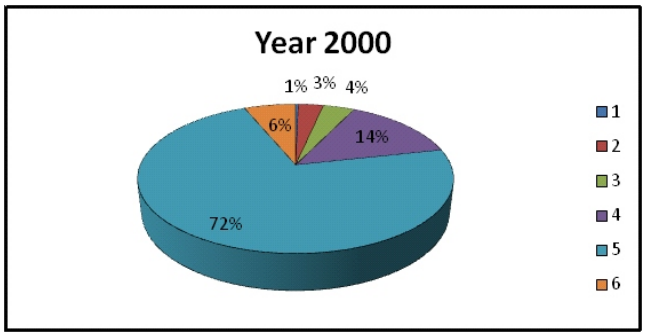

Fig.-1 : Land Use /Land Cover in 2000

land (652.5) which covers about 14 percent of total area followed by Cultivable fallow land (286.74ha, 6 percent), Dense vegetation (175.14 ha, 4 percent), settlement (140.31ha, 3 percent) and water bodies (15.21ha, 1 percent). (Fig: 1). It is inference that almost 85 percent of the land was covered by major two classes Barren Land class agriculture and Cultivated land which are most vulnerable for flood condition. Forecasting of stream flows would minimizing the losses of natural resources to large extend.

Land Use/Land Cover in 2014

The land use and land cover characteristics of the study area in 2014 described using land use/land cover (LU/LC) maps and the statistics generated on this aspect. Land use land cover pattern revealed that majority of land was comes under Barren land class (2778.57, ha). It was 60.92 percent of the total area of watershed. Next dominate class was Cultivated land (916.02) which covers about 20.09 percent of total area followed by Dense vegetation (498.06, ha, 10.92 percent), Cultivated fallow land (200.52ha, 4.40 percent).

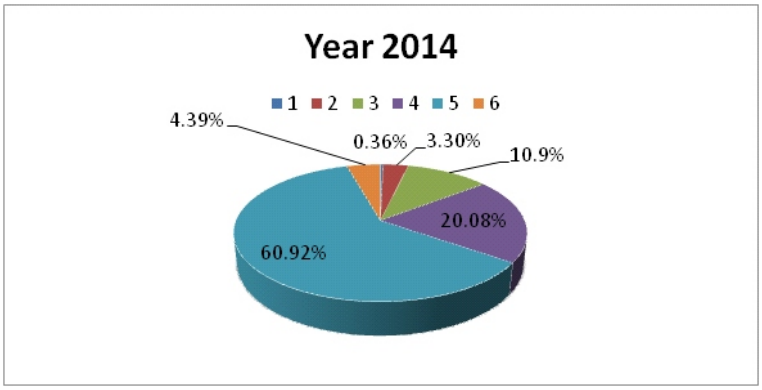

Fig.-2 : Land use/ Land cover in 2014

Table 2. Spatial coverage of land use/land cover classes of M.P.K.V. watersheds in 2014

Sr. No.	Land Use /Land Cover Class	Area (m²)
1	Water bodies	16.83
2	Settlement	150.75
3	Dense vegetation	498.06
4	Cultivated land	916.02
5	Barren land	2778.57
6	Cultivated fallow land	200.52
		4560.75

Land Use/Land Cover in 2016

The land use and land cover characteristics of the study area in 2016 described using land use/land cover (LU/LC) maps and the statistics generated on this aspect

Table-3 : Spatial coverage of land use/land cover classes of Morna river catchment in 2007

Sr. No.	Land use land cover Class	Area (ha)
1	Water bodies	3.33
2	Settlement	190.62
3	Dense vegetation	280.62
4	Cultivated land	2096.55
5	Barren land	1775.25
6		

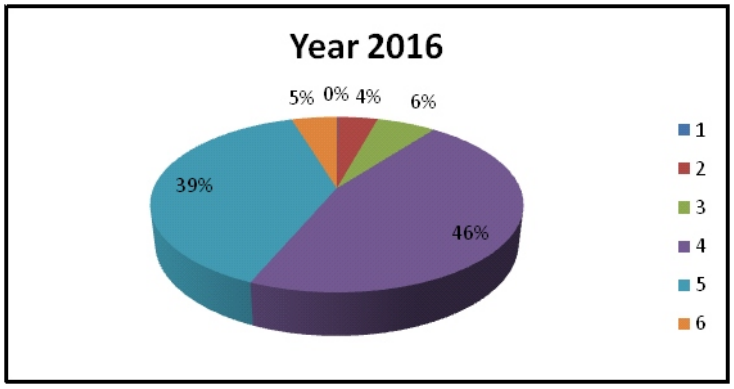

Fig.-3 : Land use/Land cover in 2016.

In 2016, Land use land cover pattern of M.P.K.V. Central campus East watersheds revealed that majority of land was comes under Cultivated land class (2096.55ha). It was 45.96 percent of the total area of watershed. Next dominate class was Barren land (1775.25ha) which covers about 38.92 percent of total area followed by Dense vegetation (280.62ha, 6.15 percent), Cultivated fallow land (214.38ha, 4.70 percent), Settlement (190.62 ha,4.18 percent) and water bodies (3.33ha,0.073 percent). (Fig: 3). It is inference that almost 85 percent of the land was covered by major two classes Barren Land class and Cultivated land which are most vulnerable for flood condition. Forecasting of stream flows would minimizing the losses of natural resources to large extend.

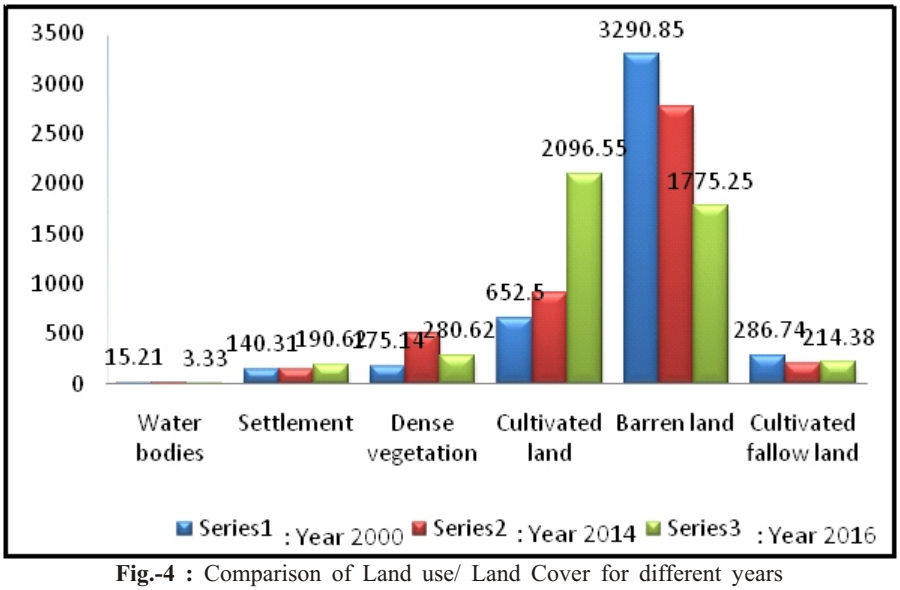

Fig.-4 : Comparison of Land use/ Land Cover for different years

Comparison of data :

During the last 16 years the change in other land use categories are negligible. The percentage of water bodies is decreased because of low rainfall and conversion of barren land into agricultural land. Water is one of the most indispensable resources. Water bodies included wetlands, ponds, streams and rivers. Water bodies cover only 0.92 % of the total area in the year 2000 which decreases to 0.073% in 2016. Settlement is also increased by the rate (35.85%), which is very obvious due to human population growth. Dense vegetation for the 2014 is highest among all the data. Cultivated land has increased and thereby barren land has been reduced considerably.

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MOLYBDENUM : A REVIEW ON MO METABOLISM IN PLANTS AND ITS IMPORTANCE FOR THE GROWTH AND NITROGEN FIXATION EFFICIENCY OF LEGUMES

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Abstract

Molybdenum is essential micronutrients for plant growth and development. Plants require small amounts of molybdenum for normal growth. The element is essential in nitrogen fixation by both symbiotic and free living soil organisms and is the metal constituent of nitrate reductase in higher plants. In symbiotic systems the nitrogen supply of the host plant is strongly influenced by the availability of Mo in soil, since both bacterial nitrogenase and NADPH-dependent nitrate reductase of mycorrhizal fungi are Mo enzymes. Crop production has been increased on many soils throughout the world by applications of small amounts of molybdenum salts. As only preliminary surveys to determine the extent of molybdenum- deficient soils have been conducted in most agricultural areas, the element will probably assume increasing importance after thorough surveys are completed. This review revealed the researches on Molybdenum effect on the growth of legumes. Mo in an optimum amount increases the growth, yield and nitrogen fixation efficiency of legumes plants.

Molybdenum is an essential component in legumes. Molybdenum which is the predominant form available to plants is required at very low levels where it participates in various redox reactions in plants. In symbiotic legumes, the enzyme nitrogenase is comprised of Mo-Fe protein that is directly involved in the reduction of N2 to NH3 and finally to other available forms of N to plants.

For the last 90 years, it has been known that the transition element molybdenum is an essential micronutrient for plants and microorganisms (Bortels, 1930, Arnon and Stout, 1939). Molybdenum is one of the micronutrients required for plant growth and development. It constitutes part of the enzyme nitrogenase which is essential for the conversion of atmospheric N2 to ammonia NH3. Mo deficiencies are therefore much more pronounced in legumes (Bailey and Laidlaw, 1999) as compared to non-leguminous plants. Symbiotic bacteria require more Mo than host plant for N2 fixation (O'hara et. al., 1988) and thus, the supply of this element to bacteroids is an important process in the maintenance of BNF (Biological Nitrogen Fixation) (Mandou et. al., 2017).

During the last thirty years detailed structural information has become available for a series of prokaryotic molybdo-enzymes which is applicable to the eukaryotic counterparts. Understanding of the biosynthesis of Moco(Molybdenum co-fcator) in prokaryotes, and recently in eukaryotes, is advancing rapidly now that sets of well-defined mutants are available (Malik et al., 2015).

Until this time it was thought that the only role of molybdenum as a specific catalyst in the process of nitrogen fixation, but Steinberg's work led him to suggest that it may also play a part in the reduction of nitrate. Practically all the work on molybdenum up to 1936 had been done on bacteria or fungi, and indeed it was not until 1939 that Arnon and Stout established the essential nature of molybdenum for higher plants. However, in 1937 Bortels, growing peas, soybeans, and red clover in sand cultures, observed higher nitrogen fixation and growth with small additions of molybdenum compounds, and this led him to suggest the possible importance of molybdenum in the symbiotic fixation of nitrogen by members of the legume family.

Availability of Molybdenum in Soil

Molybdenum is a very rare element with a crustal abundance of about 1.2 mg/kg (Fortescue, 1992). Its oxidation state in soils varies from II to VI (stages of oxidation). Whereas Mo is predicted to be in the IV oxidation state under anoxic conditions (Brookings, 1987), Mo is found in oxic soils with a pH of 4—8, mainly as Mo(Vl) anions and salts ($MgMoO_4$, $CaMoO_4$, MoO_4). In more acidic soils (pH <4) protonated Mo(Vl) compounds ($HM0O_4$, $Mo(OH)_6$, HMo_2O_7 and H_2MO_4) occur. Molybdenum can be dissociated in water, adsorbed by soil colloids, held in crystal lattices of minerals, or bound in organic matter. Total Mo concentrations of about 0.8—3.3 mg/kg soil were found in a wide range of different soils. Only the soluble Mo (VI) forms are available for plants. Adsorption on soil particles increases with decreasing pH from 7.75 to 4.45 (Reisenauer et al., 1962). Therefore, more Mo is available for plants at higher soil pH values. Large amounts of Al and Fe oxides enhance soil adsorption and reduce the amount of water-soluble Mo.

Functions of Molybdenum

Molybdenum is utilized by selected enzymes to carry out redox reactions. Enzymes that require molybdenum for activity include nitrate reductase, nitrogenase, xanthine dehydrogenase, aldehyde oxidase and sulfite oxidase. Nitrogenase and nitrate reductase are the key enzymes of biological nitrogen fixation. Molybdenum is the cofactor for the enzyme nitrate reductase which involved in nitrogen assimilation (Mendel et al., 2002).

Among the 60 enzymes containing Mo which have been described so far for prokaryotes and eukaryotes, the known Mo enzymes in plants are :

Nitrate reductase (NR) catalyzing the initial step of the assimilatory nitrate reduction.

Xanthine dehydrogenase (XDH) involved in purine catabolism.

Aldehyde oxidases (AO) catalyzing the final oxidation in the phytohormone biosynthesis of indoleacetic acid (Koshiba et al., 1996) and abscisic acid.

Sulfite oxidase (SO) catalyzing the formation of sulfate.

Molybdenum is required by the Rhizobium bacteria for proper function of nitrogenase enzyme. As a component of meta-protein nitrogenase which helps in the process of biological nitrogen fixation acts as essential component which needed by Rhizobacteria for Nitrogen fixing metabolism. The nitrogenase enzyme needs Mo element in the process of its metabolism, which acts as electron carrier between oxidized and reduction stages. Molybdenum concentrations in legume nodules can be ten times higher than in leaves. It also acts in enzymes, which bring about oxidation reduction reaction, especially the reduction of nitrate to ammonia prior to amino acids and protein synthesis in the cells of plant. The application of molybdenum in deficient soil encourages nitrogen fixation and nodule formation (Rahman et al., 2008).

Molybdenum Requirements of plants and *Rhizobium*

Among the micronutrients essential for plant growth, the amount of molybdenum required by plants is lowest. For example, an average concentration of 6 ppm was reported by Khan et al.,2014 and Soni et al., 2017. Similarly Velmurugan et al. (2013) suggested the critical limit of Mo to be 0.043 mg kg-1, below this level the plants show deficiency of Mo. However, they suggest the maximum amount of Mo to be used for better plant growth and yield 0.075 mg kg-1, above this level use of Mo cause heavy metal toxicity. Toxicity of molybdenum to plants under field conditions seldom occurs because plants requires trace amount of Mo and higher amount of Mo can cause heavy metal toxicity which can disturb the symbiosis of legumes and Rhizobium and inversely affect the growth and yield of Plants.

Molybdenum deficiency has been reported worldwide for leguminous crops as well as other crop plants. Such molybdenum deficiency delays flowering, inhibits tasseling, anthesis and the development of sporogenous tissues (Agarwala et al., 1978, Martin et al., 1995) which finally result in poor crop yield. Molybdenum deficiency in wheat results in lower dormancy levels which is probably due to reduced abscisic acid levels in seeds (Modi and Cairns, 1994); this is possibly caused by suboptimal activity of the ABA aldehyde oxidase which is a Mo enzyme. Winter wheat grown in acidic soil displays frost-induced decline of nitrate reductase activity, reduced content of digalactosyl diacylglycerol, and enhanced phospholipid degradation (which could be prevented by supplying Mo), and is probably the basis of the observed cryoprotective effect of Mo on winter wheat (Yaneva et al., 1995).

Visible symptoms of molybdenum deficiency vary according to plant species and most often result in chlorosis or a yellowing of the leaves (Gupta, 1997). Mo deficiency in plants can occur in soils (i) with low total Mo, (ii) where Mo is sequestered by oxihydroxides, (iii) in extensively weathered soils, (iv) with pH values below 6, or (v) in sandy well drained soils (Severson and Shacklette, 1988). There are many reports that crop yield can be increased by Mo fertilization (Dwivedi et al., 1996).

Molybdenum can exist in several oxidation states ranging from zero to VI, where VI is the most common form found in most agricultural soils. Similar to most metals required for plant growth, molybdenum has been utilized by specific plant enzymes to participate in reduction and oxidative reactions. Molybdenum itself is not biologically active but is rather predominantly found to be an integral part of an organic pterin complex called the molybdenum co-factor (Moco). Moco binds to molybdenum-requiring enzymes (molybdoenzymes) found in most biological systems including plants, animals and prokaryotes (Williams and Silva, 2002).

The availability of molybdenum for plant growth is strongly dependent on the soil pH, concentration of adsorbing oxides (e.g. Fe oxides), extent of water drainage, and organic compounds found in the soil colloids. In alkaline soils, molybdenum becomes more soluble and is accessible to plants mainly in its anion form as MoO_4. In contrast, in acidic soils molybdenum availability decreases as anion adsorption to soil oxides increase (Reddy *et. al.,* 1997).

When plants are grown under molybdenum deficiency, a number of varied phenotypes develop that hinder plant growth. Most of these phenotypes are associated with reduced activity of molybdo-enzymes. These enzymes include the primary nitrogen assimilation enzymes such as nitrate reductase (NR), and the nitrogen-fixing enzyme nitrogenase found in bacteroids of legume nodules. Other molybdo-enzymes have also been identified in plants including xanthine dehydrogenase/oxidase involved in purine catabolism and ureide biosynthesis in legumes, aldehyde oxidase (AO) that is involved in ABA biosynthesis, and sulfite oxidase that can convert sulfite to sulfate, an important step in the catabolism of sulfur-containing amino acids (Mendel and Haensch, 2002; Williams and Silva, 2002).

Although at low supply, molybdenum is preferentially transported into the nodules, molybdenum deficiency-induced nitrogen deficiency in legumes relying on N2 fixation is widespread, particularly in acid mineral soils of the humid and subhumid tropics. There are reports that foliar applications of Mo to grain legumes in field conditions increase levels of N2 fixation and nodule mass, resulting in higher overall N content and seed yield (Bambara and Ndakidemi 2010). It is also reported that a Bradirhizobium japonicum strain deficient in molybdenum transport showed impaired nitrogen fixation activity when inoculated to soybean roots (Delgado et al., 2006). In laboratory conditions, several different legumes that were severely starved of Mo showed more dramatic signs of deficiency (Weisany et.al., 2013).

Gad et.al.(2013) observed the positive impacts of molybdenum fertilization on nodules efficiency, growth, yield quantity and quality of cowpea plants. Molybdenum (Mo) has been reported to enhance seed dormancy (Tejakhod et al., 2018). The obtained results were summarized in the following: Molybdenum enhance cowpea root nodules efficiency, growth, minerals composition, yield quantity and quality compared with control plants. Molybdenum at 16 ppm resulted in maximum growth, nodules number and weight, nitrogenase activity, pods and seeds yield as well as nutritional and chemical content. Increasing molybdenum levels more than 16 ppm decreased the molybdenum promotive effect on cowpea (Gad et al. (2013).

There are some review articles on molybdo-enzymes in plants, animals and prokaryotes (Mendel and Haensch, 2002; Williams and Silva, 2002; Sauer and Frebort, 2003) that cover the extensive literature on the regulation and formation of Moco and the activity of Moco with molybdenum-dependent apoenzymes. In prokaryotes and lower-order eukaryotes, the molybdate transport systems have been well defined and are characterized at both the physiological, biochemical and genetic levels (Grunden and Shanmugam, 1997; Kaiser et al., 2005).

Elkhatib et al., (2009) observed the combined effect of Molybdenum &Rhizobium on different growth parameters of common bean in two growing seasons. The result showed that combined effect of Rhizobium inoculation in the presence of molybdenum revealed the highest value in rabi seasons. Similar results were obtained by Yanni (1992) who reported that the seed yield of Rhizobium inoculated legume crops is increased strikingly by Mo fertilization. Lalita et al., (2014) observed the beneficiary impact of molybdenum and Rhizobium on the yield of Mung bean up to a significant level. Hristozkova et. al., (2007) studied that foliar application of nutrients on pea reduced the inhibitory effect on the root nodulation and nitrogen assimilator enzyme activities due to molybdenum shortage when plants were inoculated with Rhizobium.

Alam et al., (2015) observed the impact of Mo on the growth of Hairy vetch. The results revealed that Mo application increased the number and weight of nodules in hairy vetch, which in turn increased the nitrate-N content in the rhizospheric soil. The improved nodule characteristics resulted in higher NA activity and increased N-fixing ability in nodules, owing to the higher total N content and N uptake. For hairy vetch, 0.63 mg Mo kg-1 is the optimum dose to maximize biomass production and to improve nodule characteristics to increase N uptake.

Silva *et al.,* (2017) observed the effect of Mo on the growth and biological nitrogen fixation by two Brazilian common bean cultivars using the 15N isotope dilution technique. The application of Mo and the inoculation with rhizobia strains contributed to improving nitrogen fixation and grain weight. These results indicated that inoculation with Rhizobium strains and Mo supply effectively contributed to biological nitrogen fixation and improving grain production.

Genetic analysis indicated that Mo application might also influence microbial diversity in the *Rhizobium* community in their nodules therefore, optimum Mo application is required to increase biomass productivity of leguminous plants (Alam *et al.,* 2015).

CONCLUSION

These observations and many others have conclusively shown that in the absence of added nitrogen: molybdenum is required for the symbiotic nitrogen fixation, in other words, it is needed to enable the Rhizobium satisfactorily to perform its function of fixing atmospheric nitrogen. More recent work have been done by Silva et al. (2017), Mandou et al. (2017) and Soni et al. (2017) on Peanut and a Vigna radiata respectively. They found the positive impact of Molybdenum on the selected legumes but up to a optimum level. Much more research is required to ascertain the usefulness of this important mineral nutrient. It is also worth investigating how they may further be used in future to support the expanding legume cultivation in areas where soil Mo profiles limit plant growth and productivity.

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Abstracts

PULSES REVOLUTION IN INDIA—A REALITY

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Abstract

More than a dozen and half pulses are known for cultivation in different parts of the country in varying crop seasons. Among these chickpea, pigeonpea, mungbean, urdbean, lentil, pea, whereas lathyrus, rajmash, moth bean, kulthi, cowpea, etc cover smaller area therefore often called as minor pulses. These crops cover ~28-29 million ha area and produce 23-24 m t of pulses grains annually. The impact of technologies developed, awareness created, demonstrated and popularized, and positive policy support resulted in realization of self sufficiency in pulses in India during recent past. The ever highest pulses' production (25.23 mt) could come from quantum jump in productivity and efforts on bringing additional area under pulses along with encouraging policy support in terms of declaration of remunerative MSP, indicative procurement, and increase in tariffs on import of pulses particularly fieldpea and chickpea. During 2017-28 pulses production crossed 25.23 m t that was higher by 2.10 m t over 2016-17 and 6.88 m t over 2015-16. Further, breaking previous record pulses' production (19.25 m t) of 2013-14, production was higher by 5.98 m t during 2017-18 breaking all records indicating that India is marching towards attaining self sufficiency. Days are not far ahead when India will attain self sufficiency in indigenous pulses production if similar kind of policy support continues and pulses are brought under public distribution system (PDS) and mid-day meals or under similar social welfare schemes. To have sustainability in current level of production of pulses there is need to exploit genetic resources (primitive landraces and wild relatives) so that future varieties can have more resilience to climate change. At the same time efforts will be required to develop varieties and technologies those can help in bringing down cost of cultivation (herbicide tolerance, machine harvestable varieties, etc.), and have farmers and industry preferred traits.

GREEN FODDER PRODUCTION AND WATER USE EFFICIENCY OF FORAGE CROPS UNDER HYDROPONIC CONDITIONS

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Abstract

Hydroponic technique can be used for green fodder productionof many forage crops in a hygienic environment, free of chemicals like insecticides, herbicides, fungicides, and artificial growth promoters. It is a well-known technique for high fodder yield, year round production and least water consumption. Unlike field production system that uses run-to-waste irrigation practices, the hydroponic fodder system uses recirculation system, thus reducing the waste water. It has been reported that hydroponic fodder production requires only about 2-3% of that water used under field conditions to produce the same amount of fodder. Fodder produced hydroponically is of a short growth period of 7–10 days and does not require high-quality arable land, but only a small piece of land for production to take place. It is of a high feed quality, rich with proteins, fibre, vitamins, and minerals. All these special features of hydroponic system, in addition to others make it one of the most important agricultural techniques currently in use for green forage production in many countries especially in arid and semiarid regions of the world. However, determining the best forage crop is an important matter in producing highest fodder yield and quality and at the same time considering the economic dimensions in the process of hydroponic green fodder production by saving seed cost. The objectives of this study were to evaluate seven forage crops maize, bajra, fingermillet, foxtailmillet, wheat, cowpea and greengram for green fodder production and water use efficiency under hydroponic conditions. The experiment has been conducted under temperature-controlled conditions (24 ± 1?C) and natural window illumination at growth chamber, Department of Crop Physiology, UAS, Raichur. The results showed that green forage can be produced in 10 days from planting to harvest using hydroponic technique. Highest values for green fresh yields were recorded for the crops cowpea, greengram and maize which gave 220, 193 and 217 tons/ha, respectively. Cowpea crop used water more efficiently than the other seven tested crops when produced about 654 kg fresh matter/m3water in comparison to 633, 585, 552, 443, 423 and 376 kg fresh matter/m3 water for maize, greengram, wheat, bajra, fingermillet and foxtailmilet, respectively. No significant differences between maize and cowpea for water use efficiency were noted. It can be concluded

from this study that maize and cowpea crops can be considered as the best choice for production of hydroponic green fodder with less water consumption.

STRESS MANAGEMENT AND PRODUCTIVITY ENHANCEMENT IN FRUIT CROPS THROUGH PLASTIC MULCHING UNDER HILLY TERRACED LAND OF UTTARAKHAND

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ABSTRACT

Uttarakhand is endowed with a wide climatic variation ranging from sub-tropical to temperate, marked by seasonal variations in temperature but also affected by tropical monsoons. January is the coldest month with temperature reaching below freezing point in hills and 21°C in southeast or plains whereas in May-July the temperature reaches around 40°c. This provides an immense possibility of producing number of fruit crops categorized under tropical to subtropical and temperate group. But the fruit productivity is quite low compared to other major producing regions. The Fruit productivity is as low as 3.8 MT/ha compared to 14.3 MT/ha of the country. The productivities of all major fruit crops like apple, peach, guava, litchi, citrus etc. are lagging far behind than the major producers of the respective crops. Low temperature during initial growth period followed by temperature fluctuations in later part of the growth, moisture stress, erratic precipitation, depletion in available soil moisture and high wind velocity with various biotic stresses are some of the major constraints in producing quality crops. The cultivation is solely rainfed. This high stress adversely affects the growth and productivity of fruit crops. It compels for adaptation of technique that despite of conserving soil moisture also prevents from weed growth and enhance yield. In this regard plastic mulching is the most appropriate method to be adopted.

Mulches are the grower's first line of defense in providing ideal conditions for plants and are easy and cost efficient technology. Mulch is used to cover soil surface around the plants to create congenial condition for the growth. This may include temperature moderation, salinity and weed control. It exerts decisive effects on earliness, yield and quality of the crop. It is an integral component of water conservation in horticulture production. About 25-30% higher moisture was recorded under plastic mulch during March-May whereas it was 40% in July in apple orchards. Similarly, both minimum and maximum soil temperature in 0-10 cm was found to be 3-4°C higher under mulch in the same orchard. Research and demonstration trails carried out by the PFDC Pantnagar at various locations of the Uttarakhand suggested that the yield can be enhanced by 25-50% in various fruit crops just by using this technology alone. The results indicated that mango and litchi responded very well if mulched during the earlier period of growth as it also reduces juvenile period by enhancing vegetative growth despite of increasing yield and quality in later part. Further, demonstration trials carried out on plastic mulching by PFDC have shown an increase in yield in different fruit crops (guava 25-30%, peach 30-35% and pomegranate 35-40%). Therefore, PFDC, Pantnagar is engaged in promotion and technology dissemination of this technology through trainings and demonstration trails at various locations of the Uttarakhand hills.

EFFECT OF EMS DOSES ON GERMINATION IN INDIAN MUSTARD (BRASSICA JUNCEA) UNDER LABORATORY CONDITIONS

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Abstract

Brassica juncea (L.) Czern & Coss., also known as Indian mustard, belongs to the plant family *Brassiceae (Cruciferae)* or the mustard family. It consist of several species which produce edible leaves, roots, stems and seeds as spice. Over the past couple of decades, these crops have become one of the most important sources of edible oil in the world. Apart from oil and nutritional contents, mustard also possesses some anti- nutritional components for e.g. glucosinolates, erucic acid and phytic acid etc. These anti-nutritional factors are required only in small amounts. High amount of these antinutritional factors are

harmful to human consumption. Mutation breeding is an effective way to delete or reduce such an antinutritional factors keeping rest of the characters of the plant intact. There are two types of basic mutagens i.e. Physical and Chemical mutagens. Alkalyting agent ethyl methanesulphate (EMS) is most commonly used mutagen in plant. This study aims to isolate mutations for anti nutritional factors in high yielding varieties. Percent germination is an indicator to decide an effective dose of mutagen. For this study EMS was used to treat seeds of the varieties PM-21 and PM-30. Thirty seeds of each variety were treated with 3 different doses of. 0.25%, 0.50% and 0.75% and placed in BOD incubator at 25^{o}C temperature for 3 Days. After 3 Days observation on germination percent was recorded.. The seedlings with normal phenotypical characters were considered for this study. The seedlings with normal phenotypical characters were considered for this study. It was observed that in the 0.25% dose of EMS, germination percentage was 96 % each for variety PM-21 and PM-30. However, in the 0.50% dose of EMS, germination percentage was 93 for variety PM-21 and 70for variety PM-30. In 0.75% dose of EMS, germination percentage was 80 for variety PM-21 and 50 for variety PM-30. It clearly indicates that increasing doses of mutagen decreases germination per cent. These results are in accordance with the previously reported data for other crops.

GENETIC ARCHITECTURE IN RELATION TO SEED YIELD AND OTHER RELATED QUANTITATIVE CHARACTERS IN FIELD PEA *(PISUM SATIVUM* L.)

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Abstract

In the present study, generation mean analysis were undertaken to estimate the nature and magnitude of gene action for yield and its component traits in two crosses of field pea viz IM 9214-10 X Rachna (C-1) and IM 9214-10 X Ambika (C-2). Scaling tests revealed the presence of one or more kinds of epistatic effects for almost all the agro-morphological traits. The selection of elite lines from delayed generations and subsequent inter mating might be useful approach to recover/ develop the high yielding field pea lines. The elite lines recovered from crosses IM 9214-10 X Rachna might be superior in terms of early maturity with more number of clusters per plant and seed yield per plant. Likewise, crosses *i.e.* IM 9214-10 X Ambika for plant height, number of clusters per plant and seed yield per plant; may give opportunity to isolate transgressive segregants in advanced generations.

FUNCTIONAL ANALYSIS OF BACULOVIRUS-ENCODED MICRORNAS ROLE INESTABLISHING INFECTION IN THE HOST

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Abstract

MicroRNAs (miRNA) are a family of small, non-coding RNAs that regulate gene expression in a sequence-specific manner. MiRNAs have emerged as key players in the regulation of several pathways including developmental timing, haematopoiesis, organogenesis, apoptosis, cell proliferation, tumorigenesis and host-viral interactions. Recent studies suggest that viruses encode miRNAs to manipulate their host gene expression to ensure their effective proliferation. Insect viruses have hardly been the subjects of miRNA investigations. We have identified four *Bombyx mori* nucleopolyhedrosis virus (BmNPV)-encoded miRNAs and also functionally characterized two BmNPV-miRNAs (*bmnpv-miR-1* and *bmnpv-miR-3*) using a combination of *in silico* and experimental methods. We demonstrate the sequence-dependent interaction of *bmnpv-miR-1* with Ran mRNA using cell culture and in vivo assays, including RNA interference (RNAi) of Ran. Our results clearly show that *bmnpv-miR-1* represses Ran, leading to reduction in the host miRNA population, and consequently, the BmNPV load increases in the infected larvae. Blocking of *bmnpv-miR-1* resulted in higher expression levels of Ran and a decrease in BmNPV proliferation. Whereas, *bmnpv-miR-3* is employed by BmNPV, in titrating out its own genes, to avoid

host immune response. Our miRNA overexpression and inhibition results showed that *bmnpv-miR-3* expresses during early stage of infection, and negatively regulates the expression of DNA binding protein (P6.9) and other late genes. These findings provide an insight into the evasion strategies used by the virus to counter the host defense for its effective proliferation and have relevance to the development of insect virus control strategies.

ASPARTIC PROTEASE MEDIATED CONSTITUTIVE ACTIVATION OF DEFENSE RESPONSES IN RICE

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Abstract

Plant aspartic proteases (AP) play key roles in the regulation of biological processes, such as the recognition of pathogens and pests and the induction of effective defense responses. A large number of AP (>400) have been identified *in silico* in the rice genome. None have previously been isolated and functionally characterized for their involvement in disease resistance. We describe here the isolation and characterization of a gene *Oryza sativa* Constitutive Disease Resistance in Rice (*OsCDR1*) from rice which encodes a predicted aspartate protease. Expression of *OsCDR1* was activated upon treatments with benzothiadiazole and salicylic acid, which are signal molecules in plant disease resistance responses. Ectopic expression of *OsCDR1* in and rice conferred enhanced resistance against bacterial and fungal pathogens. The enhanced disease resistance observed in transgenic plants was correlated with induction of pathogenesis-related gene expression and was shown by mutational analysis to be dependent on AP activity of the transgene-encoded product. These results demonstrate the role of aspartatic proteases in defence response in rice.

STUDY THE EFFECT OF SOWING METHODS, NITROGEN AND PHOSPHORUS LEVELS ON PRODUCTIVITY OF *CENCHRUS SETIGERUS* FOR RESOURCE UTILIZATION IN DRYLAND REGIONS

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Abstract

A field experiment was conducted from 2012 to 2015 at Dry land Farming Research Station, Arjia, Bhilwara (Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan) with an objective to utilize the inter row space in existing *neem* tree rows to improve the productivity of waste and problematic land which were completely degraded and there were only some unproductive local grasses in small patches between the neem trees. This area falls under sub humid Southern plains of Aravalli hills and semi-arid Eastern plain agroclimatic zones of the Rajasthan state. The land use capability class V and soil of the site were Inceptosols with pH 8.6, EC 0.42 and Organic carbon 0.47. Soils were low in available N (228.72 kg/ha), high in available P (39.13 kg/ha) and medium in available K (234.0 kg/ha). The experiment consisting of nine treatment combinations, three establishment method of *Cenchrus setigerus* grass and sowing in Main plots (Direct seed sowing-E_1, Mud ball/Pallet sowing-E_2 and Socking seed in solution of $CuSO_4$@ 50ppm for 16 hour-E_3). In Sub plot-Nutrient levels (**N_0**-No fertilizer, N_1-10 kg N+15kg P_2O_5 , and N_2-20 kg N+30 kg P_2O_5 in split plot design wth t three replications. The sowing of *Cenchrus setigerus* grass in lines 50 cm apart during fist year in 2012at the onset of monsoon. The half dose of N and full dose of P_2O_5 per ha were applied as per treatment and remaning half dose of N top dressed one month after sowing in sufficient moisture conditions. In existing *neem* tree rows on marginal land under different methods of seed sowing of *Cenchrus setigerus* grass with mud ball/pallet gave significantly higher dry grass yield (2157 kg/ha) which was 15 percent higher as compared to direct seed sowing of grass yield (1876 kg/ha). Further, application of 20 kg N+30 kg P_2O_5/ha increased significantly dry grass yield (2478 kg/ha) but at par with 10 kg N + 15 kg P_2 O_5/ha and was 81 & 59 percent higher over control (1365 kg/ha), respectively. Mean of four years data (2012-2015) revealed that sowing of *Cenchrus setigerus* grass with mud ball/pallet gave highest dry grass yield (2098 kg/ha), while, lowest grass yield (1820 kg/ha) was recorded in direct seed

sowing. Further, interaction of treatments reveals that *Cenchrus setigerus* grass with mud ball/pallet and application of 20 kg N + 30 kgP_2O_5 /ha, increased dry grass yield 71.76 % over control (1424 kg/ha). Similarly this treatment also recorded highest additional net returns and B:C ratio over control.

IMPACT OF TECHNOLOGY DISSEMINATION ON PROFITABLE FLORICULTURE

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Abstract

Available agricultural technology is of no use till it reaches its ultimate users. Research, technology dissemination and the users, these three units are necessary for creation dispersion and use of innovative knowledge. Commercial floriculture is a recent development in Madhya Pradesh which is gaining momentum spire the last few years. In quest for socio economic development of small and marginal farmers, floriculture has emerged as prominent and an attractive sector of agriculture in Indore district of Madhya Pradesh. The scope of floriculture in Madhya Pradesh has increased tremendously, which is evident from the increase in area from 1387 ha in 2009 - 10 to 1905 ha in 2016-2017 and production from 833 tons to 33150 tons during the same period .Major flower crops being grown in this area are Marigold, Gaillardia, Chrysanthemum, Annual chrysanthemum, Tuberose, Desi rose and Gladiolus under open field condition. It become feasible to find out the reason behind low productivity and quality of flower through regular survey, farmers meeting and field diagnostic visits. The major cause of low productivity and quality of flower yield was due to indiscriminate and irregular use of inorganic fertilizers, no use of micronutrient and bio fertilizers in chrysanthemum, no pinching in marigold, cutting of gladiolus spike at ground level, unavailability of quality seed material, no use of proper plant protection measure etc. To combat these causes, Krishi Vigyan Kendra, Kasturbagram was successfully attempted and established the Linkages between scientist – extension functionaries and farmers to disseminate the proper technologies and ideas to enhance the area, production and productivity, consequently enhance the income and livelihood of flower growing community.

AVOIDABLE YIELD LOSSES DUE TO INSECT PEST COMPLEX IN SUMMER MUNGBEAN GENOTYPES

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Abstract

Mungbean is an important pulse crop of Indian subcontinent. It is vulnerable to attack by various insect pests at various growth stages. In the insect pest complex damaging the mungbean crop, bean flower thrips, *Megalurothrips distalis* (Karny) is a serious threat in realizing the yield potential mainly in summer season. Both nymphs and adults of thrips thrive on pollen and cell sap resulting in flower drop, reduced pod formation and poor yield. Pod damage by pod borer complex mainly *Helicoverpa armigera* (Hübner) is another yield limiting factor. Among various management strategies, host plant resistance is an effective and safe method to manage insect pests. Seventeen interspecific lines of mungbean were screened during summer 2015 in field under protected and unprotected conditions. Observations were taken on the population of thrips at flowering stage, pod damage and yield at harvest. Avoidable losses for various genotypes were worked out. Significantly less population of thrips and pod damage and higher grain yield was registered in protected crop than in unprotected crop. The mean thrips population ranged from 2.00- 9.33 per 20 flowers in various genotypes as compared to 9.00 in local check variety SML 668 in unprotected conditions. Pod damage ranged from 6.33- 13.00 per cent in genotypes as compared to 6.33 per cent in check. Genotypes SML 1807 and SML 1837 recorded lowest incidence of thrips and higher grain yield under both unprotected and protected conditions. Yield of SML 1837 was maximum in unprotected (1136 kg/ha) as well as protected (1796 kg/ha) set. The avoidable losses due to insect pest complex in various mungbean genotypes ranged from 23.59-70.97 per cent with an average of 51.62 per cent. Based on various parameters such as lower thrips count, pod damage, better yield and lower avoidable yield losses, the genotypes SML 1837and SML 1807 were identified as superior and useful for breeders from insect point of view. These lines can also withstand insect pressure to a better extent in cases where farmers fail to take timely control measures.

BIOMASS AND CARBON SEQUESTRATION POTENTIAL IN AGRI-SILVI-HORTI SYSTEMS

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Abstract

Climate change is one of the major environmental threats that are likely to impact forest cover and livelihood of the famers. Forest cover more than 1/3rdof the world's land area constitutes the major terrestrial carbon pool. Carbon dioxide (CO_2) is the most important anthropogenic GHG. Carbon storage in forest ecosystem involves numerous components including biomass carbon and soil carbon. As more photosynthesis occurs, more CO_2 is converted into biomass, reducing carbon in the atmosphere and sequestering it in plant tissue above and below ground surface. The carbon sequestered in each part differs greatly depending on various factors *viz*., agro climatic region, the type of system, site quality, density and type of species etc. One of the approaches would be to increase carbon sink size by increasing the tree cover without affecting the livelihood. This is possible to some extent by adopting agroforestry systems by cultivating perennial plantation crops. A study was made to measure biomass and carbon sequestration rate in different tree species raised at Agricultural Research Station, Prabhunagar, University of Agricultural Sciences, Dharwad. The experiment involved horticultural crop sapota and silvicultural trees *viz.*, *Eucalyptus tereticornis, Tectonagrandis, Acacia auriculiformis*, *Lagestromialanceolata* and *Dalbergiasissoo*. Sapota planted at 10 x 10 m spacing and in between two sapota plants, tree species were planted across the slope during the year 1976 on deep clay soils. Adjoining trees to sapota were harvested during the year 1992-93 and one tree is retained in between sapota plants. Growth parameters of trees were significantly higher in *Eucalyptus tereticornis, Tectonagrandis, Acacia auriculiformis* as compared to other tree species. The total biomass and carbon sequestration was significantly higher in *Eucalyptus tereticornis* (108.68 ton/ha and 54.34 ton/ha respectively) followed by *Tectonagrandis* 107.06 ton/ha and 53.53 ton/ha respectively) as compared to other timber tree species in the agroforestry system. Among the sapota trees, total biomass and carbon sequestration was significantly higher when sapota grown with *Lagerstroemia lanceolata* (37.64 ton/ha and 18.82 ton/ha respectively) followed by sapota with *Eucalyptus tereticornis* (36.52 ton/ha and 18.26 ton/ha respectively) as compared to other agroforestry systems.

ASSESSMENT OF GENETIC DIVERSITY OF QUARANTINE IMPORTANT *PHOMOPSIS* SPECIES ISOLATED ASSOCIATED WITH SEEDS OF OILSEED CROPS

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Abstract

Genetic diversity of 12 different isolates of various *Phomopsis* spp. collected from seeds of various oilseed crops representing both exotic as well as domestic collection of India, were used for genetic variability analysis by using 3 molecular marker system *i.e.*, inter-simple sequence repeats (ISSRs), universal rice primers (URPs) and sequence-related amplified polymorphism (SRAP). They are showing various degrees of variations, which is extremely difficult by conventional techniques for fungus characterization as well as variations analysis. Both exotic as well as domestic isolates shows 100 percent polymorphism with 10 markers each of ISSRs, URPs and SRAP. Total 323 DNA amplicons was recorded with a range of 0.1 to 3.4 Kb with ISSRs marker, similarly 293 DNA amplicons was recorded with in URPs and 285 SRAP. Various parameters for analysis of genetic diversity was also analysed such as expected heterozygosity, Shannon's information index, polymorphic information content, effective multiplex ratio and marker index was highest in URP Primers. Unweighted pair group method with arithmetic average (UPGMA) analysis clustered the isolates into 2 major groups, with 39 % genetic dissimilarly using combined three type of markers. URPs marker showed superiority among all three molecular markers in detecting genetic diversity. Exotic isolates of *P. phaseolorum* collected from Jatropha showed highest similarity where as domestic isolates of *P. phaseolorum* isolated from soybean showed highest level of variation. Different isolates did not represent agro-ecological regions and crop origins.

FEASIBILITY TESTING OF TRACTOR OPERATED INCLINED PLATE MULTICROP PLANTER FOR SOWING OF PADDY AS DSR (DRY LAND) METHOD

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Abstract

This paper is mainly focused with the research work conducted with the six row inclined plate multicrop planter, which was tested for sowing of paddy at KVK, Jale, Dr RPCAU,Farm in about 0.75 ha land and also tested in farmers field of Malinagar, Samastipur in about 1 ha of land during Kharif season with different varieties of paddy and also comparative study with traditional method was conducted. This implement was used for direct seeding of paddy by DSR (dry land) method. The actual field capacity was found 0.45 ha/h with field efficiency 72%. The average hill population/m^2 was 75, whereas plant to plant and row to row spacing was 4cm and 23 cm, respectively. The cost of use of machine was Rs 665/h and Rs 1478/ha, whereas, in traditional method, the cost of sowing was found Rs. 7500/ha. There was net saving of Rs. 5027/ha by planting of paddy by this machine over traditional planting. It was observed that germination of paddy crop was founds satisfactory and useful for farmers particularly from labour and time saving point of view. Removal of weed is necessary before sowing of paddy. It is well established fact that the use of seed cum fertilizer drill increases the crop production due to timely complication of sowing work as well as accurate placement of fertilizers. However, it is not yet popular among the farmers of Bihar. This may be due to its high initial cost as well as their limited use for selected crops. The inclined plate multicrop planter will solve this difficulty to a great extent. It will be easily accepted by the farmers due to its multi use for sowing of various crops.

INTROGRESSION OF SCAB RESISTANCE IN INTRODUCED GENOTYPES OF APPLE (*MALUS X DOMESTICA*. BORKH)

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Abstract

Apple scab is one of the most widespread diseases of apple trees causing huge economic losses both quantitatively and qualitatively. The increased expenses associated with labour and fungicides justify the investigation of an alternative, effective, least expensive resistance approach to deal with this disease. In present study, "Introgression of scab resistance in introduced genotypes of apple" we first evaluated 24 genotypes against apple scab disease, using phenotypic and molecular approaches to find out the genotypes with highest resistance against sacb disease. Phenotypic screening using leaf detach method showed that, in certain genotypes fungus did not proliferate macroscopically and the leaves remained alive, green and also showed hypersensitive response, which gives indication of resistance against apple scab. To validate the results of phenotypic screening, all twenty four genotypes were again evaluated for the presence of *Vf* gene conferring resistance against apple scab disease using nine gene specific primers. Certain gene specific markers amplified only one fragment in resistant cultivars and hence confirmed the presence of *Vf* gene in these cultivars. Some amplified fragments in both susceptible and resistant lines, hence couldn't distinguish between resistant and susceptible ones. Among 24 genotypes 8 genotypes viz., Firdous, Nova easy gro, gavin, priscella, liberty, Selection 5, 1 &8 were amplified by almost all the primers used. Gene expression studies using Real time PCR also revealed that same 8 genotypes were having highest expression of *Vf* gene. Before hybridization, studies like pollen viability and pollen germination were also done, which revealed that maximum germination and viability were shown by Priscella (91.31 & 90.60% respectively). For hybridization programme to introgress the resistance in susceptible cultivars Redlum gala and fuji azitec, 8 donor parents were selected as pollen donors based on phenol-molecular screening, gene expression, pollen viability and germination studies. Out of total crosses done, the fruit set percentage was highest in Gala Redlum x Firdous with 91.66%, the seed germination and seedling survival percentage was highest in crosses between Fuji Aztec X Sel. 8 (79.62%) and Gala Redlum x Liberty (79.82%) respectively. The hybrid seedlings were further evaluated for phenotypic screening using same leaf detach method and only two classes were observed either resistant or susceptible. To validate our phenotypic results hybrids were also evaluated using molecular markers and

same results were confirmed as in phenotypic screening. The gene expression studies were done for single resistant hybrid from each cross also showed highest expression as against susceptible hybrid. Present study confirmed the resistance both by phenotypic and molecular screening among certain genotypes which can be further exploited for future molecular breeding programme for other commercially growing scab susceptible apple varieties. Also the resistant hybrid obtained from the study can be top worked on different rootstocks to develop resistant variety.

STRATEGY FOR ENHANCING FARMERS' INCOME AT VILLAGE LEVEL : A STUDY OF KASGANJ DISTRICT OF UTTAR PRADESH

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Abstract

In the present scenario of agricultural development, emphasis is being given on enhancing the income of the farmers. Government of India has targeted doubling the income of farmers by 2022. Only production oriented extension approach cannot fulfill the requirements for achieving the target. Extension agencies are needed to be more specific in actions, focused result oriented not in terms of production enhancement but also ensuring the profitable returns to the farmers. This requires the developing extension strategies at micro level within the framework of national policies. A Study was conducted in two villages of district Kasganj of Uttar Pradesh with the purpose of developing location specific strategies for enhancing the income of the farmers. Two Focused Group Discussions were conducted in each village to gather the data. There are total 148 farm families in village Afzalpur and 120 farm families in village Tikampura. Total agricultural land of village Afzalpur and Tikampura is 102 and 132.13 hectare, respectively. Major crops of the villages are maize and pearl millet in *kharif* season and vegetable pea and wheat in *rabi* season. At present farmers of the villages getting Rs. 18,750 per hectare average annual income. Almost all the farming families have at least one buffalo but average milk yield is 6-7 kg/day/ buffalo. Farmers sell their produces in local *mandis.* Farmers lack in knowledge about nutrient management, insect-pest management, animal nutrition and human nutrition. They are dependent on local private inputs dealer for agricultural inputs and information regarding suitable varieties of the crops and insect-pest management. Ensuring timely availability of suitable varieties, soil health improvement, integrated nutrient management, integrated insect-pest management, proper animal nutrition, value addition and linkage of farmers to market are the identified thematic areas needed to be addressed for enhancing farmers' income of these villages. Promotion of seed production of vegetable pea and late sown varieties of wheat, production of organic inputs, processing and value addition in pearl millet, maize and vegetable pea at village level not only can ensure timely availability of seeds of suitable varieties, soil health enhancement and better market price to the farmers but also can provide self employment to the rural youths of the villages. Rural youths must be encouraged to be engage in seed production, organic inputs production and value addition activities. In the extension activities for these villages emphasis must be given on integrated nutrient management, insect-pest management and animal nutrition. Farmers association must be formed for profitable marketing of the agricultural produces. On the basis of situation analysis and thematic areas identified, the present paper suggests the extension strategy in detail for enhancing the income of farmers of these villages and the villages having similar situations.

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 2017-18 were 49.077 lakh hectares, 82.169 lakh tones and 1674.00 kg/ha, respectively. While in Rajasthan, the area, production and productivity of groundnut during 2017-18 were 6.406 lakh hectares, 11.315 lakh tones and 1766 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 during *Kharif* 2017 and 2018. Among the tested entries viz., UG 204 (3396 kg/ha), followed by UG 210 (3318 kg/ha) were found highest dry pod yielder and recorded significantly superior dry pod yield over the checks. Kernel yield ranged from 1572 to 2394 kg/ha, 100 kernel weight ranged between 39 to 52g, shelling percent ranged from 67-72, days to maturity were ranged between 93 to 99 days, oil percentage ranged from 42 to 48%, dry haulm yield ranged from 4028 to 5826 kg/ha and sound mature kernels were ranged from 87 to 95%.

MANAGEMENT OF SCLEROTINIA ROT IN INDIAN MUSTARD (*BRASSICA JUNCEA*)

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Abstract

Sclerotinia sclerotiorum (Lib.) de Bary, the causal organism of stem rot of *Brassica* and over 500 host plants is distributed worldwide. Sclerotinia rot is menace to cultivation of oilseed *Brassica* crops in the world. Infection occurs on leaves, stems and pods at different developmental stages, causing seed yield losses of up to 80%, as well as significant reductions in oil content and quality.Management is difficult due to the presence of wide host range and long-term survival of the resting sclerotia. Since no single method can effectively control *S. sclerotiorum*, the best approach to control the pathogen is by the integration of various eco-friendly measures. Cultural practices including wider row and plant spacing or lower plant populations along with irrigation management reduce the microclimate favorable for disease development.Seed treatment (@ 2 g/kg) and foliar spray (@ 0.2%) with Carbendazim resulted in maximum reduction in infection (88%) with increased pooled mean seed yield (2439kg/ha).Different fungal and bacterial antagonist were also found effective in Sclerotinia rot management like *Trichoderma*, *Bacillus subtilis* and *Pseudomonas fluorescens* showed a medium level of disease reduction ranging from 51.3% to 64.3%. Seed treatment (@6g/kg) and foliar application (@0.6%) of *T. harzianum*showed a reduction of 51.3% disease incidence with yield (2095 kg/ha). Partial resistance has also been identified in some *B. napus* and, to a lesser extent, in *B. juncea* genotypes from India. In recent a significant partially resistant genotypes have been identified in *B. juncea*. In addition to identifying high level host resistance to SSR, breeding populations of similar levels of resistance but narrow variation in the resistance range have also been identified. Such populations not only consistently display the level of resistance expected but also reflect genetic diversity of resistance sources needed to successfully develop new more-resistant cultivars.

DIVERSITY OF POLLEN PELLETS HARVESTED FROM *APIS MELLIFERA* L. COLONIES UNDER HARYANA CONDITION

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Abstract

Honey bees, *Apis mellifera* L. get attracted towards flowers of different plant species to get floral rewards in the form of nectar and pollen. Pollen in particular is preferred by honey bees as the protein source for their developing brood. Worker bees pack the abundantly dispersed pollen on their body into pellets and carry them in their basket shaped hind legs into the colony. Honey bee collected pollen pellet is also gaining popularity as an important nutritional supplement for human beings. Keeping that in view, pollen traps were mounted on the entrance of *A. mellifera* colonies to harvest pollen pellets brought by the returning bees. The colonies were kept in the campus of College of Agriculture, Kaul, Kaithal, Haryana (coordinates: 29.8498° N, 76.6615° E). A study intended to determine the floral phenology of different botanical species of plants and resulting foraging activity of *A. mellifera* was investigated through collection of diverse pollen pellets brought by bees from

their natural surroundings was investigated during January month of 2017-18. The overall collected pollen was further segregated manually on the basis of colour and identified their botanical origin through melissopalynological techniques. During January month, harvested sample had bright yellow coloured *Brassica campestris*, green coloured *Eucalyptus* spp., orange coloured *Sida acuta*, white coloured *Ageratum conyzoides* and light yellow coloured mixed *Cicer arietinum* and *Eucalyptus* spp. pollen pellets in the range of 66-76 %, 14-26%, 3.3-4.6%, 6.3-25% and 0-2%, respectively. This study suggest that the *A. mellifera* has more preference towards *B. campestris* pollen as against rest of the other pollen types.

CHARACTERIZATION AND EVALUATION OF BREAD WHEAT GERMPLASM FOR RACE NON-SPECIFIC ADULT PLANT RESISTANCE GENES AND SLOW RUSTING BEHAVIOUR

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Abstract

Wheat along with rice and maize is fulfilling half of the calories demand of the world. In India wheat is grown in an area of about 30.72 m. ha with production of 97.44 m. tonnes and an average productivity of 3172 kg per hectare. The rust fungi are the most important diseases responsible for substantial loss of wheat production. Host resistance and chemicals are most commonly employed for disease management. Growing resistant varieties is the most economical and environmentally sound method for rust management. The leaf rust resistance genes *Lr34, Lr46, Lr67* and *Lr68* confer race non-specific adult plant resistance (APR) against many pathotypes of leaf rust. These genes confer slow rusting behavior to the wheat genotypes. Slow rusting genotypes are characterized by slow progress of the disease with less terminal disease severity which limit the losses caused by the rust diseases. A total of 198 bread wheat genotypes with leaf tip necrosis phenotype were identified for studying their slow rusting behavior as well as adult plant resistance gene/s associated with them. These genotypes were screened with molecular markers to identify the race non-specific APR genes. Genotypes were evaluated in the field for identifying slow rusting genotypes against leaf, stem and stripe rusts over two years. Out of the 127 genotypes identified carrying race non-specific APR genes, many were found to have multiple APR genes in different combinations. Out of 81 genotypes identified carrying *Lr34* gene, 53 carried *Lr34* gene singly, 17 were carrying *Lr34+Lr46* genes, six had *Lr34+Lr67* genes, four had *Lr34+Lr68* genes, while one was carrying *Lr34+Lr46+Lr68.* A total of 16 genotypes were carrying *Lr46* gene singly, five genotypes were carrying *Lr46+Lr67* genes, one genotype had *Lr46+Lr68* genes, two genotypes carried *Lr46+Lr67+Lr68* genes. While 11 genotypes carried *Lr67* gene singly, nine genotypes had *Lr68* gene singly and one had *Lr67+Lr68*. The Area Under Disease Progress Curve (AUDPC) was calculated for all 198 genotypes. A total of 115, 19 and 27 genotypes showed an AUDPC value of 0 for leaf, stem and stripe rusts, respectively. A total of 54, 134 and 108 genotypes exhibited AUDPC values of 1-100 for leaf, stem and stripe rusts, respectively. A total of 7, 16 and 22 genotypes recorded AUDPC values of 101-200 for leaf, stem and stripe rusts, respectively. These slow rusting bread wheat genotypes carrying multiple race non-specific APR genes can serve as stable sources of multiple rust resistance toward developing durable resistant varieties.

REASSESSMENT OF TEMPERATURE-HUMIDITY INDEX FOR MEASURING HEAT STRESS IN DAIRY CATTLE OF SUB-TROPICAL HIMALAYAN FOOTHILL REGION

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Abstract

The study was aimed to reassess previously described heat stress indicators of dairy cattle for Jammu region. Based on meteorological data of last four years, animals were monitored for biochemical, hematological, oxidative stress marker and for heat shock responsive (HSR) gene expression profile at THI range of 68-86. It was evident that increased heat load, as measured through THI, had adversely affected different physiological and biochemical parameters of animals. Increased THI

had direct influence on RT or RR although the relationship was not linear. The skin temperature hotspot of different body regions increased with increase in THI. Among different region analyzed, the surface temperature of head region showed an interesting and perhaps more direct relationship with THI. Among different haematological parameters, it was observed that with increased THI, WBC counts tended to increase while RBC count decreased. The PCV% and plasma glucose showed a marked variation in response to increased THI. Blood sodium and potassium levels showed fluctuations with increased THI. The activity of SOD and GPX was significantly ($p<0.05$) associated with increase in THI, however, no linear relationship between the THI and level of either SOD or GPX was observed in the study. Among different *Hsp70* gene expression analyzed, the expression *HspA8* followed a pattern with increased THI starting at THI 74. After analyzing physiological, biochemical parameters and HSR gene expression profile of animals in response to different THI, it appeared from the study that animal undergoes few or little changes at THI 72 but major physiological changes occurred after THI reaches 74. At THI range 74-79, no drastic change in these parameters occurred suggesting animals undergo transient acclimatization in this range to maintain homeostasis. Once THI reached and crossed 80, this homeostasis is disturbed and animals experienced major physiological changes again.

COMPARATIVE GROWTH OF CHEMICAL FERTILIZERS CONSUMPTION IN KARNATAKA (INDIA)

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Abstract

Agricultural sector plays an important role in economic development of developing countries. Chemical fertilizers have played a vital role in the success of India's green revolution and consequent self-reliance in foodgrain production. Fertiliser consumption in India has been increasing over the years and today India is one of the largest producer and consumer of fertilisers in the world. The analysis of growth is usually used in economic studies to find out the trend of a particular variable over a period of time. The necessary secondary data about consumption of NPK in Karnataka were collected from Directorate of Economics and Statistics, Karnataka for the year 1989-90 to 2015-16 and was estimated using the compound annual growth rate (CAGR). The results of CAGR in consumption of nitrogen fertilizer revealed that, among different divisions, the higher growth was noticed in Kalburagi division (24.19 %). Similarly phosphorus consumption also higher growth was noticed in Kalburagi division (26.25 %). In case of potash consumption was significantly higher growth in Belagavi division (26.10 %) as compared to other divisions. The consumption of NPK fertilizer witnessed significant growth during period-I compared to period-II and period-III. In overall period the growth in consumption of NPK fertilizer from 1989-90 to 2015-16 was noticed positive across all the divisions which was highest growth in Kalburagi division (24.74%) followed by Belagavi (24.50 %), Mysuru (21.32 %) and Bengaluru (20.53 %). However, higher growth was noticed in Kalburagi division and has less variability as compared to other divisions.

JAMMU AND KASHMIR (NORTH-WESTERN HIMALAYA): A HOME FOR DIVERSE WILD EDIBLE PLANTS

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Abstract

The state of Jammu and Kashmir has great diversity in the geo-ecological conditions which makes it a land of diverse flora and fauna. Jammu and Kashmir is rich in underexploited and underutilized plants which have multipurpose potential. These underexploited plants include wild edible plants that are of great importance to mankind as they have high nutritional and medicinal value. There are different kinds of wild edible plants in the world which are grouped in various families like Liliaceae, Portulacaceae, Rosaceae, Ericaceae, Brassicaceae, Lamiaceae, Asteraceae, Urticaceae, Typhaceae, Fagaceae,

Pinaceae. The primitive society of the state which includes Gujar, Bakarwala and otherinhabitants living in far-flung areas used these plants in their day to day life for medicine, food, fodder and otherreligio-social customs and beliefs. But there is lack of knowledge on the importance of the plant to other parts of world. Various studies on wild edible plants have been conducted earlier and it was found that Jammu and Kashmir state have more than 109 species of the wild edibleplants only being used by them for food in various ways. The botanical names of the wild edibleplants, local names, places of collection, parts used and mode of use are available. Some of these species are endangered thus, there is a need to find out ways for conservation of those species. Invitro propagation of these plants is also an alternative solution for sustainable development and livelihood generation. Thus there is a need to find out the importance of these plants and to create awareness about the plants among the masses.

UP 09453 : AN ERA OF SUGARCANE IMPROVEMENT

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Abstract

Sugarcane is one of the most important agro-industrial crop that spreads across both in tropics and subtropics region of India. It is cultivated over 5.0 million hectares area with total production of 350 million tones or thereabout, ranking second in the world after Brazil. One of the most important achievements during the past century in sugarcane agriculture is development of high yielding varieties through breeding, which has made the possibility of expansion of sugar industry. Over centuries of evolution sugarcane varieties were adapted to the peculiar climatic conditions. A close analysis of the trends during last decade reveals that the rate of increase in sugar yield is actually slowing down. A national programme involving multi–disciplinary group of scientists from various research institutes/stations for improving canes through hybridization and selection will help in developing new multi-purpose sugarcane varieties with better adaptability. In view of the above scenario, a field experiment was conducted at multi-location of North-Central & North-East Zones across the country under ICAR–All India Coordinated Research Project on Sugarcane to test four early maturing sugarcane clones (entries) viz., BO 153, CoP 08436, CoSe 09452, UP 09453 with two standards BO 130 & CoSe 95422 in Randomized Block Design for yield and quality traits. The mean data (two plant & one ratoon) of four locations viz., Sugarcane Research Station, Gorakhpur; G.S. Sugarcane Breeding & Research Institute, Seorahi; Sugarcane Research Institute (RPCAU), Pusa, Samastipur; ICAR–IISR Regional Centre, Motipur under ICAR–All India Coordinated Research Project on Sugarcane conceded that sugarcane variety UP 09453 was found best among all test entries and standard cultivars for quantitative & qualitative traits viz., NMC (130000/ha), cane yield (79.05 t/ha), sucrose% (17.16%), pol% in cane (13.26%), CCS t/ha (9.41t/ha) respectively. The sugarcane variety UP 09453 is developed by cross of Grl 28/92 x CoSe 92423 through hybridization & clonal selection at Sugarcane Research Station, Gorakhpur (Uttar Pradesh), India. This genotype was tested under different clonal stages for quality along with yield attributes and was also screened for red-rot reaction. The clone was accepted for multi-location testing under zonal varietal trials of North-Central & North-East Zone of ICAR–All India Coordinated Research Project on Sugarcane during 2010 and designated as 'UP 09453'. The sugarcane variety UP 09453 has been release and notified in the year 2018 by Central Varietal Release Committee (CVRC), Government of India, New Delhi for commercial cultivation in North-Central & North-East Zones comprising Eastern Uttar Pradesh, Bihar, West Bengal and Assam. The increasing yield aspects along with surpassed quality of sugarcane variety UP 09453 will be proved effective and fortunate in doubling farmer's income by 2022, a time when the nation honoring its 75 years of glory after independence.

SMALL RNA PROFILING IN RESPONSE TO RED ROT INOCULATION IN SUGARCANE

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Abstract

Red rot disease of sugarcane, also known as *Cancer* of sugarcane is caused by the fungus *Colletotrichum falcatum* and causes yield losses up to 100 percent. Though the disease is so devastating, not much is known about its genetic control. Plant

protection measures and seed treatment are recommended to manage the control of this disease. Small RNAs (sRNAs) are non-coding RNAs in the size range of 20–24 nucleotides and are important posttranscriptional regulatory factors that play an important role in growth, development and stress response of plants. Based on their size, biogenesis pathway, and mode of action, plant small RNAs are categorized into different classes. Several small RNAs are either up or down-regulated by disease stress, suggesting that they may be involved in regulation of stress-responsive gene expression and disease resistance. Since only a little is known about small RNA population in sugarcane, it was thought to be important to identify them from red rot challenged sugarcane in order to understand the small RNA-guided gene regulation. Hence, total RNA was isolated from cane stalks and leaf tissues of one red rot-resistant and one susceptible sugarcane genotype, after inoculation with *C. falcatum* and small RNA libraries were constructed from control and treated tissues and sequenced. Several non-coding small RNAs were found including Lnc RNA that ranged from 18 - 463, mature transcript ranging from 71-172, msr RNA from 0-1, Non-protein coding transcripts 0-40, piRNA7-113, pre_miRNA0-11, self-splicing ribozyme RNA4-547, snmRNA3-861, snoRNA194-1520, snRNA258-522, SRP_4.5S RNA0-1 and Y RNA 0-4 in different control and treated samples. The alignment of clean reads with miRbase21 resulted in identification of >300 known microRNA in each sample along with 472 novel miRNA in all the samples having 25-352 targets for each novel miRNA. Most of the target genes of differentially expressed miRNA genes were associated with cellular and metabolic processes, or with cell or organellar development. Some target genes have also been identified that are involved in disease resistance mechanism. Further validation of these miRNA is in progress.

EXPLOITATION OF PSEUDOMONADS FOR ANTAGONISTIC ACTIVITIES AGAINST *SCLEROTIUM ROLFSII*

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Abstract

Thirty pseudomonad isolates were screened for their antagonistic activities against 20 isolates of *Sclerotium rolfsii* and also characterized for their plant growth-promoting traits. Out of the 30 pseudomonad isolates, PUR46 was found to be best against all 20 isolates of *Sclerotium rolfsii,* because of its unique ability to suppress the growth of mycelia as well as the sclerotia formation of most of the *S. rolfsii* isolates *in vitro* conditions. In addition to it, PUR46 was also found to be positive in other growth promoting traits like phosphorus solubilization and ammonification. The results suggested that expression of one or more of the traits like antagonistic activity against *S. rolfsii* and solubilization of tri-calcium phosphate may help in controlling the pathogen besides enhancement of plant growth. In this study, our investigations clearly indicate that PGPR isolate PUR 46 may be exploited to be used as potential biocontrol agents against *S. rolfsii* in agriculture system.

MORPHOLOGICAL AND MOLECULAR DIVERSITY ANALYSIS OF *MACROPHOMINA PHASEOLINA* ISOLATES BASED ON SRAP MARKER

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Abstract

Climate change has led to aggravated pathogen thus causing huge yield loss in various crops due to charcoal rot disease. Based on different hosts and geographical regions total 16 *M. Phaseolina* isolates were collected and they revealed substantial variability. All these isolates showed variability with different characters *viz.* growth diameter, pattern of sclerotia formation and hyphal width. Out of sixteen isolates, isolate MP 7 and MP 20 were found to be fast growing having round to irregular shaped black sclerotia. Highly significant difference was recorded in sclerotial size as well as scelrotial density. With 19 SRAP primer combinations genetic variation was detected in all the isolates. The isolate MP 5 and MP 6 showed highest genetic similarity (90%) whereas lowest genetic similarity (58%) was observed in isolate MP 11 and MP 18. Out of 19 SRAP primer

screened a total of 247 alleles was observed and the product size varied from 0.11-3.0 Kb. Various parameters for analysis of genetic diversity was also analysed such as polymorphic information content, effective multiplex ratio and marker index was highest in SRAP 16 primer combination. These reports on the basis of SRAP marker and sequence analysis clearly indicates genetic variation among the strains collected from different hosts and geographical regions. The result demonstrates further applicability of SRAP primer in analysing genetic variations.

NEW FRONTIERS IN DISEASE AND PEST MANAGEMENT INTEGRATED MANAGEMENT OF ALTERNARIA BLIGHT OF NIGER

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Abstract

Niger is considered as a minor oilseed, is very important in terms of quality and taste of its oil and export potential. Beside edible uses, niger seed oil is also used for lighting, painting, lubricants and the protein rich meal obtained after oil extraction is used as animal feed and for fertilizer. Alternaria blight is the most serious and devastating diseases of niger caused by *Alternaria porri* (Ell.). The disease appears as concentric rings on the leaves, which later on turns brown with grey centre. As the disease advances, the spots become oval or circular and become irregular in shape. The infected leaves become dry and fall off prematurely. The disease is favoured by warm and humid climate. Further, the accidental rain at flowering stage leads the expansion of alternaria leaf spot incidence and results in the poor seed set and seed yield. Diseases causes heavy damage upto 35-40 per cent to this crop and reduce its seed yields upto 25-30 per cent, which harm the status of the farmers. Therefore, an experiment was conducted to test the efficacy of eleven treatment combinations viz**.,** biocontrol agents, botanicals and fungicides which were found effective *in vitro* study were further tested under field condition under Randomized block design replicated thrice and pooled data of two year trials results revealed that Seed treatment with nativo-75 WG-(trifloxystrobin 25% + tebuconazole 50%),0.5g @per kg of seed+ 3 sprays of nativo-75 WG (trifloxystrobin 25% + tebuconazole 50%),0.1% recorded least per cent disease index of 20.63% and 54.44 % PEDC with highest seed yield of 379.33 kg/ha followed by seed treatment with *T. harzianum* @5g/per kg of seed+ 3 sprays of nativo-75 WG (trifloxystrobin 25% + tebuconazole 50%), 0.1% 26.0 % PDI, 48.24 % PEDC disease control and 359.31 kg/ha of seed yield under field condition.

YIELD FORECAST MODELS OF POTATO FOR BARABANKI AND SULTANPUR DISTRICT OF EASTERN UTTAR PRADESH

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Abstract

The present investigation entitled "Yield Forecast models of potato for Barabanki and Sultanpur District of Eastern Uttar Pradesh." has been under taken use time series data on yield of potato and weekly data from 40th SMW of the previous year to 6th SMW of the following year on five weather variables *viz.,* Minimum Temperature, Maximum Temperature, Relative humidity 08.30hrs, Relative humidity 17.30hrs, and Wind-Velocity covering the period from 1990-91 to 2011-12 have been utilized for development of pre-harvest forecast model. Statistical methodologies using multiple regression, discriminant functions analysis, principal component analysis for developing pre-harvest forecast model have been described. In all, 15 models (one based on regression, six from discriminant, one from principle componant and seven from composite forecast) have been developed. The Model-I_{st} is based on step wise regression, II_{nd} to VII_{th} are based on discriminant functions analysis and $VIII_{th}$ based on principle componant and 7 composite forecast models have been developed. On the basis of adjR^2, RMSE and %SE, the best two models obtained by the application of discriminant and composite forecast analysis of weekly weather data are Model-I_{st} & Model-$VIII_{th}$ for Sultanpur and Model-III_{rd} & Model-V_{th} for Barabanki. However, the composite forecast models CF-2 for equal weight & CF-6 for un-equal weight for both Sultanpur & Barabanki have further reduced the percentage standard error of the forecast yield to some extent. These models can be used to get the reliable forecast of potato yield two and half months before the harvest.

QUANTITATIVE TRAIT LOCI MAPPING FOR HARDSEEDEDNESS IN INTERSPECIFIC RECOMBINANT INBRED LINES OF SOYBEAN

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Abstract

Soybean (*Glycine max* (L.) Merr.) is *numerous no* oilseed crop that represents a major source of protein and vegetable oil supplements for humans and livestock worldwide. Hard seededness or seed coat impermeability in the cultivated soybean is typically associated with various functions likewise seed viability under delayed-harvest field condition, seed longevity under humid environments, tolerance to fungal activity, and inhibition against rapid imbibition of water, which often deteriorates the germination. In this study, 122 genotypes of cultivated (*Glycine max)* and wild soybean (*Glycine soja & Glycine tomentella*) were screened for seed coat impermeability trait and extreme genotypes were identified for genetic studies. 300 Recombinant Inbred Lines (RILs) were developed using parent DC 2008-1 (*G. soja*) and DS 9712 (*G. max*.) as seed coat impermeable and seed coat permeable genotype respectively. 204 RILs were surveyed with 400 SSR markers to identify 218 markers as polymorphic (54.56%) between the parental lines. The linkage map developed by using 207 SSR markers with an average marker distance of 8.94 cM. Seven QTL affecting seed coat permeability after 6 hours of seed soaking in water (SCPH) were mapped on chromosome Nos. 2, 5, 12, 13 and 16 in the seeds stored for 1-3 years. Five QTL affecting seed coat permeability after 7 days of imbibition (SCPD) were mapped on chromosome Nos. 2,9,10 and 20 in the seeds stored for 1-3 years. Phenotypic variation explained (PVE) by each QTL ranged from 5.96 to 39.67%. Two major stable QTL viz., qSCPH2-1 and qSCPH2-2, which are located in tandem on chr.2, together explained 62.92% and 43.09% phenotypic variance on the seeds of two years and one year of ambient storage. One major and five minor QTLs identified in this study for both types of seed coat impermeability was novel. The QTL and markers identified in this study will pave the way for developing genotypes with enhanced viability & optimum permeability through molecular breeding in wide hybridized populations in soybean.

PPP MODEL IS AN EFFECTIVE APPROACH FOR TECHNOLOGY EXTENSION IN ZAID GREEN GRAM-AN OVERVIEW

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Abstract

Major economy of Sehore district is contributed by agriculture because more than 60 % population is engaged in agriculture. Climatic condition of sehore district is good & the average rainfall in district is 1260 mm. Farming community in District - Sehore (Madhya Pradesh) is normally endowed with fragmented land holdings, containing marginal and small sectors to the maximum, the affordability, accessibility and possibility to travel a long distance and to hunt the information is seldom possible. Mostly farmers of sehore district is grown Soybean, maize, paddy & small area under pulses–pigeonpea, green gram & blackgram in kharif season and wheat & chickpea in rabi season. Farmers are not focus in zaid season crop. For introduction of zaid crop–green gram, Krishi Vigyan Kendra are plan the activity & same are conduct with the support of line department. The objectives of programme are following:-Proper utilizing of resources–Land, Labour, water, Farm implements etc., Enhancement of farm income through introduction of new crop- Green gram in zaid season, To uplift socio–economic status of farming community. During the campaign, scientific production technologies of zaid green gram especially focus on water, nutrient & pest management are popularize. During the programme, campaign are focus on use of improved variety suitable in zaid season of green gram, properly seed treatment, Balance use of plant Nutrient, Timely Weed Management & Plant Protection measures especially sucking pest & yellow mosaic & fungal diseases. In this programme, District Administration, Sehore, Krishi Vigyan Kendra, Sehore, RAK College of Agriculture, Sehore, ATMA, Sehore, Department of Agriculture, Sehore are actively involved. In the programme for disseminate the technology organized training programme to farmers, progressive farmers, master trainers training & extension officers training; Kisan sangosthi, Field visit, E-Kisan pathashala in weekly & distribution of literature. This programme is conducted in 2010-11 to 2013-14. The impact of programme are enhance the farmers, Area & productivity of green gram in zaid season resulted enhance the socio–economic status of farming

community. Other farmers are also seen the impact of programme, they are motivated & adopt the technologies which is disseminated by KVK during implementation of programme.

FORTIFICATION OF VERMICOMPOST USING *STREPTOMYCES CAVOURENSIS*

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Abstract

Earthworm castings can be an imperative resource for bio prospecting novel actinomycetes. Actinomycetes attributes plant growth promotion as well as biocontrol abilities leading to increased agricultural yields and food safety. In the present investigation vermicompost was fortified with *Streptomyces cavourensis* and used for formulation of three products *viz;* powder form, liquid form and pellet form. The shelf life of the introduced actinomycetes was determined by Standard plate count (SPC) technique at 30 days interval upto five months. *Capsicum annuum* seed germination test was performed to check the efficiency of fortified vermicompost for growth promotion. Colony forming units of actinomycetes were found to be maximum after 30 days of incubation. Seed germination test revealed that the bio volume index of *Capsicumannuum* seed was highly significant in 30 days sample. This suggests that microbes established from vermicompost exhibit growth promotion, further increasing the crop yield.

EFFECT OF PACKAGING MATERIAL ON SHELF LIFE OF AONLA (*EMBLICA OFFICINALIS* GAERTN.)

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Abstract

Present investigation was undertaken to evaluate shelf life of Aonla (*Emblica officinalis* Gaertn.), under different packaging material *viz*. Non perforated PET bag(80 micron), Non perforated cling bag (8 micron), Shrink packaging (8 micron), PET (80 microns) with 2 perforations, LDPE bag(15 microns) with 2 perforations, LDPE Vacuum packaging (15 microns) along with control (no packaging material)during 2016 at ICAR-CIPHET, Abohar. Packaging of fruits in different packaging materialfound remarkable effect in term of reducing PLW, retention in moisture and acceptable physico-chemical qualities. Minimum weight loss was observed in LDPE bag (15 microns) with two perforations (1.9%). There was increase in Ph after15 days of packaging in all treatments which was maximum under LDPE Vacuum packaging (3.81) in comparison of control (3.74) while decreasing trend found of total soluble solids in control. The Physico-chemical changes were faster in untreated fruits (control). There was decrease of texture in term of puncture force of 5.39 kg to 3.80 kg. The shelf life of aonla fruits was extended upto 18 days at room temperature when fruits were treated with LDPE Vacuum packaging (15 microns)followed by 15 days by LDPE bag (15 microns) with two perforations packaging.

ISOLATION OF ENDOPHYTIC FUNGUS *CURVULARIA SPICIFERA* FROM MEDICINAL PLANT *TINOSPORA CORDIFOLIA* AND INVESTIGATION OF ITS ANTIOXIDANT ACTIVITY

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Abstract

In nature plants face many abiotic stresses and these stresses result in the increase in reactive oxygen in plant tissues hence causing damage to the plant growth. To protect from these abiotic stresses plants have an assembly of beneficial microbes also known as fungal endophytes present inside the tissues of plants which provide oxidative stress protection to the host plant by

producing various kind of antioxidant secondary metabolites. An increased expression of antioxidant compounds by the host plant and the endophytic fungi would counteract stress induced reactive oxygen. In the present study, an endophytic fungi *Curvularia spicifera* was isolated from stem of *Tinospora cordifolia* and extract of this isolated fungus showed significant total antioxidant potential. The finding of the study provides further support to the hypothesis that abiotic stress protection in plant is largely a function of oxidative stress protection. The isolated endophytic fungi produce secondary metabolites which can be used for the good of human beings as antioxidant compounds. This study suggests that medicinal plants should be conserved not only for their medicinal properties but also for their associated fungal diversity.

ASSESSMENT OF POTENTIAL EFFECT OF SILVER AND ZINC NANOPARTICLES TOXICITY AGAINST PATHOGENIC ALTERNARIA SOLANI AND PHYTOPHTHORA INFESTANS OF POTATO

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Abstract

Mycogenic synthesis of silver and zinc nanoparticles was carried out in the present investigation using an non-pathogenic *Aspergillus flavus* and *Aspergillus niger* against blight diseases of potato. The mycosynthesized AgNPs and ZnNPs were characterized by means of spectroscopic and electronic microscopic techniques. The surface plasmon resonance found at 420-430 nm and 280 nm con?rmed the formation of stable AgNPs and ZnNPs for several weeks at room temperature. Also, the results revealed the formation of spherical and monodispersed average size of 14.8 ± 1.2 nm and 21.6 ± 1.2 nm AgNPs and ZnNPs respectively. The FT-IR spectrum suggested that the fungal extracellular proteins and secondary metabolites had the role in Ag reduction and AgNPs capping of which protein Ag nanoconjugates were formed. Furthermore, the mycosynthesized NPs exhibited potent antifungal activity against different pathogenic isolates of *Alternaria solani* and *Phytophthora infestans* fungus, the causal pathogen of tomato early & late blight disease. The antifungal ef?ciency of the AgNPs & ZnNPs at 1 and 2 mm were evaluated after incubation by measuring the inhibition rate of fungal growth. The results were further supported by investigating fungal hyphae morphology alteration by scanning and transmission electron microscopy. Treated fungal hyphae showed formation of pores. Also,the mycosynthesized NPs were able to pass and distribute throughout the fungal cell area and interact with the cell components.

EFFECT OF PLANT GEOMETRY AND FERTILITY LEVELS ON GROWTH AND YIELD OF GARDEN CRESS (*LEPIDIUM SATIVUM* L.)

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Abstract

An investigation to assess the effect of plant geometry and fertility levels on growth and yield of garden cress (*Lepidium sativum* L.) was conducted during *rabi* season of 2016-17 and 2017-18 at Soil Conservation and Water Management Farm of C. S. Azad University of Agriculture and Technology, Kanpur. The experiment was conducted to find out suitable row spacing and optimum fertility levels for chandrasur crop. The treatment comprised of four row spacings, i.e. 20 cm, 30 cm, 40 cm and 50 cm in combination with four fertility levels, i.e. control, 30:30:00, 60:45:30 and 90:60:30 kg N:P:K ha^{-1} tested in randomized block design with three replications. The result showed that the 40 cm row spacing gave highest seed yield 16.02 q ha^{-1} and (14.94 q ha^{-1} in 2016-17 and 2017-18, respectively followed by 30 cm row spacing that gave seed yield (15.35 q ha^{-1}) in 2016-17 and (14.75 q ha^{-1}) in 2017-18 while minimum seed yield (13.39 q ha^{-1}) in 2016-17 and (11.34 q ha^{-1}) in 2017-18 was observed in 20 cm row spacing. However, fertility levels of 90:60:30 kg N: P: K ha^{-1} gave highest seed yield (16.44 q ha^{-1}) in 2016-17 and (15.62 q ha^{-1}) in 2017-18 followed by 60:45:30 kg N: P: K ha^{-1} gave seed yield (15.72 q ha^{-1}) in 2016-17 and (14.75 q ha^{-1}) in 2017-18 while minimum seed yield (12.84 q ha^{-1}) in 2016-17 and (10.83 q ha^{-1}) in 2017-18 was observed in control.

EFFECT OF DIFFERENT MOISTURE CONSERVATION PRACTICES ON GROWTH AND YIELD OF LINSEED VARIETIES UNDER RAINFED CONDITION OF CENTRAL UTTAR PRADESH

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Abstract

A field experiment was conducted on sandy loam soil at Soil Conservation and Water Management Farm of C.S. Azad University of Agriculture and Technology, Kanpur during Rabi, 2015-16 to assess the effect of different moisture conservation practices on growth and yield of linseed varieties under rainfed condition of Central Uttar Pradesh. The soil of the experimental area was Sandy Loam having Bulk density 1.35 g/cc, Particle Density 2.65g/cc, water holding capacity 29.80%, field capacity 18.6%, porosity 49.05%, pH 7.9, electrical conductivity 0.37ds/m at 25^0C, organic carbon 0.30%, Total-N 0.027% , available N 170.5 kg ha. The experiment was conducted in Randomized Block Design with 3 replications. The treatments consisted of 3 varieties i.e. T-397, Padmini and Shekhar alongwith 3 moisture conservation practices i.e. control or farmer's practice, dust mulching created by hand hoe after one weeding by Khurpi at 20 DAS and organic residue mulch(paddy stover) @ 4 t ha at 20 DAS were tested in the experiment. The result showed that Shekhar' variety of linseed proved to be the most promising in production, root development, water use efficiency, net return and benefit: cost ratio, compared to 'Padmini' and T-397 varieties under rainfed condition while among moisture conservation practices, application of organic residue mulch @ 4 t ha on soil surface in between the crop rows at 20 days after sowing was found to be more profitable in comparison to dust mulch and farmer's practice on sandy loam soil under rainfed condition at Kanpur.

IMPACT OF HIGH TEMPERATURE ON CROP PRODUCTION

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Abstract

Climate change and agriculture are interrelated processes, both of which take place on a global scale. Climate change affects agriculture in a number of ways, including through changes in average temperatures,, rainfall, and climate extremes (e.g., heat waves); changes in pests and diseases; changes in atmospheric carbon dioxide and ground level ozone concentrations; changes in the nutritional quality of foods. Temperature is a primary factor affecting the rate of plant development. Warmer temperatures expected with climate change and the potential for more extreme temperature events will impact plant productivity. Pollination is one of the most sensitive phenological stages to temperature extremes across all species and during this developmental stage temperature extremes would greatly affect production. Variability in leaf photosynthetic rates within or between species is often unrelated to differences in productivity. Similarly, high photosynthetic rates at high temperatures do not necessarily support high rates of crop dry matter accumulation. The temperature optimum for photosynthesis is broad, presumably because crop plants have adapted to a relatively wide range of thermal environments. 1 to 2°C increase in average temperature is not likely to have a substantial impact on leaf photosynthetic rates. Further, there is a possibility that photosynthesis of crop plants can adapt to a slow increase in global average temperatures.

PHOSPHORUS RESPONSE IN SESAME (*SESAMUM INDICUM* L.) IN COARSE TEXTURED SOILS

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Abstract

A field study was carried out on a coarse textured medium phosphorus status soil of CCS HAU Regional Research Station, Bawal (Haryana) at three different locations from 2015 to 2017 to study the effect of phosphorus fertilization in sesame in terms of yield, total P uptake, P build/depletion in soil and economics returns. The experimental soil was loamy sand in

texture, alkaline in reaction (pH 8.32 to 8.40), EC (0.17 to 0.20 dS m^{-1}), low in organic carbon (1.9 to 2.0 g kg^{-1}), medium in available P (10.55 to 11.45 kg ha^{-1}) and medium in available K_2O (169.0-170.0 kg ha^{-1}). The experiment was laid out in randomized block design with three replications. There were five graded levels of phosphorus application *viz.,* 0, 10, 20, 30, and 40 kg P_2O_5 ha^{-1}. Recommended dose of fertilizers for crop was applied @ 37.5 kg N ha^{-1}. Irrigation and plant protection measures were taken as per recommended practices. Crop was harvested at physiological maturity, threshed and plot wise yield was recorded. Seed, straw and soil samples were taken and analyzed for P concentration in seed and stalk and available P in soil, respectively. The data was statistically analyzed and economics of P application was worked out. The results revealed that sesame cv. HT-1 seed yield increased significantly with application of phosphorus at 20 kg P_2O_5/ha. The increase in mean seed yield was 6.06, 13.17, 15.38 and 18.04 per cent and in mean stalk yield was 6.20, 14.28, 17.62 and 19.85 per cent due to application of 0, 10, 20, 30 and 40 kg P_2O_5/ha, respectively over control. The mean P-uptake also increased with P application. The mean P-use efficiency varied from 16.30 to 20.30 per cent being maximum (20.30 %) with application of 20 kg P_2O_5/ha. The mean post harvest available P status was 9.90, 11.30, 12.68, 13.52 and 14.08 kg/ha at 0, 10, 20, 30 and 40 P_2O_5/ha, respectively. The mean economic data analysis revealed that benefit cost ratio also increased with phosphorus application and was 1.06, 1.11, 1.17, 1.18 and 1.19 at 0,10, 20, 30 and 40 kg P_2O_5/ha, respectively. The finding of this study serve to demonstrate that in coarse textured medium phosphorus status soil of Southern Haryana, application of 20 kg P_2O_5 ha^{-1} was found to be optimum for sesame in terms of crop yield, soil P fertility status and economics.

OCCURANCE, ENTEROTOXIN GENE PROFILE AND ANTIBIOGRAM OF *BACILLUS CEREUS* ISOLATED FROM PASTEURISED MILK AND MILK PRODUCTS OF KASHMIR VALLEY

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Abstract

The present study was envisaged to study the occurrence, enterotoxin gene profile, and antibiogram of *B.cereus* from milk samples of Kashmir Valley. A total of 180 samples comprising of pasteurized milk (130) and milk products (50) were collected and screened for the presence of *B. Cereus*. On complete microbiological and biochemical analysis 57 samples turned out to be positive resulting in an overall occurrence of 31.66% with about 44 (33.84%) and 13 (26%) isolates from pasteurized milk and milk products respectively. All isolates were screened by multiplex PCR for detection of eight enterotoxigenic genes (*hblCDA*, *nheABC*, *cytK*and *entFM*) and the isolates were divided into six different groups based on the presence or absence of enteroxigenic genes. Group I was occupied by 36 (63.15%), Group II by 7(12.28%), Group III by 4 (7.01%), Group IV by 8 (14.03%), Group V by 2 (3.50%) and Group VI by 0(0%) of isolates, respectively. About 65.90% of isolates from pasteurized milkand53.84% from milk products harbored all the enterotoxin genes. *In-vitro* antibiotic sensitivity of isolates revealed a high sensitivity towards gentamicin (97.56%), chloramphenicol (95.93%), ciprofloxacin (94.33), erythromycin (87.8%), amikacin (83.73), levofloxacin (78.04%), tetracycline (68.29%) and azithromycin (50.40%). On the contrary, the highest resistance was recorded against penicillin-G (100%) followed by metronidazole (94.73%), ampicillin (91.22%), amoxicillin (84.21%) and cotrimoxazole (87.71%). A high resistance to most of the antibiotics was found in isolates from pasteurized milk samples.Among the total 57 isolates 49 (85.96%) of isolates showed resistance to less than six antibiotics and 8(14.03%) of isolates showed resistance to more than six antibiotics, thereby indicating multiple antibiotic resistant *B. cereus* isolates recovered from pasteurized milk and milk products.Occurrence of enterotoxigenic *B. cereus* isolates in pasteurized milk (33.84%) and milk products (26%) is an alarm for public health.

EVALUATING THE SUSTAINABILITY OF COMPLEX SOCIO-ENVIRONMENTAL SYSTEMS: MESMIS FRAMEWORK

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Abstract

Sustainable development has become a leading target of scientific research and policy agenda. In the context of natural resource management, understanding and evaluating the performance of complex socio-environmental systems has become a

challenge, and the design of more sustainable alternatives is a driving need. In addition, there is a need to translate the general principles of sustainability into operational definitions and practices. The present study examines key methodological issues in the selection, transformation and aggregation of economic, environmental and social indicators for sustainability analysis. Specific reference is given to the MESMIS approach, a systemic, participatory, interdisciplinary and flexible framework for sustainability evaluation. The MESMIS operative structure is a six step cycle. The first three steps are devoted to the characterization of the systems, the identification of critical points and the selection of specific indicators for the environmental, social and economic dimensions of sustainability. In the last three steps, the information obtained by means of the indicators is integrated through mixed (qualitative and quantitative) techniques and multi criteria analysis, so as to obtain a value judgment about the resource management systems and to provide suggestions and insights aimed at improving their socio-environmental profile. MESMIS attempts to generate a cyclic process which, by effectively integrating the evaluation into the decision making process, improves the likelihood of success in the design of alternatives and the implementation of development projects.

IMPLEMENTATION OF NEW TECHNOLOGIES IN MOLECULAR GENETICS FOR CROP IMPROVEMENT IN TODAY'S ERA

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Abstract

The major objective of crop breeding approaches is to develop new genetically superior genotypes. During this era of ever increasing demand of population, molecular genetics and all associated technologies have been a source of great contribution For achieving this, breeders are considering various new innovative technologies; such as CRISPR-CAS9, ZFNs, and TALLENs etc. These advanced technologies in molecular biology allow breeders to specifically alter genes, epigenetic modifications, generate site specific deletions.DNA repeat depicts an important role in generating phenotypic diversity and plants have evolved epigenetic mechanisms by various techniques. DNA manipulation and new throughput sequencing is a milestone for innovation in DNA sequencing. Variety of sequencing method are now in use for different application in crop improvement such as Long read sequencing (100 genome), Linked read and whole genome sequencing (1000 genome), whole genome sequencing (10000 genome), exome sequencing and genotyping by sequencing (100000 genome).Pre breeding activities which bridges conservation and use of plant genetic recourses thus offer an additional access to new and desirable genes for generating useful materials for breeders such as small changes (mutation) lead to improved character such as resistance against pests and pathogens. There is also high throughput plant phenotyping, where, G*E interaction determine plant programme and productivity, improved data management and modelling. Among all these genomic approaches there is also an innovation in normal agriculture practices i.e. precision agriculture which include using of tools like satellites , drones, UAV analoging, auto sheer system and cloud computing.

MOISTURE STRESS MITIGATION STRATEGIES IN WHEAT THROUGH IRRIGATION AND NITROGEN RESCHEDULING UNDER CLIMATE CHANGING SCENARIO

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Abstract

Climate change has a serious impact on the availability of various resources on the earth specially water, which sustain life on this planet. Changes in the biosphere, biodiversity and natural resources adversely affecting human health and quality of life. Conventional practices of wheat production has for many years resulted in the deterioration of soil quality through depetion of soil organic matter and nutrients Moisture stress mitigation strategies in wheat through irrigation and nitrogen rescheduling as alternative to address the issues of resources degradation. A field experiment was conducted during *rabi*, 2015 and 2017 at CCS Haryana Agricultural University, Regional Research Satiation, Bawal, Haryana situated latitude 28.1 ^{0}N, longitude 76.5 ^{0}E and 266 m above mean sea level in South-West zone of Haryana. In general the soils are light textured sandy and sandy

loam. The experiments consisting of two irrigation schedule (irrigation at 22, 45, 65, 85, 105 and 120 days after sowing and irrigation at 22, 55, 75, 95, 110 and 125 days after sowing as main plot treatments. While, nitrogen management practices that is 150 kg nitrogen (½ at sowing + ½ 1st irrigation), 150 kg nitrogen (1/3 at sowing + 1/3 at 1st irrigation + 1/3 at 2nd irrigation, 175 kg nitrogen (½ at sowing + ½ 1st irrigation) and175 kg nitrogen (1/3 at sowing + 1/3 at 1st irrigation + 1/3 at 2nd irrigation as sub plot treatments making 12 treatment combinations, were replicated thrice in split plot design. Results on pooled data basis indicated that there was no significant difference between yield attributing parameters viz. effective tillers, 1000 grain weight and grain yield of wheat under recommended irrigation schedule at 22, 45, 65, 85, 105 and 120 DAS and manipulated irrigation schedule at 22, 55, 75, 95,110 and 125 DAS. Application of nitrogen @ 175 kg/ha in three splits (1/3rd as basal,1/3rd at 1st irrigation and 1/3rd at 2nd irrigation) recorded significantly higher grain yield (45.46), net return (57419) and B:C (1.22) over 150 kg N applied in either two or three splits.

INTEGRATED MANAGEMENT OF ALTERNARIA BLIGHT OF NIGER

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Abstract

Niger is considered as a minor oilseed, is very important in terms of quality and taste of its oil and export potential. Beside edible uses, niger seed oil is also used for lighting, painting, lubricants and the protein rich meal obtained after oil extraction is used as animal feed and for fertilizer. Alternaria blight is the most serious and devastating diseases of niger caused by *Alternaria porri* (Ell.). The disease appears as concentric rings on the leaves, which later on turns brown with grey centre. As the disease advances, the spots become oval or circular and become irregular in shape. The infected leaves become dry and fall off prematurely. The disease is favoured by warm and humid climate. Further, the accidental rain at flowering stage leads the expansion of alternaria leaf spot incidence and results in the poor seed set and seed yield. Diseases causes heavy damage upto 35-40 per cent to this crop and reduce its seed yields upto 25-30 per cent, which harm the status of the farmers. Therefore, an experiment was conducted to test the efficacy of eleven treatment combinations viz**.,** biocontrol agents, botanicals and fungicides which were found effective *in vitro* study were further tested under field condition under Randomized block design replicated thrice and pooled data of two year trials results revealed that Seed treatment with nativo-75 WG-(trifloxystrobin 25% + tebuconazole 50%),0.5g @per kg of seed+ 3 sprays of nativo-75 WG (trifloxystrobin 25% + tebuconazole 50%),0.1% recorded least per cent disease index of 20.63% and 54.44 % PEDC with highest seed yield of 379.33 kg/ha followed by seed treatment with *T. harzianum* @5g/per kg of seed+ 3 sprays of nativo-75 WG (trifloxystrobin 25% + tebuconazole 50%), 0.1% 26.0 % PDI, 48.24 % PEDC disease control and 359.31 kg/ha of seed yield under field condition.

WEATHER ELEMENTS OF CONCERN : GREENHOUSE GASES, GLOBAL WARMING AND THEIR IMPACTS ON AQUATIC LIFE

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Abstract

Nowadays, nearly all climatologists have agreed that the climate change results from the increase in the greenhouse gas emissions in the atmosphere and this comes on account of numerous human activities. Weather elements are highly concerned in oceans and seas as they are typically influenced by the process of change in weather caused by global warming since they constitute a large portion of our planet and feature rich biodiversity. A temperature rise of few degrees does not only caused by an increase in the temperature of large water masses but also by the hydrological actions that cause to alter in the physical and chemical characteristics of water. Water temperature is the most important environmental parameter that affects the lifestyles cycle, physiology and behaviors of aquatic living beings. The dissolution of carbon dioxide, which has the main share amongst greenhouse gases in term of contribution in global warming and climate change have caused decline in surface waters, a rise in the sea level, alteration in streams and precipitation models. Consequently this has started to show harmful effect on all aquatic organisms from planktons to mammals. Typically krills have reduced by 80% on an average in the past 30

years. Coral bleaching has multiplied dramatically. Reproduction area of sea turtles has diminished as coastal habitat is destroyed by rise in sea level. Melting of the sea ice has caused many of marine mammals to face extinction. As stated by mathematical computer models evolved recently, it's been calculated that if the CO_2 density is doubled, the global temperature will increase by 3°C. For this reason, a lot many precautions to be taken towards global warming, reducing of the carbon dioxide emission comes first and research has to be executed at the war foot for this purpose on international stage.

BOTANICAL PEST CONTROL

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Abstract

Botanical pesticides are plant derived products and their insecticidal properties have been on record since 1950s. Much before the advent of synthetic organic insecticides, neem, pyrethrum, rotenone, nicotine, ryania, sabadilla and a number of other lesser known botanical pesticides were used to protect agricultural crops from the ravages of insect and non- insect pest in different parts of the world. Nowadays, the problems caused by synthetic pesticides and their residues have increased the need for effective biodegradable pesticides. The natural plant products derived from plants effectively meet this criterion and have enormous potential to influence modern agriculture research. The highest number of pesticidal plants belong to Meliaceae as the neem tree (*Azadirachta indica*) derivatives are rich in atleast 35 biologically active principles, of which azadirachtin, a tetranortriterpenoid, is highly crucial. Due to its legendary insect-repellent and medicinal properties, it has been identified as the most promising of all plants by the National Research Council, Washington, USA. Botanicals degrade more rapidly than most chemical pesticides, and are relatively environment friendly than synthetic chemicals.

BIO-INTENSIVE PEST MANAGEMENT OF CHILLI

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Abstract

Chilli is one of the important spice as vegetable crops in India. India is the largest producer, consumer and exporter of chilli in the world and accounting for 13.76 million tonnes of production annually. Chilli encounters several insect pests and disease throughout the growing season and considered as one of the major constraints for chilli production. Because of this there is an indiscriminate use of insecticides that has led to insecticide resistant development, pest resurgence, disturbance in natural ecosystem and environmental pollution. By considering all these point the Bio-intensive pest management (BIPM) is good. BIPM is essentially a component of integrated pest management. It will help to reduce the dependence on chemical pesticides and ecological deterioration. BIPM includes biopesticides derived from microbials, parasitoids, predators, botanicals and all conventional non chemical methods of pest control. Indian farming which is going through a transition phase, is slowly but surely adopting the ways and means of pest management for sustainable agriculture.

GLOBAL CLIMATE CHANGE AND FOOD SECURITY

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Abstract

Reducing risks to food security from climate change is one of the major challenges of the 21st century. Climate change will have far-reaching impacts on crop, livestock and fisheries production, and will change the prevalence of crop pests. Climate change has always been a prevalent phenomenon. Climate change has not only resulted in increasing global-averaged mean annual air temperature but also the increased amount of atmospheric greenhouse gases. It has been reported that the global mean temperature has increased by 0.74 degree Celsius during the last 100 years. According to FAO, there are about 795 million people who are undernourished globally, with poor nutrition accounting for nearly 45% of deaths in children below the

age of five years annually. Food security, food production and climate change are all interlinked and intertwined. Hence, changes to any system would have a domino effect on the other two systems. The wider adoption of environment-friendly food production systems would allow for sustainable development and progress for current and future generation to come and a higher chance of achieving both food security and better management of climate change. This is because with more environment-friendly food production systems and the introduction of environmental certification regimes, the current levels of GHG emissions can be reduced or maintained at levels where we are still able to seek solutions to mitigate and adapt to this phenomenon and address the problems in the other systems. The reduction of climate change effects will help to improve the food security problem as it reduces the likelihood of crop failure or the deaths of livestock due to natural disasters and climate change.

IMPROVEMENT OF SOIL FERTILITY AND PRODUCTIVITY BY USE OF GREEN MANURING

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Abstract

Green manuring is the practice of ploughing and turning into the soil, undecomposed green plant tissue for the purpose of improving soil fertility and productivity. It increases the soil fertility by the direct addition of nitrogen and also improves the soil structure, water holding capacity and increases microbial population of soil by the addition of humus or organic matter. The soil physical properties that are affected by incorporation of the green manure include the structure, moisture retention capacity, consistency and density. Other properties such as the porosity, aeration, conductivity, hydraulics and infiltration are allied to the modifications to the soil structure. Post-harvest decaying roots significantly increase macropores in soil. Green manuring had significant effect in increasing soil organic carbon. Green manure crops are grown in a field prior to crop cultivation and then cut and buried when approximately 50 percent of all plants are flowering. The practice of incorporating green leaf manure is different from green manure grown in situ, in this method the leaves are cut and brought to the farms in bundles. Green manuring is practiced according to suitability of soil and climatic conditions. Green manuring is generally done with sunhemp, dhaincha, cowpea, green gram, black gram, etc. These crops when rotten nourish the soil with their nutrients. Dhaincha as a green manure crop does well in the waterlogged and alkaline soils. Generally a higher seed rate is recommended for green manuring. They absorb nutrient from the deeper soil layers and leave them in the surface soil. The amount of green plant material buried stimulates the activity of the micro-organisms inhabitant to the soil. Application of green manure crops supplements the chemical fertilizers and restores soil fertility. Therefore, it is an eco-friendly low cost technology to conserve the natural resources besides maintaining environmental quality in a sustainable manner.

CASCADING IMPACTS OF CLIMATE CHANGE ON AGRICULTURE

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Abstract

In every region of the world, plants and ecosystems are adapted to the prevailing climatic conditions. When these conditions change, even slightly, even in a direction that could seem more favourable, the plants will be impacted, some will become less productive, or even disappear. Some of these impacts can be easily predicted, like the direct impact of a heat wave on a specific plant at a specific moment. Others are more complex to predict, like the effect of a certain climatic change on a whole ecosystem, because each element will react differently and interact with the other. For instance, many cultivated plants react favourably, in controlled conditions, to an increase of CO_2 in the atmosphere. The result, in the field, can be an increase or decrease in yield of the cultivated plant depending on weeds competing for nutrients and water and on remedial agricultural practices. Pests and diseases are likely to move, following climate change, thus arriving in areas less prepared to them, biologically and institutionally. A cascade of risks from climate changes to agro-ecosystems, to agricultural production, to economic and social consequences and finally to food security and nutrition. These additional risks on agricultural production directly translate into additional risks for the food security and nutrition of the people who directly depend on agriculture for

their food and livelihood. They can also have an impact on the food security and nutrition of distant populations through price volatility and disrupted trade.

ANALYSIS OF VARIOUS GROWTH AND OTHER BIOCHEMICAL PARAMETERS OF *CAPSICUM ANNUM L.* GROWN UNDER EXPERIMENTAL CONDITIONS USING LIQUID AND CARRIER BASED BIO-FERTILIZER

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Abstract

Nowadays, using bio-fertilizers has become the need of the hour as extensive use of chemical fertilizers reduces the soil fertility and irreparable damage to the overall system. The two major bio-fertilizers available in the market are carrier based bio-fertilizer and liquid bio-fertilizer. The purpose of this research was to study the effect of carrier based and liquid bio-fertilizer on plant growth and various other plant parameters using pot culture with treatments; T_1: Absolute control, T_2: Control + Vermicompost, T_3: Liquid bio-fertilizer + Carrier based bio-fertilizer + Vermicompost, T_4: Carrier based bio-fertilizer + Vermicompost and T_5: Liquid bio-fertilizer + Vermicompost,. Our study clearly highlighted that combined addition of liquid bio-fertilizer and carrier based bio-fertilizer (T_3) is best and enhanced the growth parameters such as height of the plant, shoot length, root length and biochemical constituents such as chlorophyll compared to individual inoculation and control. The physico-chemical parameters highlighted the increase in available nitrogen and phosphorus in the soil.

RELATIVE WATER CONTENT (RWC) : PHYSIOLOGICAL APPROACHES TO AID IN SELECTION OF GENOTYPES UNDER MOISTURE STRESS CONDITIONS FOR CROP IMPROVEMENT PROGRAM

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Abstract

In mid 80s, RWC was introduced as a best criterion for plant water status which, afterwards was used instead of plant water potential, as RWC referring to its relation with cell volume, accurately can indicate the balance between absorbed water by plant and consumed through transpiration. Measuring leaf relative water content (RWC) is a reliable and simple way to assess the water status of a leaf without any need for special equipment. Similar to leaf water potential, leaf RWC gives a strong indication of the plant's response to different environmental conditions. It gives the intrinsic capacity of a plant to hold maximum amount of water. RWC is defined as the leaf water content as a percentage of turgid water content and is calculated by the following equation expressed in percentage. RWC (%) = fresh weight- oven dry weight/ Turgid weight–oven dry weight. Normal values of RWC ranges between 98% in fully turgid transpiring leaves to about 30-40% in severely desiccated and drying leaves, depending on the plant species. The typical leaf RWC at around initial wilting is about 60% to 70%, with exceptions.

An experiment was carried out to measure RWC with 6 different plant species which include cotton, simarouba , sesamum, groundnut, neem and nilgiri. Leaves were collected from stressed and non stressed plants. RWC is accurately estimated using the ratio of tissue fresh weight to tissue turgid weight by saturating in water for 4hrs where as dry weight is measured by oven drying the sample at 65^{o} c for 24hrs.The RWC in all the species under non-stressed condition ranged between 90-95% whereas the stressed leaf samples in all the species showed less relative water content compared to control. However, under moisture stress condition, groundnut shows highest RWC value (78.0 %) ,and cotton being the lowest (47.8%) .The other species recorded are nilgiri (68.4%), sesamum (65.4%), simarouba (64.0%), neem(54.3%).The species with high RWC is associated with drought tolerance and this parameter has also been proposed as a very important indicator of plant water status under moisture stress condition . RWC can be used as an easily reproducible and meaningful physiological parameter for selection of genotypes for crop improvement in dry zones.

DETERMINATION OF MOISTURE STRESS ON SEED GERMINATION AND SEEDLING ESTABLISHMENT

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Abstract

Moisture stress can be defined as the scarcity of water, sufficient enough to significantly reduce the growth and yield of crops. It is one of the major constraints limiting the productivity of crops. It can occur at any stage of the crop.All stages of crop growth are affected due to moisture stress. Some stages are highly sensitive and some are less few others are relatively tolerant. For instance, germination of seeds, germination growth and leaf expansion are highly sensitive. With this background we have conducted an experiment to study the effect of moisture stress on seed germination and seedling establishment in green gram and sorghum. The seeds of green gram and sorghum were initially soaked in water and incubated in polyethylene glycol (PEG) solution of different osmotic potential (-0.2Mpa, -0.6Mpa, -1.0Mpa, -1.2Mpa, -1.6Mpa) and kept for germination inside the germinator and observed for 72hrs. An absolute control was kept by incubating the green gram and sorghum seeds in water. After 72hrs of incubation, 100% germination was found in absolute control and in the -0.2Mpa PEG treatment.

However, there was no germination in all the other treatments. Even though 100% germination was noticed in -0.2Mpa treatment, there was a significant difference in the root length and shoot length when compared with the absolute control. In the -0.2Mpa treatment, the average root length and shoot length of green gram seedlings ware 2cm and 1.5cm respectively, where as the absolute control measured 3cm and 4.5cm respectively. The same trend was followed in the sorghum seedlings showing 0.9cm and 1.5cm respectively in -0.2Mpa treatment where as the absolute control measured 2.5cm and 4.0cms respectively.

The results revealed that the stages like germination and seedling growth is highly sensitive to moisture stress and is inhibited at a very low moisture stress level viz -0.6Mpa. Even though, the seedlings germinated at -0.2Mpa, they did not show a better growth rate in terms of root length and shoot length which is again an evidence that germination and seedling establishment is highly sensitive to moisture stress.

PRODUCTIVITY ENHANCEMENT AND LIVELIHOOD SECURITY THROUGH LOW COST PROTECTED STRUCTURES IN UTTARAKHAND HILLS

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Uttarakhand, usually termed as '*Audhyaniki'* state, has significance for its horticulture production. However, the average productivity of vegetables (12.0 t/ha) is far below the national (17.3 t/ha) as well as its adjoining state Himachal Pradesh (18.3 t/ha) averages. It may be due to the fact that major chunk of the cultivated land are facing severe adverse climatic factors in terms of heavy rain fall, hails, frost, snow fall, long dry spells and storms. Further horizontal expansion of cultivable area is very difficult owing to rough terrain and undulating topography hence, productivity can be enhanced by adopting protected cultivation technology. The experiments conducted by the authors at various locations in Uttarakhand showed that protected vegetable cultivation under low cost structures viz., polyhouses, poly low tunnels, insect proof net houses etc. are highly beneficial under stress prone hilly conditions. The low cost polyhouse is a zero energy chamber made of polyethylene sheet of 200 µ supported on bamboos with *sutli* (ropes) and nails. It is used for protecting the crops from extreme conditions with improved quality and quantity. Plastic low tunnels are miniature form of greenhouses to raise the early off-season nursery and off-season vegetables and protect these from rains, winds, low temperature, frost and other vagaries of weather. The low tunnels are very simple structures requiring very limited skills to maintain and are easy to construct and offer multiple advantages. For construction of low tunnels, film of 50-100 µ would be sufficient. Insect proof net houses are being used for virus free cultivation of selected vegetables particularly during the rainy season. Raising of vegetable nursery in these structures has many fold benefits such as easy management, early nursery with protection from biotic and abiotic stresses. With these low cost protected structures the farmers of the district can be encouraged to devote the cereal crop land into vegetable crops and can increase their income by raising early and quality vegetables. It will certainly improve the economic status of the rural people in the state and also help in checking migration of rural youth.

NEUROENDOCRINOLOGY OF OVARAN MATURATION IN COMMERCIALLY IMPORTANT GIANT FRESHWATER PRAWN, *MACROBRACHIUM ROSENBERGII* (DE MAN)

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Abstract

The giant freshwater prawn, *Macrobrachium rosenbergii,* is an important species for diversifying aquaculture in India due to its attributes like reproduction under captivity, established technique for larval rearing, excellent growth rate and survival, absence of major disease problem, wide consumer acceptance and high market value. Out of 150 freshwater prawn species recorded world over, 40 species are inhabitant of the Indian subcontinent. *M. rosenbergii*, the largest species of the genus, is distributed throughout the tropical and subtropical zones of the world. It is cultured on commercial scale in many Asian countries including Thailand, China, Taiwan, Philippines, Vietnam, Malaysia, Indonesia, Bangladesh and India. It is mostly found in inland freshwaters including lakes, rivers, swamps, irrigation canals, ditches, ponds and estuaries of the country. During the past, seed collected from natural environment were used in prawn farming but in recent years, the natural seed resources have been drastically declined due to several anthropogenic interventions. Since quality seed is the most critical input in prawn farming, it is imperative to understand the reproductive physiology of the candidate species. The neurosecretory system plays vital roles in reproductive physiology of crustaceans by transducing the environmental stimuli into physiological processes. An attempt has been made to understand the neuroendocrine mechanisms involved in ovarian maturation in *M. rosenbergii*.

Neurosecretory cells (NSCs) of *M. rosenbergii* involved in reproduction are congregated in eyestalk, brain and thoracic ganglia. There were five types of NSCs in eyestalk having size in range of 5-35 mm with or without axons and round to oval shape. They were distributed in medulla externa, medulla interna and medulla terminalis. Sinus gland measuring 30-35 mm was also observed in the medulla interna region. Axonal terminals of these neurosecretory cells were found to terminate in this structure. Brain and thoracic ganglia possessed five types of neurosecretory cells such as giant neuron (>80 mm), A (60-80 mm), B (40-60 mm), C (20-40 mm) and D (<20 mm). They were seen arranged in several groups in different parts of brain. In anterior region B, C and D cells were located whereas in posterior region giant neurons and A cells predominated. In lateral regions A, B, C and D cells were recorded. The thoracic ganglionic mass was divided into anterior, middle and posterior regions. The NSCs were distributed in anterior and posterior portions but were lacking in middle portion. A and B cells were present in anterior-most region followed by C and D cells. In posterior-most region, giant neurons and A cells were present. Histochemical tests demonstrated that the neurosecretory cells of the giant freshwater prawn were strongly positive to acid fuchsin, paraldehyde fuchsin but exhibited feeble reaction to Sudan black B and periodic acid-Schiff's reagent (PAS) too.

Unilateral eyestalk ablation for 15 days induced ovarian maturation by increasing GSI and ova diameter as well as enhancing the secretory activities of the giant neurons (GN) and A cells of the brain and thoracic ganglia of *M. rosenbergii*. Neurotransmitters like 5-HT administration to the intermolt prawns induced ovarian development while dopamine injection resulted in negative response. Ovary of 5-HT treated prawns exhibited development from primary vitellogenic to vitellogenic stage on day 28 of the treatment whereas in dopamine treated group ovaries, remained in previtellogenic stage but a few oocytes depicted the signs of degenerative changes too.

CHARACTERIZATION AND ASSESSMENT OF VARIABILITY FOR QUALITATIVE AND QUANTITATIVE CHARACTERS GERMPLASM ACCESSIONS OF RICE (*ORYZA SATIVA* L.)

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Abstract

Rice (*Oryza sativa* L.) is one of the pivotal staple cereal crops feeding more than half of the world population. In view of the

growing population, the basic objective of the plant breeders would always be towards yield improvement in staple food crops. India is the second largest producer after China, has an area of over 43.9 m ha with production of 111.5 m/t and productivity of 2539 kg/ha (Anonymous, 2017). In crop improvement programme, to increase the productivity breeder needs to maintain a pool of diverse desirable donor parents. The investigational materials of 6981 Rice germplasm accessions were received from NBPGR, New Delhi under the project of 'Consortium research Platform on Agrobiodiversity on Germplasm Characterization and Evaluation' during *kharif* 2017-18.The materiel was evaluated in augmented design with six checks viz., Pusa Basmati-1, Jaya, NDR 97, Annada, Swarna and IR 64 during *kharif* 2017-18 at Research-cum-Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh. Each plot consisted of three rows of 3 m length with the spacing of 15 x 20 cm of plant to plant and row to row respectively, standard packages of practices were followed over the season for normal growth of crop.The present study was carried out to characterize six thousand nine hundred eighty-one rice germplasm accessions along with checks on the basis of nineteen qualitative and eleven quantitative traits. Mostof the qualitative characters showed variation in different accessions except: shape of ligule. Unique accession were identified for different trait *viz.,* purple blotch leaf blade colour *i.e.*IC126265 IC199579 IC134200 etc, purple colour stigma IC124690. IC132614 IC132616 etc,red color apiculus colour was found in accession *viz.* IC386344 IC132613, IC132614, IC124690 red seed coat color IC276446, IC123521, IC123522, and purple hull color *i.e*. IC145382, IC116016, IC518862, IC215715 etc. A significant amount of variation was displayed for most of the agronomical traits examined. The 6981 accessions evaluate for eleven quantitative characters. The desirable accession were identified for yield and important yield contributing traits *viz,* effective tillers were recorded more than 27 in IC 458578 followed by IC 135263 (25), IC123872 (23) and IC 323852(22); panicle length was having more than 32 cm are as IC518892 (35.5), IC324614 (34.2), IC257988(34.1) and IC125870(33.7), Length/breadth ratiohaving more than 6.00 mm were in IC518073, IC216890,IC114241,IC 216890, IC 218171,IC 377773 and IC 377987.On the basis of yield per plant (in gram.) desirable germplasm accessions were identified *viz.* IC252072(59.6), IC455469(53.8), IC379316(53.4), IC462202X(51.0), IC458448(50.3), IC218046(50.0), IC518632(48.7), IC390324(48.3), IC386367(47.0) and IC517006(46.6). Theabove desirable accession can be used to identify phenotypically divergent sources for traits of interest in breeding programmes as well as directly released as a variety based on the desirable agronomic traits.

BIOINDICATORS AND ITS ROLE IN ENVIRONMENTAL POLLUTION

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Abstract

Pollution alters the physical, chemical or biological characteristics of air, soil and water that adversely affect the normal health status of the organisms residing in the environment. Bioindicators are the sensitive indicators of the environment which describes the qualitative status of the environment. Globalisation and industrialisation put up enormous pressure on the existing biota leading to the degradation and damage to the environment. Status of an ecosystem can be judged by an organism, which is actually an indicator and play a key role in biomonitoring of changes caused by anthropogenic activities. A trustworthy and cost-effective way to find out the changes in the environment is the bioindicator species. These bioindicators monitors the status and quality of the environment cost effectively and helps in detection and mitigation of impacts of pollution. The degree of sensitivity of different bioindicators like microbes, plant, animal, bacteria are accessible in prediction and identification of the status of environmental pollution.

HEAVY METAL TOLERANCE POTENTIAL OF *ASPERGILLUS FLAVUS* AND *ASPERGILLUS FUMIGATUS*

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Abstract

Heavy metal pollution of wastewater currently becomes a key environmental problem throughout the whole world. Conventional methods for the removal of heavy metals from aqueous solutions are not economically and environmental

friendly. Biological treatments, especially filamentous fungi have gained an increasing attention for heavy metal removal and recovery due to their upright performances, low cost and huge quantities. The filamentous fungi have a great potential to produce large amount of biomasses which are widely used for metal adsorption capacities. Training of fungi to high concentration of heavy metal may increase their metal uptake capacity as a mechanism of metal resistant. *Aspergillus flavus* and *Aspergillus fumigatus* were trained to higher concentration of copper from 50 ppm to 2500 ppm by repeated subculturing on potato dextrose agar medium containing relatively high levels of copper. This process enabled *Aspergillus flavus* and *Aspergillus fumigatus* to tolerate higher levels of Cu^{+2} than their original. The copper adaptation was the result of physiological mechanisms, and the adaptation of the mycelium was also transferred to the spores. The trained fungi can removed much copper from solution than those of the non-trained parentals.

STANDARDIZATION OF DIFFERENT TRAINING SYSTEMS, SPACING AND FERTIGATION LEVELS ON *CAPSICUM ANNUUM* GROWN UNDER PROTECTED CONDITIONS

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Abstract

A study was conducted to standardize the different training systems, spacing and fertigation levels on capsicum annum in order to out appropriate spacing with respect to different training systems and to find out most effective fertilizer dose applied through fertigation under protected conditions. The whole experiment was arranged over 12 modules consisting of 2 different levels of training systems (T_1 =2 stem and T_2 =4 stem), 2 different levels of spacing (S_1=30x60cm S_2 = 30 x 90cm) and 3 different fertigation levels (F_1=100kg NPK/ha, F_2=150kg NPK/ha and F_3=200kg NPK/ha.) The results reveal that module M_6 consisting of 4 stem training system at a spacing of 30x60cm with 200kg NPK/ha exhibited the maximum number of fruits/plant (21.29), fruit length (82.23 mm), fruit weight (141.80g), plant height (130 cm), fruit yield/plant (2.7 kg/plant) and fruit yield/plot (32.40 kg/plot).

EXTENT OF RURAL WOMEN'S PARTICIPATION IN AGRICULTURAL AND HOUSEHOLD ACTIVITIES

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Abstract

In Indian Society both husband and wife participate in different household activities. Their role are generally complementary not only in physical participation in farm but also in the decision making process concerning major land use activities. She influences the farmer in selection of crop, developing the farm with irrigation and other facilities, adoption of latest technologies, timely harvesting, assisting the farmer in post harvesting and storage, timely marketing of the produce and in savings for the future. Inspite of all these, women are not given proper attention. But the globalization has provided many ways and means for the overall development and empowerment of women. The study was conducted in Deoria district of Uttar Pradesh during the year 2015-16 and 2016-17, out of sixteen blocks three blocks i.e. Salempur, Bhatni and Bhatpar Rani were selected for this study. From each block three villages were selected purposively. From these villages 15 farm women selected. Hence total sample size was 135 farm women. The data were collected from each respondent through personal interview method with the help of structured schedule. The findings of this study revealed that majority of the women participated regularly in activities like grading and storage, animal husbandry activities, weeding, drying and cleaning of grains, cutting, sowing operations and shifting production to threshing floor activities are the operations in which farm women participate regularly. Majority of the women perceived that losses at storage pests and diseases attack are the major causes for food grain losses. Empowerment of women in agriculture field is one of the major strategies for achieving food security. There is a need for empowerment of farm women to take care of food production and post harvest production losses for global food security through extension strategies.

KASP™ TECHNOLOGY FOR HIGH THROUGHPUT SNP GENOTYPING AIMED AT MAPPING QTLS FOR DISEASE RESISTANCE IN RICE (*ORYZA SATIVA* L.)

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Abstract

Rice is a major food crop of Jammu and Kashmir grown across varied climatic conditions and altitudinal range of 600 to 2200 mamsl. Broad range of environmental regimes predisposes crop to array of diseases and pests. Among the major diseases, rice blast and bacterial leaf blight have been recorded to cause considerable economic losses. Besides, bakanae or foot rot disease has from last decade shown recurrence as notorious disease of rice in Kashmir with incidence to have ranged from 0.6 per cent to 19.3per cent. The fungus *Fusarium fujikuroi* Nirenberg [teleomorph*: Gibberella fujikuroi* (Sawada) Ito] was studied for its morphological and pathologicalcharacteristics. The genetic resistance is a safe and reliable option to combat disease in susceptible backgrounds. However, not many of the genes have been reported to confer resistance to bakanae. Therefore, an experiment was undertaken with the aim of mapping genes/QTLs for resistance to the disease. A set of 400 rice germplasm lines was screened using isolate SKUA-18-21. The 10 seedlings for each germplasm line was grown in portrays under controlled conditions. Incidence was recorded on 35 days after sowing. Genotyping is being carried using high throughput KASP™ genotyping platform. KASP™ genotyping technology utilises a unique form of Kompetitive allele-specific PCR (polymerase chain reaction) that enables highly accurate bi-allelic scoring of SNPs (single nucleotide polymorphisms) and In Dels (Insertions and Deletions)at specific loci across a wide range of genomic DNA samples, including those of complex genomes. KASP technology delivers extremely high levels of assayrobustness and accuracy with significant cost savings. KASP assay involves several ingredients like KASP Assay Mixcontaining two different, allele specific, competing forward primers with unique tail sequences and one reverse primer; the KASP Master mix containing FRET cassetteplus Taq polymerase in anoptimised buffer solution. The technology shows lot of promise in precise genotyping of large number of germplasm lines with maximum cost effectiveness, and the technology is being used for developing rice varieties in Kashmir for improving livelihoods of farming community.

PHYTOCHEMICAL PROPERTIES OF *GYMNEMA SYLVESTRE:* A MIRACULOUS MEDICINAL PLANT

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Abstract

Gymnema sylvestre R.Br. (Asclepiadaceae) is a perennial climber which is distributed throughout the world, popularly known as “Gudmar”. It is a reputed herb in the Ayurvedic system of medicine, for its distinct property as sugar destroyer. Its leaves contain triterpene saponins belonging to oleanane and dammarene classes. Oleanane saponins are gymnemic acids and gymnemasaponins, while dammarene saponins are gymnemasides. Besides this, other plant constituents are flavones, anthraquinones, hentri-acontane, pentatriacontane, á and â-chlorophylls, phytin, resins, d-quercitol, tartaric acid, formic acid, butyric acid, lupeol, â-amyrin related glycosides and stigmasterol. The plant extract also tests positive for alkaloids. Leaves of this species yield acidic glycosides and anthroquinones and their derivatives. The plant of gymnema shows a broad range of therapeutic actions as an effective natural medicine for diabetes, arthritis, diuretic, anemia, osteoporosis, hypercholesterolemia, cardiopathy, asthma, constipation, microbial infections, indigestion, dyspepsia, jaundice, haemorrhoids, renal and vesicle calculi, bronchitis, amenorrhoea, conjunctivitis, leukoderma and maintain body weight and also inhibits glucose absorption. Some of the components which are extracted from gymnema, prevent the accumulation of triglycerides in muscle and liver, also reduces fatty acid accumulation in the circulation. The present review is an attempt to highlight the various ethno-botanical and traditional uses as well as phytochemical and pharmacological reports on *G. sylvestre*. Most of the commercial source is used in the manufacturing of healthcare products, food and dietary supplements of antidiabetic and antiobesity categories. These products are available in many forms like tablets, capsules, teas, chewing gums etc., mostly in combination with other ingredients.

MAPPING OF SALT AFFECTED AND WATERLOGGED AREAS USING GEOSPATIAL TECHNIQUE

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Abstract

Study was conducted from November 2015 to May 2017 at Shahapur and Shorapur taluk, Yadgir district, to mapping of salt affected and waterlogged area using Landsat-8 imagery of D-7 Shahapur branch canal of UKP command area Karnataka. NDSI values ranges from 0.153 to -0.132 and -0.153 to -0.142 respectively during November 2015 and 2016. During this period the salt affected area was 1747.02 and 1663.14 ha respectively. For May 2016 and 2017 NDSI values ranges between -0.129 to -0.136 and -0.165 to -0.153 and salt affected area was of 3458.93 and 3523.27 ha. The NDVI approach discriminates the water bodies during November 2015, May 2016, November 2016 and May 2017. The results indicated that the presence of water bodies were to the tune of 138.72 ha, 121.80 ha, 98.58 ha and 58.62 ha during November 2015, November 2016, May 2016 and May 2017 respectively.

TECHNOLOGICAL NEED OF TRUE POTATO SEED (TPS) GROWERS OF TRIPURA

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Abstract

The study was conducted in Khowai district of Tripura with randomly selected True Potato Seed (TPS) growers of Tripura. TPS can serve as a great alternative to the seed tubers in the hilly state of Tripura as only 100 g TPS is needed for one ha. of land as compared to nearly 2 tones of seed tubers required to plant in the same area. TPS can be used as a suitable alternative technology of potato cultivation in the state to improve the productivity and reduce the cost of production. The technological need of the majority of the TPS growers, i.e., 87.50 per cent was plant protection measures with rank I. The other technological need observed were post harvest treatment (79.17%) which includes application of boric acid, sorting and grading, packing, curing etc. and method of fertilizer application (76.67%) with II and III rank respectively. So, it is utmost necessary that the agricultural extension workers through regular trainings on plant protection measures with the TPS growers should guide the farmers to get optimum yield per unit area by effective management of pests and diseases.

DEVELOPMENT OF RICE (*ORYZA SATIVA* L.) VARIETIES SUITABLE FOR WET DIRECT SEEDING

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Abstract

Increased labour and water scarcity in paddy cultivation triggered new ideas among the scientific community towards the shift in method of cultivation in paddy from raising nursery and transplantation method to direct seeding in puddle condition. This is not only labour and water saving approach but also time saving method. Due to lack of varieties suitable for this condition, wet direct seeding method in rice is not much popular among the farming community. To address this problem a study was conducted at Regional Agricultural Research Station, Polasa, Jagtial during *Kharif,* 2016 with thirty five rice genotypes evaluated in wet direct seeding condition for obtaining desirable genotypes suitable for wet direct seeding through divergence studies. Analysis of variance revealed significant differences among the all the treatments studied except for effective bearing tillers per square meter. All the genotypes distributed in 6 clusters with maximum number of genotypes (16) allotted to cluster I followed by cluster II (10). Inter cluster distance which is a measure of divergence among the genotypes was highest (27.75)

between clusters IV and VI followed by cluster III and VI (24.69). Hence crossing between genotypes belongs to these clusters could yield better segregants which can perform better in wet direct condition and also could be used as parents for development of varieties suitable for wet direct seeding. JGL 23183 (Cluster IV) recorded highest cluster mean (25.10 cm) for panicle length whereas, the genotypes from cluster II recorded lowest cluster mean value (13.61 g) for 1000 grain weight and highest value (260) for number of grains per panicle. Hence, the genotypes from clusters II and IV could be a better source for developing high yielding and fine grain varieties suitable for wet direct situation. 1000 grain weight, an important yield parameter, contributed maximum (44.20%) towards total divergence followed by days to 50% flowering (40.17%). Therefore, present experimental material can used to develop varieties with different maturity groups and grain segments suitable for wet direct seeding.

AANALYSIS OF CALMODULIN BINDING PROTEIN GENE(S) IN DISEASE RESISTANCE RESPONSES IN RICE (*ORYZA SATIVA* L.)

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Abstract

Plants are usually subjected to one or more biotic stresses which reduce agricultural output significantly, leading to a huge yield-gap. To cope with the various stimuli generated by various environmental stresses, plants have evolved with complex mechanism of signal perception and transduction. Several phytohormones and secondary messengers are the main players in mediating cellular responses to various stimuli. Of the various secondary messengers in eukaryotes, the role of Ca^{2+} has been most extensively studied. The calcium ion (Ca^{2+}) is a well-known universal second messenger in plants regulating the responses of growth and development as well as different environmental stimuli in plant. Changing cytosolic-free calcium concentration ([Ca^{2+}]cyt) is one of the earliest responses to biotic stresses. These changes in cellular Ca^{2+} level are being mediated by different Ca^{2+} binding proteins like calmodulin (CaM). CaM interacts with calmodulin binding protein (CBP) and activates downstream defense response. CBP is family of protein, among them, CBP60g also known as SARD1 (systemic acquired resistance deficient 1) is well characterized which involved in defense responses via systemic acquired resistance (SAR). However, no rice *CBP60* (*OsCBP60*) has been identified in relation to pathogen infection till date. In this study we have identified 15 *OsCBP60* gene using bioinformatics studies. The expression of different *OsCDB60s* were analysed in *Xanthomonas oryzae* pv. *oryzae* and *Magnapor the oryzae* treated rice samples.

AGRICULTURAL AND SOCIO-ECONOMIC TRANSFORMATION: POST-INDEPENDENCE CONSEQUENCE FROM INDIA

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Abstract

The present paper analyzed the role of technological initiatives and policy measures accounted for agricultural and socio economic conversion since independence in India. The study showed that the country faced enormous problems after independence like massive jump in population growth, food shortage, rise food prices at the rate of nearly 20 per cent per annum between 1965 and 1968, climate vagaries like two drought years (1965 and 1966) leading to a fall in agricultural output by 17 per cent and food output by 20 per cent. Due to these problems, food crisis and famine conditions were emerged in various parts of the country. In this scenario of the mid-1960s, economic self-reliance and food self-sufficiency was the foremost objectives of Indian economic policy. In the world, post independence scenario of India was poverty, illiterate people, huge unemployment and food-short country which changed as self-sufficient and which became over time, even surplus in food and exporter of some of the commodities. The study further revealed that the agricultural and socio-economic changes have been experienced particularly from the mid-1960s, due to green revolution occurred by adoption of modern technologies such as introduction of seeds of high yielding varieties, use of irrigation, mechanization, pesticides and fertilizers etc. The New Agricultural policy and paramount strategy has been implemented to cope up the challenges of new

independence India and integrated intelligent cognitive system of India and intellectual minds of Indian scientists and researchers has been devoted for the task. In addition, physical and scientific infrastructures, numerous agricultural universities, Krishi vigyan kendras and research institutes have been established to development of modern technologies for increasing the food production in country. These technological initiatives and policy measures played an important role for successive growth of Indian agriculture.

The study showed that the agriculture sector is a mainstream of livelihood for more than 65% of population and contributing 49% of the total workforce and provides raw materials to non-agriculture sectors. Also it contributes around 17% to the total GDP of nation and about 09.1% of foreign currency has been generating annually through export business. Besides, it plays major role in food security and as per the NSSO, 2013 an average Indian still spends more than half of the income in food security. However more equipped and sound technologies like advances in computation, GIS techniques, biotechnology, artificial intelligence etc. are tremendously used for development of agriculture in India. Comprehensive growth of agriculture in rural areas and structural conversion from conventional agriculture to scientific and high-productive sector can be able to realize through technological change in individual's lives. Conscious of the issues, the Honorable Prime Minister of India Narendra Modi has launched new national policy ''doubling the farmers income by 2022'' in 2016. The major focuses of the policy is reduction of poverty, nutritional security in food and cope up the challenges of climate change, which are upsetting the agricultural and socioeconomic growth in terms of poverty, unemployment, temperature escalating, occurrence of droughts and floods, and incidence of pests and diseases.

EFFECT OF PACKAGING MATERIALS ON QUALITY LOSSES IN FRESH FIG (*FICUS CARICA* L.) FRUITS DURING TRANSPORTATION

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Abstract

Protection of the fig fruit quality in the chains from harvesting to marketing is very important. Vibration often causes some damages to perishable fruits in transportation and reduces their quality. The fruit injury due to vibration is related to the transportation characteristics of vehicles, packaging boxes and condition of the road. The objective of this study was to investigate the effectiveness of packaging materials to reduce the quality loss of fresh fig fruits during transportation. Experiments were carried out with five packaging materials and three transportation distances. Results showed that the CFB box with news paper lining was not proper for transporting of the fresh fig fruits in all transportation distance. The mass loss and total soluble solids of fresh fig fruits packed in CFB box with paper lining was more than CFB box with polyurethane foam sheet and polyethylene foam sheet. Also the decay loss of fresh fig fruits was more in CFB box with paper lining. Fruits packed in CFB box with polyurethane foam sheet were more firm and had extended shelf-life than other packaging materials.

DATE OF TRANSPLANTING AND PLANTING GEOMETRY ENHANCE THE RESILIENCE OF GROWTH PARAMETERS AND YIELD OF INDIAN MUSTARD

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Abstract

Transplanting of Indian mustard seedlings is a good cultivation practice, to increase the yield of mustard for small farmers. Competitive ability of a rapeseed mustard plant depends greatly upon the density of plants per unit area and soil fertility status. The optimum plant population density/unit area varies with the environment, the genotype, the seeding time, and the season. Uniform distribution of crop plants over an area results in efficient use of nutrients, moisture, and suppression of weeds leading to high yield. A field experiment was conducted during 2016-17 at Directorate of Rapeseed–Mustard Research, Bharatpur, Rajasthan. Seedlings of Indian mustard variety RH 406 were raised in root-trainers and 10-14 days old seedlings were transplanted at 30 cm x 30 cm, 45 cm x 30 cm and 60 cm x 60 cm spacing in field on 3 dates at about 10 days interval starting form Oct 13 to Nov 01. Recommended fertilizer dose 80 kg N and 17.5 kg P/ha was applied. The sources of N and P

were urea (46% N) and di-ammonium phosphate (18% N & 46 % P_2O_5), respectively. Other package of practices, including insect, pests including weed control were followed according to local agronomic practices unless otherwise indicated. Significantly higher seed yield (4.01 t/ha) was obtained at Oct 13 transplanting. However, the geometric trend was observed to 45x30 cm>30x30 cm>60x30 cm. The yield trend in planting dates was recorded in October 13>October 22>01 November. The significant variation in yield and its attributes were also observed between the plant geometry and dates of transplanting

VARIABILITY AMONG DIFFERENT ISOLATES OF *TILLETIAINDICA* CAUSINGKARNAL BUNT OF WHEAT AND IDENTIFICATION OF PATHOGENCITY-RELATED GENES

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Abstract

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops in India. India is the second largest producer of wheat in the world with 93.50mt production and 302.27 lac hec area (DAC&FW, 2017). Due to the change of cropping system, cropping intensity, crop management and climate change, the Karnal bunt caused by *Tilletiaindica*(Mitra) is resulting in great quality losses to wheat in all major wheat growing parts in northern India. Karnal bunt is an important disease prevalent in several countries and is internationally quarantined. Infection cycle of *T. Indica* leads to a great extent of variability as infection of wheat plant necessary requires fusion of two allantiod spores.Keeping this in view present study was undertaken to study the variability aspect of virulence and pathogenicity of *T. indica*isolates. Twenty isolates of *T. indica* were compared on the basis of mycelial growth, mycelial weight and sporulation. It was observed that there was non-significant variation in mycelial growth and mycelial weight, but significant variation in sporulation was observed among various isolates of *T. indica*. In modern resistance breeding, effectors are emerging as tools to accelerate and improve the identification, functional characterization and deployment of resistance genes. Therefore, "Secretomics" of this pathogen, using high throughput genomics approach that uses effectors for probing wheat germplasm to detect R-genes and characterization of pathogenicity related genes is an important area. Whole genome sequence generated earlier in Fungal Molecular Biology Lab (ID: RAKB_UP_1; Acc. No. MBS0000000) was analysed to understand mechanism(s) of pathogenesis required to manage this disease. In total, 1,337 unique proteins having secretory signatures were predicted using SignalP v4.1 as well as Target Pv1.1. PHI based analysis suggested that 97 genes were related to effector, 25 genes to increased virulence, 63 genes to loss of pathogenicity and 7 genes to resistance to chemicals. Pathogenicity-related/ virulence genes were selected on basis of Secretomics & PHI database and were further validated by gene expression studies using real time PCR. Thesegene may have role in pathogen establishment and sporulation. Pathogenicity-related genes shall be utilized to understand the mechanism(s) of pathogenesis which will help in developing strategies for management of Karnal bunt of wheat caused by *Tilletiaindica*.

EFFECT OF MUNICIPAL SOLID WASTE COMPOST AND MINERAL FERTILIZERS ON SOIL FERTILITY AND YIELD OF MUSTARD

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Abstract

Field experiment was conducted for three years during 2012–15. Treatments details are control, recommended dose of N:P:K fertilizers at 60:30:30 kg ha^{-1} (100% RDF), rice straw compost at 14 t ha^{-1} (RSC-14), Municipal solid waste compost at 16 t ha^{-1}(MSWC-16), 50% RDF + RSC-7 (RDF+RSC) and 50% RDF + MSWC-8(RDF+MSWC) laid out in randomized block design with three replication. Significant improvement of soil fertility in terms of available nitrogen (N) and potassium (K) was maintained with RSC+RDF as compared to control. Application of 100%RDF produced 56 and 37% higher available N and K respectively, over the control. MSWC+RDF maintained significantly higher soil organic carbon (SOC) as compared to alone use mineral fertilizers. The magnitude of changes in mean soil salinity (electrical conductivity, EC) was highest under MSWC+RDF than other treatments followed by RSC+RDF. However, soil EC (mean of 3 year) was at par in all treatments

except control. Microbial biomass carbon (MBC) was significantly increased with RSC+RDF. Application of RSC+RDF had significantly higher microbial biomass carbon (260 mg kg^{-1} soil) and dehydrogenase activity (83 mg TPF g^{-1} soil 24 h^{-1}) than 100% RDF and control. Integrated use of MSWC+RDF produced 17% higher mean (3 year) grain yield of mustard over the use of 100% RDF. MSWC had significantly higher grain yield of mustard as compared to control, however, it was statistically at par with 100% RDF. We hypothesized that combined use of organic amendments and mineral fertilizers is beneficial option for improving mustard yield and fertility of saline soils.

PHOSPHORUS RESPONSE IN SESAME (*SESAMUM INDICUM* L.) IN COARSE TEXTURED SOILS

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Abstract

A field study was carried out on a coarse textured medium phosphorus status soil of CCS HAU Regional Research Station, Bawal (Haryana) at three different locations from 2015 to 2017 to study the effect of phosphorus fertilization in sesame in terms of yield, total P uptake, P build/depletion in soil and economics returns. The experimental soil was loamy sand in texture, alkaline in reaction (pH 8.32 to 8.40), EC (0.17 to 0.20 dS m^{-1}), low in organic carbon (1.9 to 2.0 g kg^{-1}), medium in available P (10.55 to 11.45 kg ha^{-1}) and medium in available K_2O (169.0-170.0 kg ha^{-1}). The experiment was laid out in randomized block design with three replications. There were five graded levels of phosphorus application *viz.,* 0, 10, 20, 30, and 40 kg P_2O_5 ha^{-1}. Recommended dose of fertilizers for crop was applied @ 37.5 kg N ha^{-1}. Irrigation and plant protection measures were taken as per recommended practices. Crop was harvested at physiological maturity, threshed and plot wise yield was recorded. Seed, straw and soil samples were taken and analyzed for P concentration in seed and stalk and available P in soil, respectively. The data was statistically analyzed and economics of P application was worked out. The results revealed that sesame cv. HT- 1 seed yield increased significantly with application of phosphorus at 20 kg P_2O_5/ha. The increase in mean seed yield was 6.06, 13.17, 15.38 and 18.04 per cent and in mean stalk yield was 6.20, 14.28, 17.62 and 19.85 per cent due to application of 0, 10, 20, 30 and 40 kg P_2O_5/ha, respectively over control. The mean P-uptake also increased with P application. The mean P-use efficiency varied from 16.30 to 20.30 per cent being maximum (20.30 %) with application of 20 kg P_2O_5/ha. The mean post harvest available P status was 9.90, 11.30, 12.68, 13.52 and 14.08 kg/ha at 0, 10, 20, 30 and 40 P_2O_5/ha, respectively. The mean economic data analysis revealed that benefit cost ratio also increased with phosphorus application and was 1.06, 1.11, 1.17, 1.18 and 1.19 at 0,10, 20, 30 and 40 kg P_2O_5/ha, respectively. The finding of this study serve to demonstrate that in coarse textured medium phosphorus status soil of Southern Haryana, application of 20 kg P_2O_5 ha^{-1} was found to be optimum for sesame in terms of crop yield, soil P fertility status and economics.

IDENTIFICATION OF BIOACTIVE POLYPHENOLS IN GROUNDNUT KERNELS USING LC-MS/MS

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Abstract

Groundnut is an important oil seed and food crop. Thus nutritional composition of groundnut kernels is most important and largely studied; however, there is dearth of information on various bioactive polyphenols including kaempferol, resveratrol and quercetin. Therefore, a study was undertaken to quantify bioactive polyphenols from 14popular groundnut cultivars of India. Polyphenols were extracted in 80% methanol and analysed using liquid chromatography-tandem mass spectrometry (LC-MS/MS).Methanol and acetic acid (1%) as a gradient mobile phase was usedto separate various phenolics using C18 column. Total 16 polyphenols viz., caffeic acid, catechol, chlorogenic acid, cinnamic acid, coumaric acid, ferulic acid, gallic acid, syringic acid, salicylic acid, vanillic acid, catechin, epicatechin, epigallocatechin, kaempferol, resveratrol and quercetin were identified in groundnut kernels. These phenolics were identified based on retention time of standard phenolics and mass-charge (m/z) ratio of charged particles. Among these cinnamic acid, catecholand kaempferol are predominant phenolics

in groundnut kernels followed salicylic acid, syringic acid and epicatechin. Wide variation (4-25 µg/g) was observed for cinnamic acid content in groundnut cultivars, while, minimum variation detected in catechol (14-16µg/g) and kaempferol (13-14 µg/g) content. Resveratrol content ranged of0.42-4.6 mg/g kernel. Antioxidant activity of groundnut cultivars was also analysed by ABTS method which was 14.0µM TE/g kernels. The study identified various polyphenols that have been reported for potential health benefits, including protection against oxidative stress, cardiovascular disease, cancer, diabetes, neurodegenerative disease and even aging. Thus groundnut is considered as functional food and recommended to take handful of groundnut kernels in the diet.

TRANSCRIPTOMIC DATA BASED MICRO RNA FROM IN *GYMNEMA SYLVESTRE*

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Abstract

A set of single-stranded non-coding small (~22 nt) RNAs playing an important role in regulation mRNA targets are called the micro RNAs. *Gymnema sylvestre* is important medicinal plant lacking genomic as well as transcriptomic information. For identification of homologous miRNAs, 6,028 unique know plant miRNAs were screened against 272161 unigenes of *G. Sylvestre*unigenes generated from a paired-end deep transcriptome sequencing. Total 76 aligned identified unigene were utilized for extracting the precursor sequences in *G. sylvestre.* Total 16 potential candidate miRNAs were identified belonging to 12 miRNA families. The mean minimal folding free energy index (MFEI) value of these predicted 16 miRNAs was -0.966 ranging between -0.653 to -2.37 and G+C% content varied between 27.3 and 61.9%. As per the nucleotide composition, cytosine was the dominant nucleotide (26.3%), uracil was the next most prevalent nucleotide (25.7%) followed by guanine (24.3%) and adenine (23.7%) in mature miRNAs. In more than 81% cases, the first position of the 5‘ end was occupied by uracil in the mature *G sylvestre* miRNAs. Utmost care has been taken while prediction of miRNA as well as target and for the first time in *G. sylvestre* we report total 13 miRNA through transcriptomic study**.**

IMPROVEMENT IN SOIL FERTILITY AND YIELD OF MUSTARD BY USING ORGANIC SOURCES OF NITROGEN UNDER SODIC WATER IRRIGATION

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Abstract

Continuous use of sodic ground water has degraded a significant areas of fertile tracts particularly in arid and semi-arid regions of country and caused significant loss to crop productivity. The groundwater in arid and semi-arid regions is generally saline/sodic, used as a chief source of irrigation. Continuous application of high SAR water for irrigation caused poor soil physical condition, reduced nutrient availability, poor microbial activity and toxicity of certain ions affected the productivity of soils. The organic matter status of sodic soils is extremely low and major fraction of nutrient N required for crop growth in these soils must come from applied N fertilizers. To explore the production potential arid and semi-arid regions having sodic groundwater for mustard cultivation, an experiment was conducted at Agronomy Farm, S.K.N. College of Agriculture, Jobner (Rajasthan) to find out the mitigation effect of organic sources of nitrogen under sodic water irrigation. The experiment comprising 24 treatment combination replicated three times, was laid out in split plot design with four treatment of sodic water (6 SAR, 10 SAR, 20 SAR, 30 SAR) and six treatment of sources of nitrogen (control, 125%RDN through urea, 75% RDN through urea +50% RDN through FYM, 75% RDN through urea +50% RDN through VC, 50% RDN through urea +75% RDN through FYM, 50% RDN through urea +75% RDN through VC). Result revealed that total and available N, P, K, and NH_4^+-N, NO_3^--N and organic carbon content decreased significantly with increasing the level of sodic water during both the years and in pooled mean. Total and available N, P, and K, of soil at harvest increased significantly with 50% RDN through urea +75% RDN through VC. However, application of 50% RDN through urea +75% RDN through VC significantly brought highest reduction in C: N, C: P and sodium adsorption ratio of soil at harvest. NH_4^+-N and NO_3^--N, soil microbial biomass C, N and P at different months, soil dehydrogenase, alkaline phosphatase enzyme activities at different months increased significantly under 50% RDN through urea +75% RDN through VC.The maximum yield was recorded under application of

W_6M_5 (normal water +50% RDN through urea +75% RDN through VC), while minimum under $W_{30}M_0$ (30SAR + control) during both the years and in pooled analysis. Resultsshow that the application of 50% RDN through urea +75% RDN through VC (M_5) is a better choice for mitigating adverse effect of high SAR water on yield of mustard. It is evident from this study that the harmful effects of SAR rich water can be mitigated by applying organic sources of nitrogen instead sole application of chemical fertilizers.

EVALUATION AND ANALYSIS OF GAPS IN ADOPTION OF IMPROVED GREENGRAM PRODUCTION TECHNOLOGY IN RAJASTHAN, INDIA

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Abstract

The present study was undertaken in Raipur and Sumerpur blocks of Pali district of Rajasthan to analyze the status of greengram production technology, constraints in its cultivation and the possibilities of increasing production. A fundamental problem to overcome the significantly increasing pulse production is to change the prevailing perceptions of their status as subsistence crop and to consider as commercial crop. This will require aggressive on farm demonstration of the viable technical options to alleviate the gaps in production technology of greengram cultivation. It emphasizes the dissemination of improved varieties and low-cost, environment friendly crop husbandry techniques. Keeping this in view, front line demonstrations (FLDs) on greengram involving existing technology between recommended technologies were conducted to evaluate the adoption gaps during 2015-16 and 2016-17 and have proved immensely useful in increasing the production and productivity of pulse crops. The recommended technology produced 11.0 and 12.3 per cent more seed yield and 12.3 and 15.6 per cent higher net returns of greengram than the crop raised by existing technology in first and second year, respectively. The results showed that indicated an overall increase of 34.6 per cent and 44.5 per cent in yields due to adoption of improved technology in the year 2015-16 and 2016-17, respectively. During the year 2015-16, the average yield obtained under existing and recommended technology was 9.4 and 12.4 q/ha with expenses of Rs. 16900 and 17800, respectively. In the year 2016-17, the average yield obtained in existing and recommended technology was 8.93 and 12.9 q/ha with expenses of Rs 18700 and 19900, respectively. The gross returns obtained in recommended technology were Rs 64480/- and Rs 67725/- which were 34.6 and 44.5 per cent higher than that of existing technology in 2015-16 and 2016-17, respectively

INFLUENCE OF DIFFERENT DRYING METHODS ON NUTRITIONAL QUALITY OF IMPORTANT ARID ZONE FRUITS (KAIR & SANGRI)

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Abstract

To bridge the gap and ensure food security at household, regional and national levels, popularisation of traditional food plants assumes much importance. Among the fruit tree species of Rajasthan, *Capparis decidua* and *Prosopis cineraria* rank high in local people's preferences. In lean periods `kair' & ´sangri' provide essential vitamins and minerals in the human diet and thus their place as drought food is very important. If utilized properly, they can provide and supplement a substantial vegetable source for human food. Since these are seasonal fruits, optimization of processing methods for longer storage is necessary. Traditionally, the collected fruits are blanched and dried in shade initially and then finally in open sun by the village people. These are then stored for future use. Drying in sun or shade is time consuming, requires continuous monitoring and has risk of contamination. Slight mishandling results in severe post harvest losses. Hence more effective way of drying using solar driers was investigated. Two types of solar driers viz. Inclined and preheated (designed by CAZRI, Jodhpur) were procured & used for drying of the selected fruits. Sugar and protein analysis was carried out as per AOAC methods. Results showed that fruits dried in solar driers took less time (2-4 days) for drying as compared to normal shade drying (7-8 days). Kair samples dried in inclined solar drier had protein (11.42 %) and sugar (10.62 %) as compared with shade dried fruits with protein (14.29 %) and sugar (13.6 %). Samples dried in preheated solar drier retained more sugar (13.75 %) and protein (15.46 %). Samples dried in

direct sun took 3-4 days to dry and had sugar (13.6 %) and protein content (13.42 %). Similar results were obtained in case of sangri. These results showed that preheated solar drier was found more effective than inclined solar drier as well as the sun/shade dried samples. The fruits dried in pre heated solar drier also retained some green colour. Samples were also dried in lyophilizer. Protein (10.81%) and sugar (16.12%) content in kair samples dried in lyophilizer were comparable to those in shade dried samples (10.74 % and 16.63%).

EFFECT OF PACLOBUTRAZOL AT ANTHESIS STAGE ON DIFFERENT PHYSIO- BIOCHEMICAL PARAMETERS TO AMELIORATE WATER DEFICIT STRESS IN RICE

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Abstract

Rice (*Oryza sativa* L.) is one of the major grain cereals of the Indian subcontinent which face water-deficit stress for their cultivation. Genetic engineering has helped in improving the drought tolerance of rice cultivars although negativepublic opinion hSas triggered a debate preventing its further use. In lieu of genetic engineering, exogenous application of phytohormones has emerged as an alternative approach for strengthening and improving planttolerance to drought, without altering its genetic makeup. In recent years, use of pesticides and fungicides, such as Paclobutrazol (PBZ), has shown a potential for improving crop drought tolerance. 100ppm dose of PBZ showed significant increase in DM, RWC,MSI, Total chlorophyll content, CSI, ABA, Total antioxidant activity and expression of *R*ice *D*rought-responsive genes ZEP and NCED3 in contrasting rice genotypes (Nagina-22, drought-tolerant and IR-64, drought-sensitive) under drought stress. However, decrease in GA and ABA8OX gene expression was observed under the PBZ treated plant compared to stress plant. The present study suggests that PBZ application under water deficit stress condition could be one of the useful approaches to be explored toward the development of simple, cost-effective and farmer-friendly technology to enhance rice yield in rainfed areas.

VARIEGATIONS IN *ARECA CATECHU* L. (VAR. MANGALA AND SOUTH KANARA LOCAL)- A CASE STUDY

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Abstract

Variegations in ornamentals crops are not uncommon however, no reports of variegations in *Areca catechu* L.-an economically important plantation crop- have been made yet. In the present study we identified and characterized the palms of Mangala and South Kanara Local populations from farmer's gardens of Dakshina Kannada District of Karnataka that showed variegation trait. These variant palms have variegated green and yellow stripes on nuts, leaves, leaf sheath and greener portion of the stem. Kernel of the variegated arecanut of Mangala population was whitish (cream) compared to normal red arecanut. The variegated arecanut of S.K. Local population have more reddish kernel compared to normal type. Variegated nuts of both the varieties were characterized for biochemical parameters like total sugar, reducing sugar, phenolics, non-tannin phenolics and anti-oxidant potential. In the immature variegated nuts of Mangala population, all the biochemical parameters studied showed significantly low values compared to the normal nuts of same genotype. However, when the nuts are matured there were no discernible or significant differences in the biochemical parameters between the variegated and normal nuts. On the contrary variegated nuts of S. K. Local population showed higher content of total sugar, reducing sugar, phenolics and anti-oxidant potential. Nevertheless upon ripening the differences in various biochemical parameters of the variegated and

normal nuts vanished. Physiological parameters of variegated and normal are canut tree leaves of both Mangala and S.K. Local populations were also recorded. The photosynthetic rate of greener portion of variegated leaves did not differ significantly with normal leaves. Expectedly, yellow regions of the variegated leaves showed very low chlorophyll index measurements compared to greener regions or normal leaves, hence yellow regions showed lower photosynthetic rate. Similarly stomatal conductance of green portion and the normal leaves were high than the yellow regions of the variegated leaves, so is the transpiration rate. Hence, stomatal resistance was low in green region of variegated and normal leaves.Variegations in the leaves and consequently the yellow regions with less chlorophyll content reduced the transpiration rate because of its stomatal resistance but low chlorophyll content markedly influenced photosynthetic rate too. Thirty seven seed nuts were collected from variegated tree of S.K. Local population and were sown in nursery at ICAR-CPCRI, Regional Station, Vittal. Out of which only two progeny seedlings showed variegation trait. The genetic, biochemical and physiological significance of these variegations and its implications for breeding are also discussed.

FIRST REPORT OF EYE LEAF SPOT (ELS) DISEASE OF PLEOMELE REFLEXA VAR. GRACILIS AND PLEOMELE REFLEXA VAR. VARIEGATA CAUSED BY DRECHSLERA AUSTRALIENSIS IN INDIA

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Abstract

An eye leaf spot (ELS) disease of *Pleomele reflexa* var. *gracili*s and *Pleomele reflexa* var. *variegata* is prevalent in India. They are very popular and hardy ornamental plants which are found mostly in Indian houses and gardens. Symptomatic can be seen on the leaves like an eye shaped with dark brown margin and light brown in the centre. Purified fungal suspension (2 x10^5 conidia/ml) was sprayed on healthy plants for the confirmation of pathogencity test. Koch's Postulates were established. This fungus was identified as *Drechslera australiensis* and is the first report of 'eyespot disease' on these hosts from India.

IN SITU ROLE OF PLASMID IN PHYTOPATHOGENIC BACTERIA AND PLANT DISEASE MANAGEMENT

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Abstract

Phytopathogenic bacteria constitute a large domain of prokaryotic microorganisms lacking true nucleus or other membrane bound organelles and possessing three main structural components including surface appendages, cell envelope and cytoplasmic organelles. Bacterial plasmid is a small, circular, self-replicating extra chromosomal component with a double-stranded DNA molecule. The presence of linear plasmids has also been reported in both gram positive and gram negative bacteria and described for the first time in *Streptomyces rochei* during 1979. Different types of plasmids impart various properties to the host bacterium and three mechanisms are involved in plasmid replication *viz.*, theta mechanism, rolling circle mechanism and strand displacement mechanism. The occurrence of Streptomycin resistant strains of *Pseudomonas syringae pv. populans* has been reported in western New York orchards. The bacterium was isolated from blister spot lesions and a 68-megadalton plasmid was reported in streptomycin resistant strains of bacteria. The virulence genes as well as antibiotic resistance factors of phytopathogenic bacteria are located on transmissible genetic elements. These transmissible genetic elements may include transposons, bacteriophages as well as plasmids. Horizontal gene transfer by plasmids or phages play a major role in the creation of new pathogenic variants. The development of Streptomycin resistance in *Erwinia amylovora*, *Pseudomonas* and *Xanthomonas* has been reported to be conferred by the genes strA and strB that usually reside on plasmid-borne transposons. The plasmids from bacteria among six genera *viz.*, *Burkholderia*, *Erwinia*, *Pantoea*, *Pseudomonas*, *Ralstonia* and *Xanthomonas* play important role in host pathogenicity and host specificity. The genes involved in pathogenicity and host specificity comprise two main groups, *i.e.*, termed as avirulence (*avr*) and virulence (*vir*)

genes & involved with a type III protein secretion system. The reports on DNA hybridization studies reveal that virulence genes in *Agrobacterium rhizogenes* and *Agrobacterium tumefaciens* reside on large plasmids. The bacteria bring about changes in host as a consequence of incorporation of the T-DNA into host plant nuclear DNA. Plasmids play important role in conjugation and *Agrobacterium*-mediated gene transfer. The *Agrobacterium* system is successfully used to introduce new genes to plants by isolating and splicing them into appropriate plasmids. Genetic engineering has been used for disease resistance in several crops. Plasmids, though dispensable to bacterial survival, are the sites where many important genes of prokaryotes are stored in separate circular DNA structures and helpful in management of plant diseases by imparting various degrees of resistance to the engineered plants. Still there are more scopes to explore other properties of bacterial plasmids with the vision to figure the way out for managing plant diseases in an economic way.

STUDIES ON NITROGEN AND PHOSPHORUS MANAGEMENT IN WHEAT (*TRITICUM AESTIVUM* L.EMEND FIORI & PAOL) UNDER RAINFED CONDITIONS OF JAMMU AND KASHMIR

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Abstract

A field experiment was conducted during *Rabi* season 2013-14 and 2014-15 at Regional Agricultural Research Station Rajouri, SKUAST-Jammu under rainfed conditions of Jammu and Kashmir. The soil of the experimental field was clay loam in texture with pH 7.2, EC 0.10 ds/m, organic carbon 0.68%, alkaline permanganate oxidizable available nitrogen 430 kg/ha, Olsen's available phosphorus 18.4 kg/ha and available potassium 246 kg/ha. The treatments consisting of combination of three levels of nitrogen (0, 60 & 120 kg/ha.) and three levels of phosphorus (0, 40 & 80 Kg/ha) were laid down in complex Randomized Block Design with four replications of each treatment. Wheat variety VL-907 was grown as per recommended cultural practices at a line spacing of 20 cm. The data on various agronomic characteristics were recorded following standard procedures. There was a progressive increase in grain yield of wheat with each increment from 0 to 120 kg N ha^{-1} from the crop fertilized being maximum from 120 kg N ha^{-1} and 80 kg P ha^{-1}. Lowest plant height, number of effective tillers per plant, panicle length, dry matter per plant, number of grains per panicle, weight of grains per panicle, grain yield, straw yield and biological yield was observed in 0 and 50 per cent nitrogen and phosphours. Various crop traits such as number of fertile tillers, 1000-grain weight and number of grains per spike were significantly influenced by nitrogen and phosphorus application. Similarly, fertilization with at 120 kg N ha^{-1} and 80 kg P ha^{-1} maximally improved all these traits in both the years. As a result of interactive the highest dose of nitrogen (120 kg N ha^{-1}) and phosphorus, (80 kg ha^{-1}) gave maximum yield (41.84 and 42.07 q ha^{-1}).

MANAGEMENT OF INSECT PESTS OF RICE IN MEDIUM LAND IN PALAMAU REGION OF JHARKHAND

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Abstract

A field experiment was conducted during *Kharif* 2017-18 on "Management of insect pests of rice in medium land in Palamau region of Jharkhand" in a Randomized Block Design with three replications and ten treatments comprising of summer ploughing uniformly in all the treatments. All the treatments were recorded significantly superior over control. The treatment application of carbofuran 3G @ 1.0 kg. a. i./ha. at 15 days after transplanting (DAT) in combination with spraying of indoxacarb 14.5 SC @ 0.50 ml/l. water (two sprays). 1st at 45 DAT and 2nd at 15 days after 1st spray found the best treatment for management of insect. Pests of rice, which produced the maximum grain yield (50.22 q/ha) and received the lowest percent incidence of insect pests (8.25% grain) by gundhi bug and (3.05 % tiller) by rice stem borer followed by the treatment application of carbofuran 3G @ 1.0 kg. a. i./ha. at 15 DAT in combination with spraying of imidacloprid 17.8 SL @ 0.50 ml/l.

water (two sprays) in the same method. In this plot the grain production was recorded (48.07 q/ha) and the insect pests damage (9.09 % grain) by gundhi bug and (3.36 % tiller) by rice stem borer. While control plot produced the lowest grain yield (24.13 q/ha) and received the maximum insect- pests damage (22.83% grain) by gundhi bug and (16.49% tiller) by rice stem borer, respectively.

CLIMATE CHANGE VS ECONOMIC GROWTH, DEVELOPMENT: PERILOUS BREAKDOWN

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Abstract

India as a developing nation is rapidly moving towards industrialization to mark its presence in the global economy. However, rapid industrialization is accompanied with various other environmental problems since our development paradigms are not based on a sustainable pattern. Numerous environmental issues prevailing and arising out of unsustainable development include natural disasters like flood, drought etc, air pollution, water pollution, climate change, land degradation, deforestation due to massive population growth etc. All these problems should not be looked upon as individual factors but, as inter linked with one another. For example, afforestation would not only lessen the levels of air pollution but also help prevent land degradation. Planting trees alongside river banks helps binds the soil together and prevents soil erosion while simultaneously helps rainfall to seep into the soil. This eventually increases the groundwater levels which enter the rivers, streams through well connected channels. Increasing crucial issues which needs immediate attention are addressed in these aspects specifically, the problem of waste management and garbage disposal, Water pollution due to increasing discharging of effluents in the rivers and Loss of biodiversity due to loss of habitat.

The initial focus on economic development of the state led to establishment of economic zones in various parts of the country. But the endeavor was nipped in the bud as political nepotism prevailed and government land got distributed in the name of industrial development. This can be said to be the biggest illegal marketing of government land till date. Unemployment is at its peak today, yet the factories that were supposed to come up are nowhere to be seen. However, the richness of states in metallic and non-metallic minerals and resources are there. But the geographical and seismic sensitivity in many northern and NE states does not make it very favourable to exploitation of resources, construction of infrastructures, developmental projects and mining. However, this sensitive ecological warning was not heeded by the state as well as central government. Consequently, there is a scramble by mining companies and real estate sharks, who are using the material to build multistoried commercial buildings in the delicate ecosystem leading to deadly landslides and floods. The national media's focus on the plight of tourists has grossly distorted the true nature of the tragedy even in the pilgrimage area. Instead of herding millions of tourists along the yatra routes, the number of daily visitors to the shrines ought to be limited, as has been done for the Gangotri glacier trek at Gaumukh. Safe facilities can be developed for these limited numbers. Nature tourism can be encouraged taking advantage of scenic locations and tourists can be dispersed throughout the state. Community-based tourism, where local families host visitors and their youth act as guides, introducing the guests to scenic locations, local history, culture and foods can replace massive hotels and resorts. Illegal dumping is another major issue, which is the unlawful deposit of any type of domestic, commercial, or industrial waste of 200 litres or more. The illegal dumping of both industrial and household waste has become a huge environmental problem over the past few decades, especially in poorer countries. This is more so due to overconsumption of goods. Moreover, many poor countries have lax environmental protection laws and corrupt law enforcement. Due to this, many larger companies dispose of toxic waste directly into waterways or water bodies. If they are caught, they either pay off the officials, or pretend to clean up their act.

TAILORING CHICKPEA VARIETIES FOR ENSURING HIGHER INCOME

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Abstract

Chickpea (*Cicer arietinum* L.) is one of the important pulse crops that has played important role in achieving almost self sufficiency for pulses in India. During 2017-18, chickpea was grown on about 10.17 m ha area producing 11.23 m t as per 4th

advance production estimates of Govt. of India. The additional production came from an increase of 1.24 m ha area and improved productivity of 160 kg/ha over XI Plan period. This resulted in low price to the farmers for chickpea during 2017 and 2018. To protect interest of the chickpea growers the main challenge enhancement in farm profitability is of paramount importance. If crop is not profitable chickpea farmers may lose their interest. To maintain current level of growth in productivity and production there is need to develop technologies those can help in reducing cost of cultivation so that higher income form per unit of cultivation can be ensured to the farmers. Foresightedness of breeders led initiation of research for development of tall and erect varieties. Tall and erect varieties having at least 20 cm ground clearance were found suitable for combine harvesting even in plateau region here mostly fields are undulation. Tall and erect varieties also offer ease in application of agro-chemicals to mange foliar diseases and insect pests besides allowing better sunlight penetration inside crop canopy that is required in northern India to minimize flower drop and incidence of foliar diseases. There is economy in application of insecticide even for management of gram pod borer. At ICAR-IIPR several crosses were made and elite breeding lines were developed and evaluated. During 2017-18, out of 56 elite breeding lines evaluated IPC 2014-10, IPC 2016-127, IPC 2015-132, IPC 2016-96, IPC 2016-129, IPC 2015-12, IPC 2016-6, IPC 2015-17 and IPC 2015-165 exhibited more than 22 q/ha grain yield and adjudged better than the best check in terms of grain yield and 70 cm plant height making these breeding lines suitable for machine harvesting. Considering the importance of tall and erect varieties under AICRP-Chickpea sincere efforts were made for tailoring suitable varieties ensuring reduction in cost of cultivation. A number of breeding lines have been developed and evaluated multilocationally and Shubhra, HC 5, GBM 2, RVG 204, NBeG 47, Phule Vikram, etc. were released and now under cultivation. Popularization of tall and erect varieties is going to help in reducing cost of cultivation in big way. There is further need of research to identify gene(s)/QTL conferring lodging tolerance in tall and erect genotypes and develop associated molecular markers for enhancing efficiency of selection in a breeding program.

INFLUENCE OF TEXTILE INDUSTRIAL WASTEWATER ON SEED GERMINATION OF LENTIL (*LENS ESCULENTUM*)

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Abstract

Textile industrial wastewater is highly polluted in nature and varies in its compositions. In the adjoining agricultural area of textile industries sector, there is immense degradation of crops productivity being contaminated by irrigation through tubewells or directly from the effluent drain or village pond. The present paper deals with the physico-chemical parameters of textile industrial effluents and its impacts on germination and growth performance of Lentil (Masoor) *Lens esculentum*, (Family: Leguminoceae, Sub-family: Papillionateae). Seeds were found more tolerant against 25% concentrated effluent.

EFFICACY OF MUTAGENIC TREATMENT WITH GAMMA-RAYS, EMS AND COMBINATIONS IN PRODUCING SUPERIOR MUTANTS IN OKRA (*ABELMOSCHUS ESCULENTUS* L.)

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Abstract

Okra or lady's finger (*Abelmoschus esculentus* (L.) Moench), also known as bhindi in India, belongs to the family Malvaceae. Broadening the genetic base through induced mutations is a supplementary tool that can lead to the development of genetic variability. The present experiment was undertaken to generate a broad genetic variability by determining mutagenic effectiveness and efficiency of gamma rays, EMS and their combinations in 526 lines of okra. The research was conducted in two generations namely M_1 and M_2 during *kharif* season (May-September) of 2015 and 2016 at Experimental Farm, Department of Vegetable Science, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (Himachal

Pradesh). The parent material, selfed seeds of P-8 variety were irradiated with 65, 75 and 85 kR doses of gamma rays and 1.2, 1.4 and 1.6% concentrations of EMS. The seeds along with control were space planted for raising M_1 generation. Each M_1 plant was harvested separately and desirable M_1 individual plant progeny rows were laid in augmented design for raising M_2 generation. The effectiveness and efficiency of the mutagen used was assessed from the data on biological damage in M_1 generation. In M_1 generation, results showed a dose dependent retardation in biological parameters like seed germination and plant survival; 75kR and 1.4% was depicted as LD_{50} values for both gamma rays and EMS, respectively. In M_2 generation, 1.2% EMS had highest effectiveness (0.0431) and efficiency (2.02). The mutants with short internodal length, more number of nodes per plant, dwarf plant height, branched and high yield were isolated in M_2 generation.

STUDIES ON FLORAL BIOLOGY, POLLINATION AND FRUIT SET IN RASPBERRY (*RUBUS ELLIPTICUS*) UNDER HILLY CONDITIONS OF UTTARAKHAND

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Abstract

The present investigation was carried out at College of Horticulture, Uttarakhand University of Horticulture and Forestry, Bharsar during 2015-2016. The different parameters for floral biology, pollination and fruit set were recorded on the basis of time period. It was observed that the total span of flower bud development from bud emergence to the anthesis had six different stages. The time required from flower bud development to reach anthesis was 39 days. The period of anthesis varied from 6 am to 6 pm with the peak period of anthesis (41.20 %) having reached between 10 am to 12 noon. The major dehiscence period of the day was recorded between 10 am to 4 pm. The highest number of anthers (37.20 %) dehisced between 10 am to 12 noon. Amongst different media tested, the average size of pollens (length x width) was 177.73 x 124.43µ in glycerol conditions, followed by 173.29 x 173.29 µ in water suspension. The highest pollen germination percentage (36.66 %) and maximum pollen tube length (284.37µ) was recorded with T_{12} (25 % sucrose solution + 0.4 % boric acid solution). Best receptivity of stigma (86.66 %) has been witnessed on the day of anthesis by the fruit set method and the stigma receptivity continued upto one week. The maximum fruit set (96.66 %) has been recorded under self pollination, followed by natural pollination (76.66 %). The fruit retention upto maturity in case of natural pollination was 64.66 %. Hence, the studies indicated that the best time and duration of raspberry for production and breeding programme is last week of February to first week of March under hilly conditions of Uttarakhand. There is little literature about its flowering and fruit set in India. Therefore, to enlighten this part of the raspberry improvement present study is conducted.

IMPACT STUDY OF ANTIFUNGAL ACTIVITIES OF NEEM OIL (*AZADIRACHTAINDICA* A. JUSS.) ALONGWITH A BOTANICAL SYNERGIST AGAINST A PLANT PATHOGENIC FUNGUS, SC*LEROTINIA SCLEROTIORUM*

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Abstract

In the present investigation, the neem oil was evaluated for its antifungal activity against *Sclerotinia sclerotiorum* under standard laboratory conditions by using the poison food technique. Different concentration of neem oil, neem oil plus synergist and carbendazim were analyzed for its effect on the growth of pathogenic fungus, *S. sclerotiorum.* The observation on percent inhibition growth was observed under lab condition at different time intervals. The treatment of neem oil plus synergist at different treatment concentrations of 200 µl,400µl, 500µl concentration and 0.1% concentration of carbendazim showed no growth at three days of incubation period of *S. sclerotiorum* .However, a certain growth of 4.9 mm and 5 mm growth was observed at 100µl and 300µl concentration in case of neem oil plus synergist and neem oil alone, respectively. After nine days of incubation period, the percent inhibition growth was observed 100% in case of carbendazim followed by neem oil plus synergist with 96.29 % inhibition growth whereas treatment alone with neem oil showed relatively lesser

percentage of inhibition growth i.e 81.48% in comparison to control. The growth inhibitory effect of treatments included various concentrations of neem oil plus synergist shows the the anti fungal effect of the mentioned botanicals to control the growth S*lerotinia sclerotiorum.*

UTILIZATION OF RICE LANDRACES FOR DEVELOPMENT OF NUTRITIONALLY ENRICHED RICE VARIETY THROUGH ADVANCED GENOMIC TECHNIQUES

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Abstract

Rice is main staple food of the growing population of India. Chhattisgarh state, the 'Rice Bowl of India' is famous due to its rich rice biodiversity. Rice landraces have broader genetic base and they are the store house of several desirable and rare alleles. Malnutrition becomes one of the severe problems in India and especially in Chhattisgarh state. Many people and children died every year due to hidden hunger. Looking to the nutritional security of poor peoples and children it is essential to develop naturally Biofortified rice varieties by exploiting the potentials of traditional rice landraces. It needs accurate estimation and characterization of rice landraces for grain nutritional traits *viz.,* iron (Fe), Zinc (Zn), protein content, lysein content, essential fatty acids components, glycemic index amylase contents etc, along with the grain yield and attributing traits. Superior landraces for various nutritional traits and grain yield attributing traits could be selected for making a core set. These superior landraces would then exploited by advanced genomic techniques for identification mapping and pyramiding of desirable genes. Molecular markers are very useful for identification and mapping of desirable genes/ alleles in rice landraces. Marker-trait associations could be used in marker assisted gene pyramiding for development of nutritional rich rice varieties. Identified superior landraces could be improved and release as bio-fortified rice variety and also used as donors parents to develop nutritional rich rice variety.

UNDERSTANDING THE MOLECULAR BASIS OF HOST-PATHOGEN-BIOAGENT INTERACTIONS THROUGH PROTEOMIC APPROACH IN RICE

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Abstract

Brown spot of rice is a highly destructive disease causing extensive losses to rice production worldwide. We tested the antagonistic potential of forty *Bacillus* spp. against *Bipolaris oryzae* under *in vitro*. Based on their antagonism, ten effective strains against *B. oryzae* were selected among them and characterized at molecular level. The antibiotic biosynthetic genes responsible for the production of bacillomycin, bacilysin, iturin, surfactin, subtilin, mersacidin, subtilosin, ericin, mycosubtilin and fengycin from the effective strains were detected by PCR analysis. Among the strains, BS5 exerted higher mycelial growth inhibition (76.66%) of the pathogen and possesses the maximum number (9) of antibiotic genes as well. In this study, we evaluated the efficacy of liquid formulation of the strains BS5, BS6 and BS39 against *B. oryzae* under glasshouse conditions. Glasshouse studies illustrate significant reduction in the incidence of brown spot disease (72.61%) on rice crop with the combined application of seed treatment+seedling dip+foliar spray of BS5 liquid formulation. Furthermore, 2D-PAGE analysis was implemented in order to understand the molecular mechanisms behind bio-protection. A total of nine differently expressed proteins were selected and subjected to MALDI-TOF Mass spectrometry (MS) analysis. The Mascot protein search algorithm demonstrated homology among proteins such as ribulose 1, 5 bisphosphate carboxylase, 2-cys-peroxiredoxin, ATP synthase, trehalose-phosphate phosphatase, serine/threonine protein kinase and 50s ribosomal protein. The functions of the analyzed proteins were mainly related to plant metabolism, defense response and disease resistance. An initial insight into the molecular basis of a three-way interaction among the host-pathogen-bioagent in rice plants will be provided in this study.

EFFECT OF ADDITION OF DIFFERENT LEVELS OF LACTULOSE IN LITCHI SHRIKHAND

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Abstract

Shrikhand is one of the important fermented milk product which is found in western part of our country. The curd mass known as chakka is the base material for shrikhand. It is obtained by removal of whey from dahi. The quality of shrikhand is largely influenced by physical and chemical properties of chakka. Recent trends indicate that consumers are accepting those products which embeds fruit pulp as the beneficial effects of fruit can be harvested by consumption of some routine food products. Litchi is one such delicious fruits having high nutritional and medicinal values. Dairy products are deficient in fiber. During high heat treatment of milk lactulose is formed from lactose which has a established laxative effect and is used in treatment of constipation. In the present study, buffalo milk was standardized to 6% fat and 9% Solid Not Fat for manufacturing of Chakka. Sugar and litchi pulp was added @ 35% and 5% respectively. Lactulose was added @ 3.0, 4.5, 6.0, 7.5 and 9.0 per cent respectively and treatment was designated as T1, T2, T3,T4 and T5 respectively. Control (T0) was formulated in which there was no lactulose. On the basis of organoleptic evaluation, it was found that the sensory score of T2 treatment for colour and appearance, flavour and taste, consistency as well as overall acceptability was significantly higher as compared to other treatment. Total solid, fat, protein, carbohydrate and ash content of T2 treatment was found to be 52.14, 11.52, 7.70, 32.16 and 0.76 per cent respectively.

VARIATION IN YIELD AND QUALITY OF GUAVA PLANTED IN DIFFERENT PLANTING SYSTEMS AS AFFECTED BY PRUNING

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Abstract

The present investigation was carried out at Horticulture Research Centre, Patherchatta, G.B. Pant University of Agriculture and Technology, Pantnagar to study the variation in yield and quality of guava planted in different planting systems as affected by pruning. The experimental material consisted of seven year old uniformly grafted trees of guava cv. Sardar. The treatment consisted of two pruning levels i.e. Unpruned (P_0), one leaf pair pruning (P_1) and five planting systems i.e. Square system (S_1), Hedgerow system (S_2), Double Hedgerow system (S_3), Paired system (S_4) and Cluster system of planting (S_5). Thus, there were ten treatment combinations each replicated thrice in Factorial Randomized Block Design with single tree as a treatment unit. The soil of the field was classified as sandy loam having pH 7.2.

According to the results obtained One leaf pair pruning significantly influenced the fruit yield and quality in terms of mean fruit weight, fruit volume, fruit length and fruit diameter, T.S.S., total titratable acidity, ascorbic acid, sugars, T.S.S.: acid and sugar: Acid ratio during both the years. One leaf pair pruning significantly increased the winter season crop as compared to unpruned (control). Maximum number of fruits per tree and yield kg per tree was found in treatment combination unpruned and square system of planting in rainy season, while in treatment combination one leaf pair pruning and square system of planting in winter season during both the years. Pruning improved Fruit weight, size, volume, T.S.S., ascorbic acid content and total sugars of fruits which were inversely proportional to increase in plant population during both the years. However, the maximum T.S.S. (13.04%) was found in winter season crop with Square system of planting during both the years. Interaction between pruning and planting system had only significant effect on T.S.S. content of fruit in winter season. Maximum T.S.S. content of fruit was obtained in treatment combination One leaf pair pruning and Square system of planting (P1 ×S1). Decrease in plant population decreased the total titratable acidity of guava fruits and increase in plant population significantly increased the total titratable acidity. However, the maximum total titratable acidity (0.74 %) was found in winter season crop in Double Hedgerow system of planting in first year. Reducing sugar content of fruit increased with decrease in plant population. However, the maximum reducing sugar (7.21 %) was found in winter season crop in Square system of planting followed by paired system of planting (5.48 %) with comparatively low plant population during both the years. Maximum reducing sugar content, non reducing sugar and total sugar, TSS:acid ratio and sugar:acid ratio of fruit was obtained in winter season in treatment combination One leaf pair pruning × Square system of planting (P1 ×S1).

PERFORMANCE OF NARMADA NIDHI AND KADAKNATH BIRDS IN EXTENSIVE SYSTEM OF FARMING

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Abstract

Mandla is a tribal district situated in the east-central part of Madhya Pradesh. The district lies almost entirely in the catchments of river Narmada & its tributaries. Birds native to our country are very colorful, easy to manage as backyard flocks and are disease resistant. Their meat as well as eggs are in good demand and also fetch good price. Kadaknath, which is reared by most of the tribes as backyard system of farming without any vaccination and hygiene and offered only kitchen waste and small amount of grains, therefore its growth rate is very low and mortality rate is high. Narmada Nidhi Bird is developed by Nanaji Deshmukh Veterinary Science University, Jabalpur for rural and tribal poultry keeping. The experiment was conducted to know the Performance of Kadaknath and Narmada Nidhi Birds reared as backyard system of farming in Mandla District of M.P. (India) at KVK, Mandla. Day old twenty female with five male chicks of Kadaknath and Narmada Nidhi chicks for each farmers (Total Two hundred and twenty five each breed) were randomly distributed reared as backyard system of farming. The birds were vaccinated against Ranikhet disease (F_1-strain) and Gumboro disease. From the experiment it was concluded that body weight gain was significantly higher in Narmada Nidhi Birds birds as compare to Kadaknath birds, similarly egg production was also significantly higher in the Narmada Nidhi Birds but age at 1st laying, hatchability and mortality data were non significant among each other. The egg selling rate was same for both the breeds but meat of Kadaknath bird fetch high price due to its medicinal uses.

SIMPLE SEQUENCE REPEATS (SSR) MARKERS FOR ASSESSING GENETIC DIVERSITY AMONG THE JNPT LINES OF RICE (*ORYZA SATIVA* L.)

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Abstract

The present study was taken up with the objective of studying the genetic divergence among the selected JNPT lines of rice using SSR markers which are distributed throughout the rice genome. A total of fifty SSR markers were used for screening the diversity of JNPT lines. All the markers were resolved on 2% agarose gel. For the molecular analysis, forty five promising JNPT lines were selected on the basis of morphological, quantitative and qualitative traits from Seed Breeding Farm, J.N.K.V.V., Jabalpur (M.P.).Out of fifty markers amplified, thirty nine markers were polymorphic. The total number of alleles amplified was 103 with a mean value 2.06. The highest numbers of allele i.e. 5 were amplified by marker RM 17. Single alleles were amplified by using the markers viz., RM 1, RM 42, RM 231, RM 118, RM223, RM 233, RM 236, RM 261, RM 283, RM 338, RM 455, RM 468, RM 529 and RM 5474. The mean value of major allele frequency, gene diversity, heterozygosity value and polymorphic information content value were 0.7400, 0.3335, 0.8667and 0.2813, respectively. The cluster analysis on basis of molecular analysis divided selected JNPT lines into two major clusters. Cluster II further sub divided into two major sub-groups. It depicted that there is considerable genetic variability in the JNPT lines and this was similar to the result of the principal component analysis done on the basis of morphological data.

IMPROVING HERITAGE RICE KALANAMAK OF U.P. TO TRIPLE FARMERS INCOME

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Abstract

Kalanamak is heritage rice of eastern Uttar Pradesh and valued for its aroma, taste and nutritive quality. Its cultivation

declined from 50,000 ha to less than 2,000 ha due to varietal deterioration and competition from HYV. Four improved varieties, KN3, Bauna Kalanamak 101, Bauna Kalanamak 102 and Kalanamak Kiran were released in 2010, 2016, 2017and 2018 respectively. Last three varieties yield 50% more than traditional Kalanamak KN3 and mature 10 days earlier. Normal selling price of the Kalanamak paddy ranges between Rs. 2500/- to Rs. 3500/- per quintal. In spite of MSP announced by the governments, most farmers sell their HYV paddy around Rs. 1300/- per quintal. Cost of cultivation of Kalanamak and yield the same as HYV now, farmers get three times more net profit. Organic Kalanamak fetches 20% premium over normal Kalanamak. Summarily compared to Rs. 17,500 / ha net profit from common HYV rice, Kalanamak KN3 will give Rs. 44,375, Bauna Kalanamak Rs. 71,500 and Organic Kalanamak Rs. 92,500 per hectare net profit. With the PRDF arranged contract growing, by involving farmers and marketing companies from Kharif 2018, tripling the net profit of the farmers is assured sustainably. Thus, the proverb "Paddy and Poverty go together" is a myth now.

RESPONSE OF CURRENTLY CULTIVATED SORGHUM VARIETIES TO CLIMATE CHANGE IN SAT REGIONS OF SOUTH INDIA: DSSAT MODEL ANALYSIS

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Abstract

Indian national food security is not only challenged by ever growing population, it's fast changing food diets and consumption patterns, but also by the expected adverse impacts of climate change. Global food production needs to be doubled by 2050 from the current levels to feed some nine billion people and most of it needs to be met by cereals. This suggests that the productivity of cereals needs not only be enhanced from the current level, but maintained under future adverse climates. Sorghum is one of the important coarse cereal crops of India grown mostly in semi-arid tropical climates, where high temperatures and moisture stress during post-monsoon crop growing period severely affect yield levels. This would be further adversely affected by projected rise in temperatures and changing rainfall patterns. Therefore, currently ruling and newly to-be released sorghum cultivars need to be tested for their performance under future climates. This would help us identify i) traits which need to be targeted in crop improvement programs to design required ideotype and ii) identify adaptations in crop management for SAT regions for future climates. In this study, DSSAT model was used to assess both the potential yield and impacts of climate change on currently popular and newly to-be released sorghum cultivars. This study also identifies adaptation strategies and suggests ideal traits required to be targeted by the sorghum breeders to enhance and maintain higher yields under future climates.

INFLUENCE OF MOISTURE STRESS ON RELATIVE LEAF WATER CONTENT AND LEAF GAS EXCHANGE IN SORGHUM

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Abstract

Sorghum is a C4 crop with a high photosynthetic efficiency. Sorghum is drought tolerant and heat tolerant adapted to grow in hot, arid or semiarid areas. It is generally grown under stored and receding soil moisture conditions with increasing temperature after flowering. As such the crop productivity in these areas is low. Moisture stress leads to a decrease in water potential of plant tissues. It restricts the expression of full genetic potential of the plant. Moisture stress is a major constraint limiting the productivity of sorghum crop. Drought stress disrupts photosynthetic pigments and reduces the gas exchange, radiation use efficiency, water balance and chlorophyll content leading to a reduction in plant growth and productivity. Plants have different adaptive mechanisms for copping with drought stress condition. Sorghum genotypes have an ability to adapt one or more than one mechanism for sustaining growth and productivity under drought stress condition. In view of this the field experiment was carried out to evaluate physiological basis of drought tolerance under moisture stress during *rabi* 2013-2014 and 2014-2015 at Pulses Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in split plot design with three replications. Ten sorghum varieties evaluated under different moisture regimes. Seeds

were grown separately under three moisture regimes viz; moisture stress condition with irrigation applied at the time of sowing, terminal stress condition with irrigation applied at the time of sowing and panicle initiation stage and non stress condition with irrigation applied at various critical growth stages. Gas exchange parameters were recorded with the help of IRGA. Genotypes differed significantly with respect to photosynthetic rate, transpiration rate, stomatal conductance and stomatal resistance and relative leaf water content . RSV 1237 and RSV 1572 under stress conditions performed better in respect of net photosynthetic rate, transpiration rate, stomatal conductance and stomatal resistance. Physiological parameter relative leaf water content decreased as moisture stress increased. RSV 1572 and RSV 1237 under stress recorded higher relative leaf water content. It was observed that relative leaf water content and leaf gas exchange characters were affected by moisture stress. However, some genotypes performed better under stress conditions. In those genotypes leaf water content and leaf exchange characters were superior under stress conditions. It was concluded these parameters could be reliable for screening of genotypes for drought tolerance.

DEVELOPMENT OF NEAR-ISOGENIC LINES FOR BLAST RESISTANCE GENE, *PI54* IN AROMATIC RICE CULTIVAR *MUSHK BUDJI*

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Abstract

Rice is a major food crop of Jammu and Kashmir and occupies an area of 2.63 Lakh ha with the production of 5.62 mt. The high yielding varieties though occupy 90% of the area under rice, rest of the area is covered under specialty rice landraces / cultivars, prominent among which are *Mushk Budji,Kamad*, Nun Beoul, and others. *Mushk Budji* is a short grained aromatic landrace known for its quality and aroma, however, it is highly susceptible to rice blast. The recurrence of rice blast at seedling and panicle bearing has been a factor behind its declining area and produce. Therefore, an initiative was taken to incorporate major genes for resistance to rice blast. A donor line, DHMAS70Q 164-1b was crossed to *Mushk Budji* followed by recurrent backcrossing to generate BC_3F_3 NILs for gene *Pi54*. The InDel marker Pi54 MAS was used for foreground selection of individuals in BC_3F_2. Out of 63 plants in BC_3F_2, nine homozygous plants were selected for Pi54 and advanced to BC_3F_3. BC_3F_3 lines were grown in blast hotspot conditions of Khudwani, Anantnag and were recorded for disease under open field conditions. The Area under disease progress curve (AUDPC) for susceptible recurrent parent was observed to be more than 90% against 5% for the lines. The recurrent parent genome recovery of parental BC_2F_1 lines was recorded to be more than 92% for the lines. The program is currently in progress for development of NILs in BC_3F_3.

USE OF VAM AS BIOFERTILIZER TO ENHANCE THE KAIR (*CAPPARIS DECIDUAS*) FRUITS IN ARID RAJASTHAN

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Abstract

Capparis decidua (Kair) is a small spinous shrub to small tree with an ability to survive in various habitats under extreme condition of temperature of arid region. Its immature fruits collected from natural stand are used to prepare pickles. Dried fruits fetch high return which plays an important role in rural economy. To enhance the productivity of kair fruit a research trial was taken by Arid Forest Research Institute Jodhpur in collaboration with SFD Rajasthan in the naturally occurring Kair shrubs in Gogelao beed forest area Nagaur, Rajasthan. The area is undulating and the texture of the soil was loamy sand. The soil pH values are ranging from 7.82 to 8.39, EC 0.27 to 0.39 dSm-1 and organic carbon (0.28 to 0.51%) in 0-20 cm soil layers. Literature revealed role of VAM as Biofertilizer in enhancing yield of wheat, rice, chili etc. therefore the trial was laid with Vesicular Arbuscular Mycorrhizae (VAM) in combination to inorganic fertilizers leading to five treatment combinations, T_1 (VAM 250g/ stem + NPK (70/ stem g), T_2 VAM +SSP (625 g/ stem), T_3 VAM + SSP (1250g /stem), T4 VAM only and T5 Control. It was applied with irrigation. There were seven plants per treatment in RBD. Moisture conservation trenches of the size 1ft. deep 1ft. broad and minimum 6ft. in length, were prepared around individual or group of Kair shrubs in June 2014.

The results of three year observations on frequency of fruiting and fruit yield on wild kair shrubs are reported here. Periodic observations revealed that in one year three times flowering and fruiting in April July and October was observed in the kair plants in the year. Three years cumulative data pulling revealed that the maximum % fruiting shrubs were observed in October in all the treatments (85.7% in T_4 to 76.2% inT_2) except T_1 (66.7%) treatment followed by April(61.9% in T_2 to 28.5% in control) and minimum in July(57.1% in T_3 to 28.5% in control). Treatment wise lot of variation is observed T_2 recorded maximum (61.9%) in April, T_3 (57.1%) in July and T_4 (85.7%) in October. Overall total fruit yield wise T_1(V+NPK) with 463g, T2 (V+P1) 436 g and T_4 (V only) 432.5 g are nearly equal in performance Season wise October yield is significantly high for all the treatments ranging from 595.7 g in T_4 to 448.7 g in control however T_2 is almost equal to control. Probably high moisture availability in post monsoon season due to moisture trenches may be the reason. April is at second place ranging from 634 g in T_2 to 77.11 g in control. July was at third place with 470 g in T_1 to 103 g in control. However total per shrub yield was maximum for T_1 treatment (V+NPK) in all the three seasons followed by T_4 treatment. Thus though overall fruiting shrubs were less in T_1 but their per plant fruiting efficiency is high followed by T_4 treatment indicating the positive influence of VAM in fruit yield enhancement.

ANALYSIS OF MOLECULAR REGULATORY MECHANISMS DETERMINING LOW TEMPERATURE STRESS TOLERANCE IN *SACCHARUM SPONTANEUM*

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Abstract

Sugarcane is an important commercial crop in India. Subtropical India contributes more than 50 % production. Major constraint in this region is sugarcane active growth period restricted to 8-9 months mainly due to low temperature (LT) conditions prevailing during November-February every year. Hence, tolerance to LT is important in sugarcane improvement programs. *Saccharum spontaneum,* a wild species of sugarcane is the major source for resistance to biotic and abiotic stresses to sugarcane varieties.To understand the molecular mechanisms governingLT stress tolerance, transcriptome data was generated fromlow temperature tolerant *S. spontaneum*IND 00-1037 collected from high altitude regions of Arunachal Pradesh. Three months grown seedlingswere exposed to critical chilling temperature (10ºC at 1, 3, 6, 12, 24 & 48 hrs) and sequenced the cDNA libraries using illumina nextseq500 platform.A total of 105516 unigenes were identified and annotated using Nr (NCBI non-redundant protein sequences), Pfam protein domain, GO (Gene Ontology), COG (cluster of orthologous groups), KEGG (Kyoto Encyclopedia of Genes and Genomes), SOGI3 (Sugarcane Gene Index version 3) and SUCEST (Sugarcane EST) databases. Gene expression analysis revealed that 71177 genes were differentially regulated during cold acclimation. Network analysis onmolecular regulatory mechanisms revealed that cell wall modification, homeostasis, cold signaling, transcription factors, osmoprotectants, photosynthesis and ubiquitinationgenes were found to determine cold tolerance. This study provides insights into the molecular signatures and regulatory mechanisms underlying low temperature tolerance which will further facilitate research in various areas of functional and translational genomics in *Saccharum* sp.

CHARACTERIZATION OF SORGHUM (SORGHUM BICOLOR (L.) MOENCH) GERMPLASM UNDER CRP-AGRO BIODIVERSITY

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Abstract

One thousand sorghum germplasm accessions were characterized in Augmented Block Design (ABD) with two checks viz., CSV 15 and CSV 21F replicated after each 50 accessions in each block at Sorghum Research Station, Sardarkrushinagar Dantiwada Agriculture University, Deesa during *Kharif* 2016. The data on quantitative and qualitative traits were recorded using minimal descriptors of sorghum. The accessions studied exhibited considerable variability for all the characters studied.

Majority of accession showed good early vigour (580 acc.), dark green leaves (457 acc.), non-tan type (956 acc.), drooping leaf orientation (741 acc.), white mid rib color (902 acc), non-senescence (309 acc.), awn less (353 acc.), semi compact ear head (520 acc.), oblong ear head shape (109 acc.), white (65 acc.), half glum covered (147 acc.) and bold seeded (109 acc.).The preliminary characterization revealed that there was considerable variability found in morphological and agronomical characters among the grmplasm studied. The dry fodder yield, plant height, grain yield, leaf length, days to flowering and ear head length were the most variable characters because they showed higher range, variance and standard deviation. High positive and significant correlation was observed among grain yield, days to 50% flowering, total number of leaves, leaf length leaf width, ear head length, ear head width, 100-seed weight and dry fodder yield per plant. Based on the mean some accessions showed outstanding performance for different traits viz., early flowering (EC 487069 and EC 486957 with 23 and 43 days) total number of leaves (EC 486946 and EC 487120 with < 19.6), leaf length (EC 487226 and EC 487500 with < 104.4 cm), leaf width (EC 487499 and EC 487501 with < 10.1 cm), ear-head length (EC 487023 and EC 487205 with < 42.7 cm), ear-head width (EC 486919 and EC 487091 with < 14.80 cm), plant height (EC 487273 and EC 487116 with < 316.2 cm), 100-seed weight (EC 486884 and EC 487085 with < 4.9 g), dry fodder yield (EC 487409 and EC 486839 < 696.0 g/ plant) and seed yield (EC 486956 and EC 486809 with < 139.2g). These accessions with potential for different agro-morphological traits may be utilized in crop improvement program for developing superior varieties and parental lines.

POPULATION DYNAMICS OF LEAFROLLER *SYLEPTA DEROGATA* FABRICIUS ON OKRA IN RELATION TO ABIOTIC FACTOR AND MANAGEMENT PRACTICES AT MIZORAM STATE

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Abstract

A field experiments were carried out to study the population fluctuation of leaf roller *Sylepta derogata* Fabricius in okra and its relation with different weather variables during 2016 and 2017 crop seasons at Mizoram state. The results revealed that leaf roller population commenced from 25th and 32th standard week in 2016 and 2017 respectively. The highest population leaf roller was recorded on 28th standard week (38.94%) in 2016 while the maximum population was recorded in 30th standard week (46.85%) during 2017. It was found that leaf roller infestation was heavy during July in both the years (27th to 31st SMW). The maximum number of predator {*Brumoides suturalis* (Fabricius)*, Scymnus (Scymnus) nubilus* Mulsant and *Oxyopes lineatipes* (C.L.Koch)} was recorded on 29th standard week (16.85%) in 2016 while in 2017 population of predator was highest in 30th standard week (16.34%). Least *Sylepta derogate* damage was recorded with variety (Parbhani Kranti) 35.28 % which was inferior to the varieties Punjab no 13, Pusa Swaani, Arka Anamika Pusa Makhmali and Panjab Padmani (41.19%, 40.51%, 38.94%, 37.43% and 36.75%), respectively. The population of leaf roller Maximum temperature, Maximum RH, Minimum RH, Rainfall and sunshine hours showed a significant positive correlation with the leaf roller where as a negative correlation was established with relative Minimum temperature.

IMPACT OF GST (GOODS AND SERVICE TAX) ON AGRICULTURE

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ABSTRCT

Agriculture is one of the primary employment sectors to millions across the country and becomes vital for the country's growth. India ranks third in farm and agriculture output globally. It is also the largest producer, consumer and exporter of spices and related products. Agricultural exports constitute 10% of the country's exports, and are the fourth-largest exported principal commodity. India is also among the top producers of wheat, rice, sugarcane and fresh fruits. Thus, a major taxation reform like implementation of GST has an effect on the agricultural sector of Indian Economy. After more than a decade of intense discussion and debate, finally, GST is becoming a reality. Although, in its current form, it is not the perfect GST as

originally envisaged, it is being lauded as one of the most transformational reforms since 1991. GST is a comprehensive tax levy on manufacture, sale and consumption of goods and services at a national level. The tax is levied on all transactions involving supply of goods and services, except those which are kept out of its purview. The implementation of GST have its impact on every sector, and quite large at the Indian Agricultural Sector as it accounts for approximately 17.40% of the national GDP and employs around 52% of the population. GST will improve the transparency, reliability, timeline of supply chain mechanism for the agricultural products, which have various interpretations. A better supply chain mechanism would ensure a reduction in wastage and cost for the farmers. GST would also helpful in reducing the cost of heavy machinery required for producing agricultural commodities. Under the model GST law, poultry farming, dairy and stock breeding are kept out of the definition of agriculture. Therefore these will be taxable under GST. Fertilizer which is important input for agriculture is previously taxed at 6 % but now under GST regime tax on it has been increased to 12 %.The same impact is on Tractor. India's milk production was 160.35 (2015-16) which is increased from 146.31mt(2014-15).Under GST tax on fresh milk is nil and skimmed milk is kept under 5% bracket and condensed milk is going to be taxed at 18%. Tea is probably one of the most crucial items in an Indian households. The price of tea might also increase due to the tax rate of 5% under GST rate from the current average VAT rate of 4-5 % with Assam and West Bengal with the exception of 0.5 and 1% An increase in the cost of few agricultural products is anticipated due to the rise in inflation index for a brief period. Though, implementation of GST is going to benefit a lot, the farmers and distributors in the long run as there will a single unified national agriculture market.

MOISTURE RELATED PROPERTIES OF DIFFERENT PLANTATION GROWN TREE SPECIES IN WESTERN GHAT REGION

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Abstract

Wood is widely used in different applications. However, due to the hygroscopic nature of wood, it has affected various properties such as poor resistance against fungal and insect as well as swelling and shrinkage due to adsorption and desorption of water. Ultimately, these properties affect the end uses of wood. The present study were carried to evaluate the moisture related properties of different plantation grown tree species i.e., selected based on preliminary survey of Uttara Kannada district, Karnataka, India. The physical properties such as density, water absorption, swelling and shrinkage were evaluated as per IS: 1708. The results revealed that the species *Artocarpus hirsutus* and *Grewia tilifolia* were shown better results than the other selected species in overall physical properties. Hence, the results concluded that these two species i.e., *Artocarpus hirsutus* and *Grewia tilifolia* may be the best substitute of primary species i.e., teak in uttara kannada region of Karnataka in future.

STUDY OF GENETIC VARIATION IN CONSERVED GENE SEQUENCES OF WHEAT PATHOGENS AS A SOURCE FOR DEVELOPING DIAGNOSTIC MARKERS

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Abstract

Wheat (*Triticum aestivum* L.), belonging to family Poaceae is one of the major cereal crops cultivated worldwide. Total production of wheat in world is 607 million tones and it occupies 29.5 million hectares of area (FAOSTAT.FAO.org). Major diseases affecting this crop are stripe (*Puccinia striiformis tritici*), leaf (*P.tritici*)and stem *(P.graminis tritici*) rusts; leaf blight (*Bipolaris sorokiniana*, *Alternaria triticinia* and *Pyrenophora tritici repentis*); loose smut (*Ustilago segetum*) and Karnal bunt (*Tilletia indica*) and minor diseases include powdery mildew (*Erysiphe graminis* f.sp. *tritici*), loose smut (*Ustilago tritici*), head blight (*Fusarium graminearum*) and storage pathogens (*Aspergillus, Fusarium* and *Penicillium* etc.). To cope up with increasing demand of wheat it is important to increase production that can be achieved by adopting diseases management strategies in time, for which identification /diagnostics of diseases is mandatory. PCR is rapid technology for detection; however, this method has limitations to develop markers for large number of pathogens. Amplification of conserved genes

using universal primers in all pathogens and their phylogenetic studies using Mega 7 and multiple sequence alignment tool (ClustalW program) will provide variable regions among different sequences. These regions could be used for developing markers. In present study we have used six pair of primers for amplifying six conserved genes ITS region, Translation elongation factor (*tef gene),* Glyceraldehyde 3-phosphate dehydrogenase gene (GAPDH), beta tubulin phosphoglycerate kinase (PGK) and actin in all test pathogens. Using MEGA7 software, ITS regions showed 5 to 22% variability among different genera with maximum between *Ustilago* and other pathogens and minimum between *Bipolaris* and *Alternaria*. Intra genus variability was less than 3 percent for all pathogens. *tef gene* showed more than 25% variability among different genera, while intra genus variability in *Bipolaris* was only 2% and among different species of *Fusarium* it was 10%. GAPDH gene showed >30% variable sequences among different genera. However *Aspergilli* showed only 1% intra genus variability, while *Bipolaris sorokiniana* and *B. oryzae* showed 20%. Beta tubulin gene showed variability in the range of 15 to 30% among different genera. However, variations between *Puccinia striiformis* and *P. triticina, P. graminis* was 18%, while between *P. graminis* and *P. triticina* was 2%. Differences between different Aspergilla were more than 20%. Similarly *Fusarium fujikuroi* and *Fusarium graminearum* showed variation of >20%. Likewise actin and PKG genes also showed variability among different pathogens. This study will open path for designing multiple markers and probes for detecting several pathogens at the same time and also developing pathogen specific housekeeping genes to study relative expression of desired gene in host pathogen interaction.

MANAGEMENT OF CHICKPEA WILT DISEASE THROUGH HOST PLANT RESISTANCE

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Abstract

Chickpea (*Cicer arietinum*) is one of the world's major legume crops and suffers substantial damage from wilt disease incited by *Fusarium oxysporum* f. sp. *ciceri* (Padwick) with yield loss over 60 per cent. It is an important soil borne plant pathogen and is difficult to manage by application of chemical. Moreover, the chemical control is costly and leads to residual effect. In the present study, an attempt was made for management of chickpea wilt disease through host plant resistance. A total of fifty five chickpea genotypes, collected from All India Coordinated Research Project on Chickpea, T.C.A., Dholi were assessed for their reaction against chickpea wilt disease in wilt sick plot during *Rabi,* 2017-18. Out of 55 chickpea genotypes, only one genotype was found to be resistant, however, twelve were found to be moderately resistance (10.1-20 per cent), nineteen were moderately susceptible (20.1-30 per cent), and nineteen genotypes were showed susceptible reaction for wilt disease and recorded more than 30 % wilt incidence and four genotypes showed highly susceptible reaction exhibited more than 50% wilt incidence.

EFFECT OF MULCHING AND POTASSIUM APPLICATION ON GROWTH AND YIELD OF RICE-WHEAT CROPPING SYSTEM

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Abstract

A field experiment was conducted to study the effect of mulching and potassium application on growth and yield rice –wheat cropping system during the rainy (June - October) and winter (November – March) seasons for one years during 2016-2017 at research farm of ICAR-Indian Institute of Farming Systems Research, Modipuram, India. The experiment was laid out in a randomized block design consisting of ten treatments and three replications. Results revealed that all the treatments with mulching and potassium application were significantly superior in growth and yield over control (no mulching and no potassium) in both the crops. No significant difference was observed in the yield of rice and wheat crop when crop was applied with mulch and without mulch. In rice crop highest leaf area index (1.34) at 60 DAS, grain yield (5.08 t ha^{-1}) and biological yield (14.3 t ha^{-1}) at harvest was observed in the treatment applied with 100% RDK+25% FYM. Similarly, in wheat

crop highest leaf area index (7.06) at 90 DAS, grain yield (4.04 t ha^{-1}) and biological yield (10.76 t ha^{-1}) at harvest was observed in the treatment applied with 100% RDK+25% FYM. The yield in treatment applied with 100% RDK+25% FYM without mulch was found at par with treatment applied with 100% RDK+25% FYM with mulch.

APPROACHES FOR IMPROVING HEAT TOLERANCE AND NITROGEN USE EFFICIENCY IN WHEAT TO COMBAT CLIMATE CHANGE

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Abstract

Wheat is the most widely grown cereal crop in the world. Stress due to high-temperature is emerged as a major constraint for the successful wheat production worldwide. Nearly 40 % of total irrigated area, where wheat is grown, is severely affected by heat stress. Breeders are seeking to incorporate late or terminal heat tolerance in the wheat germplasm, and selection of genotypes with early flowering and maturity along with low canopy temperature for improving grain yield under terminal heat stress. Several parameters viz., plot yield, thousand grain weight (TGW), grain filling duration (GFD), no. of effective tillers per plant, early ground cover, leaf rolling, stay green, biomass, canopy temperature, photosynthetic rate, chlorophyll content, stem reserve and membrane thermo-stability have been suggested to identify heat tolerant lines in wheat. Susceptibility index (SI) has been effectively used for measuring heat tolerance and drought tolerance in wheat. The physiological-trait-based breeding approach has merit over breeding for yield *per se* because it increases the probability of crosses resulting in additive gene action. High to moderate heritability coupled with high to moderate genetic advance as percentage of mean was exhibited for 5 traits *viz.,* hectoliter weight, 1000 grain weight, no. of tillers/m, spike length and no. of grains/spike, which indicate that predominance of additive gene action in the expression of these characters. Therefore, number of tillers/plant, spike length, number of grains/spike, 1000 grain weight, sedimentation value and hectoliter weight along with physiological traits like canopy temperature and Fv/Fm values were important traits to be included in selection indices, while selecting genotypes with high grain yield, high nitrogen efficiency and good quality under heat stress conditions. Genotypes HI 1544, MP 3288, HI 8713 (d), HI 8663 (d), MACS 3125 (d), HD 2967 and KRL 229 performed superior for grain yield with high nitrogen use efficiency, therefore, these genotypes should be used as donors to increase the genetic variability in wheat for improving their nitrogen use efficiency. Screening of wheat germplasm for heat stress tolerance using marker assisted selection (MAS) approach for the known tolerance genes might be the right approach to assist a conventional breeder for developing heat stress tolerance which would play an important role to minimize the yield losses.

COLLECTION, MORPHOLOGICAL AND BIOLOGICAL ACTIVITY OF MEDICINAL MUSHROOM GANODERMA FROM DIFFERENT AREAS OF UTTARAKHAND

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Abstract

Ganoderma is a large, widely distributed genus of the family Ganodermataceae, order Polyporales, class Agaricomycetes, and phylum Basidiomycota with about 80 species distributed worldwide. Species of *Ganoderma* occur as plant pathogens, their fruit bodies have been used in traditional Chinese medicine for more than 2000 years . *G. lucidum* is the leader in terms of medicinal potential and is known as the “king of herbs” in China. It is reported to contain different bioactive compounds, such as alkaloids, terpenoids, polysaccharides, steroids, fatty acids, and proteins .Uttarakhand is filled with rich flora of medicinal mushrooms due to the diversity and lattitude variation. The present study provides information on the collection, morphological characterization and biological activity of different isolates of *Ganoderma* sp from Uttarakhand region. Five different isolates (GA,GP,GD,GK,GM) of Ganoderma mushroom collected from five different regions of Uttarkhand viz; Almora (GA), Pantnagar (GP), Dehradoon (GD), Kashipur (GP) and Mukteshwar (GM) were isolated and were characterized on fruiting body (shape, size , colour) and basidiospore morphology which shows variation among the isolates because of difference in temperature and moisture in place of their origin. Antifungal activity against plant pathogens viz; *Colletotrichum*

sp and *Rhizoctonia* sp were exhibited by methanolic extract of isolate GA and methanolic extract was found to be more effective against *Rhizoctonia* sp in comparison of *Colletotrichum* sp. The collected information leads to the additional kowledge of diversity of this medicinal mushroom in Uttarakhand and also specify the location where fruiting bodies have high content of biactive compounds for pathogenic as well as medicinal effect.

EXPLORING DIVERSE INDIAN WHEAT LANDRACES FOR FE AND ZN FOR BIOFORTIFIED WHEAT WITH IMPROVED NUTRITIONAL QUALITY

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Abstract

The short-term agricultural tools like agronomic bio-fortification of available nutrient resources are an emerging cost-effective strategy to address global malnutrition especially in developing countries. This strategy involves supply of micronutrients such as iron and zinc in the staple foods by using conventional plant breeding and biotechnology methods. Unraveling existing variation in crop genetic resources for the natural genetic reservoir articulating nutrient content is utmost important for improving nutritional quality through plant breeding. Iron and zinc have been studied in 180 Indian wheat landraces obtained from National Bureau of Plant Genetic Resources, Delhi and were collected from different states of India. Substantial variations among 180 lines existed for both iron and zinc content. Iron concentration ranged from 32.7 ìg/g to 54.5 ìg/g and zinc concentration from 15.8 ìg/g to 66.3 ìg/g in wheat landraces. Iron and zinc concentration were positively correlated implying the chance for concurrent selection for both the micronutrients. In this study, we have identified six potential landraces namely IC-82198, IC-532790, IC-534886, IC-532310, IC-82377 and IC-79062 having high amount of both Fe and Zn content. Micronutrient-rich genotypes identified in this study opens up the possibilities for the identification of genomic regions or QTLs responsible for mineral uptake and translocation that can be used as donor for developing nutrient enriched varieties.

MARKER ASSISTED PYRAMIDING/STACKING OF ADULT PLANT RUST RESISTANCE GENES FOR DURABLE RESISTANCE AND SUSTAINABLE AGRICULTURE IN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

Wheat is one of the most important cereal crops for food security and rust diseases continually pose a threat to wheat production at national and international level. Resistant cultivars are the economical, most reliable and environmentally safest way to manage the rust diseases. Most of the rust resistance genes are all stage resistance (ASR) and therefore succumb to new variants of the respective pathogen soon after their deployment. Deployment of ASR genes does not often provide durable resistance, whereas adult plant resistance (APR) genes have small to intermediate effects when present alone. Same time, high and durable rust resistance could be achieved by combining the APR genes together. Selection of two or more genes in a single genotype can be difficult using conventional selection system. In such a scenario, phenotype neutral selection based on marker-trait association becomes inevitable. Stacking of adult plant rust resistance (APR) genes, *Lr34/Yr18/Sr57/Pm38/Ltn1, Lr46/Yr29/Sr58/Pm39/Ltn2* and *Lr68* was attempted with recipient parents viz., Agra local and NI5439 using Parula as donor parent by adopting single back cross approach. Transgressive segregants for yield and rust resistance were selected at F_2 generation and forwarded. Presence of the rust resistance genes were detected using molecular markers, *CsLv34* (*Lr34+*), *Xwmc44* (*Lr46+*) and csGs (*Lr68)* in the backcross derivatives. APR genes had been studied extensively and it had pleiotrophic association with stem and stripe rust and powdery mildew resistance, providing resistance not only to leaf rust, but also to stem and stripe rust and powdery mildew. Presently, it is being extensively used in the wheat improvement program in India and worldwide. The use of gene stacks of APR genes that confer resistance to most of the pathotypes of rusts could impart durability and sustainability to the cultivars than single gene deployment.

EFFECT OF MATURITY STAGES OF BOTTLE GOURD (*LAGENARIA SICERARIA MOL.*, STAND L.) ON POWDER SENSORY PROPERTIES.

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Abstract

The investigations were carried out to study the effect of different maturity stages, storage periods and different drying temperatures on drying behavior of shredded bottle gourd samples, to study the changes in the sensory properties of bottle gourd powder during storage for 3 months. The Factorial Completely Randomized Design (FCRD) was used for the purpose of analysis. The bottle gourd fruits were harvested at four different maturity stages i.e. fruits of 8, 13, 18 and 23 days after fruit set, cleaned and physical properties were measured. The samples were shredded and blanched in hot water at 80°C for 3 min. The samples were dried under shed and in mechanical tray drier at 45°C, 55°C, and 65°C. Powder was prepared from dried shreds by using grinder.

During storage study of bottle gourd powder, sensory parameters colour, flavour, texture, taste and overall acceptability were found to be decreasing gradually during storage of powder. In case of colour, texture, taste and overall acceptability, freshly prepared sample of first maturity stage dried under shed was found to be best treatment combination.

EFFECT OF CHICKPEA AND LINSEED INTERCROPPING SYSTEM ON *HELICOVERPA ARMIGERA (HUBNER)* INCIDENCE AND YIELD IN CHICKPEA

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Abstract

The gram pod borer *Helicoverpa armigera (Hubner)* is most important pest of chickpea. Lot of pesticides are uses for control this pest but they not only leaves harmful residues but also effect on non target organisms and environment, pest resurgence and development of resistance to insecticides. Use of intercropping has been found to be not only eco-friendly but provide higher economic return. By adoption of intercropping, problems of incidence of insects and pests are greatly reduced.

Therefore, a field experiment was conducted at Research farm, RARI, Durgapura, during 2015-16 and 2016-17 in randomized Block Design with three replications and eight treatments viz. T_1-Sole chickpea, T_2-Sole linseed, T_3-Chickpea +Linseed (3:1), T_4-Chickpea + Linseed (4:1), T_5-Chickpea + Linseed (5:1), T_6-Chickpea + Linseed (3:2), T_7-Chickpea + Linseed (4:2), T_8-Chickpea + Linseed (5:2) to assess the influence of intercropping on the incidence of *Helicoverpa armigera (Hubner)* and yield of chickpea. The lowest percent pod damage was found in treatment No T-6 (6.12%) and followed by T-7 (6.89%), T-8 (8.22%), T-3 (10.43%), T-4 (12.73%),T-5 (14.03%), and T-1 (22.75%).

PROTEIN RICH FODDER TREES - *LEUCAENA LEUCOCEPHALA*

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Abstract

Subabul (*Leucaena leucocephala* Lam.) tree is a highly nutritious leguminous tree fodder with 27-34 percent protein, rich in carotene and vitamin A. It is a large, evergreen, fast-growing shrub or a small tree. Livestock rearing form an integral part of rural living. Dairy farmers depend on expensive concentrates which reduce their profit to a considerable extent. Of the total cost involved in dairying 70-80% is for feed alone and this can be brought down to 40-50% if good quality forage is made available. Hence, along with cattle rearing farmers should also cultivate quality fodder on farm itself for maintaining animal health and productivity, thereby ensuring sustainable and profitable livestock production. Utilization of protein rich fodder trees has long been recognized to be one of the most effective means of improving both the supply and the quality of forage for

livestock especially during the dry season. Subabul tree is valued as an excellent protein source for cattle fodder, consumed browsed or harvested, mature or immature, green or dry. The nutritive value is equal to or superior to alfalfa. It nourishes the soil by fixing the nitrogen, helps in controlling the pest attack, reduces water requirement and provides fodder for livestock.

AWARENESS AMONG THE RESPONDENTS W.R.T. 'INTEGRATED MURRAH *DEVELOPMENT SCHEME' (IMDS)*

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Abstract

In Indian agrarian economy, the contribution of buffalo in terms of milk, meat and draught power production, is quite considerable. India reigns, globally, in terms of the largest buffalo population, huge buffalo germplasm diversity and the world-renowned buffalo breed 'Murrah'. There is a lack of awareness among the farming community about the quality of Murrah germplasm presently available which needs to be identified through performance-recording; and then preserved and multiplied. Keeping these things in view, the present study was taken up to measure the extent of awareness among 160 each beneficiaries and non-beneficiaries respondents regarding "Integrated Murrah Development Scheme (IMDS) in Haryana. The findings related to awareness (somewhat aware, aware & highly aware categories) depicted that, majority of the beneficiaries (53.75%) and non-beneficiaries (60.00%) were present in the aware category followed by highly aware (46.25%) category of beneficiaries and somewhat aware (40.00%) category in case of non-beneficiaries, respectively and 'Z' test analysis indicated that, there was significant difference between most of the statements regarding awareness about 'Integrated Murrah Development Scheme' (IMDS) at 1 % as well as 5 % levels of significance between beneficiaries and non-beneficiaries, in the locale of the study. The possible reason might be that, beneficiaries' had more extension contacts, better education, high exposure to mass media, and better interaction with the outside world, which made them more aware about the 'Integrated Murrah Development Scheme' (IMDS). Moreover, beneficiaries are more conscious about their Murrah buffaloes. While, non-beneficiaries had less exposure to outside world, low mass media exposures, low extension contacts, and lower education status than the beneficiaries. Such development programmes should be promoted to create awareness among the dairy farmers which leads to improvement of production & reproduction efficiency of dairy animals as well as socio-economic status of the farmers.

EVALUATION OF MAIZE AND GOBHI SARSON BASED INTERCROPPING SYSTEMS FOR HIGHER PRODUCTIVITY UNDER RAINFED SUB-TROPICS OF JAMMU AND KASHMIR

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Abstract

A field experiment was conducted during 2015-16 at research farm of Advanced Centre for Rainfed Agriculture under All India Coordinated Research Project on Dryland Agriculture, SKUAST-Jammu, Rakh Dhiansar to evaluate the most efficient maize and mustard intercropping system in rainfed sub-montane tract of Jammu region. Ten treatments comprising of sole crops (in *kharif*: maize, cowpea, *Sesamum,* groundnut and in *rabi*: gobhi sarson, chickpea, pea, wheat) and their possible intercropping systems with different row ratios were tested during *kharif* and *rabi* seasons. During *kharif*, the highest maize equivalent yield (MEY) was obtained in paired rows of maize with 2 rows of cowpea with corresponding MEY, B:C ratio and land equivalent ratio (LER) values of 2423 kg/ha, 1.63 and 1.32, respectively with the highest rain water use efficiency (RWUE) of 5.86 kg/ha-mm. The lowest MEY value of 891 kg/ha was registered in sole *Sesamum* with RWUE of 2.16 kg/ha-mm. Maximum LER (1.32) was observed under 2 rows of maize + 2 rows of cowpea and minimum LER (0.99) was observed under 2 rows of maize + 2 rows of *Sesamum* among different paired row cropping. During *rabi*, highest value of MEY, B:C ratio and RWUE was obtained in sole wheat with the corresponding values of 1017 kg/ha, 2.22 and 7.1 kg/ha-mm,

respectively and lowest MEY (670 kg/ha-mm) was observed in paired rows of gobhi sarson with 2 rows of pea. However, among the different intercropping systems, highest gobhi sarson equivalent yield (GSEY) was obtained in paired rows of gobhi sarson with 2 rows of wheat with the corresponding value of 856 kg/ha having LER value of 0.96 compared to all other intercropping systems. Therefore, intercropping systems comprising of paired rows of maize with 2 rows of cowpea and paired rows of gobhi sarson with 2 rows of wheat could be a profitable and sustainable proposition under rainfed sub-tropics of Jammu and Kashmir during *kharif* and *rabi* seasons, respectively.

GROUNDNUT DISEASE INCIDENCE UNDER JHANSI DISTRICT OF BUNDELKHUND REGION OF UTTAR PRADESH

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Abstract

Approximately 80% of the world groundnut crop is produced in developing countries where the yields are usually very low. India is the largest producer of groundnut in the world with low average yields 745 kg/ha. The crop is hampered by many diseases in the country which reduced crop yield. A large number of diseases caused by fungi, bacteria, viruses, mycoplasma, nematodes, and parasitic flowering plants have been reported, and with some exceptions, they are widely distributed. All parts of the groundnut plant are susceptible to diseases. More than 55 pathogens including viruses have been reported to affect groundnut under India condition. In this study, two blocks of Jhansi district namely Badagaon and Chirgaon were survey during *kharif* 2018 and each block 12 villages randomly selected and incidence data collected. It was observed that four disease namely early leaf spot (*Cercospora arachidicola*) late leaf spot (*Cercosporidium personatum*) Rust (*Puccinia arachidis*) and Alternaria leaf disease (*Alternaria arachidis* and *A. tenuissima*) reported in the farmer's field with different disease incidence. It was revealed that the maximum mean disease incidence (45% and 35%) was found early leaf spot (*Cercospora arachidicola*) late leaf spot (*Cercosporidium personatum*) respectively in Badagaon village. However, diseases incidence was reported lowest in Chirgaon block, it was 25 and 20% incidence respectively. It was also observed that rust and Alternaria leaf diseases were seen in the both blocks but incidence was in the minor form.

COLLECTION OF INDIGENOUSLY INHERITED GERMPLASM LINES OF MILLET CROPS OF TRIBAL FARMERS OF EASTERN GHATS

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Abstract

Genetic resources have received due attention in the sense of their collection, characterization, conservation, evaluation and utilization in consequence to grave warnings from the scientific community about genetic erosion of total germplasm. The diversity in genetic resources of millets crops is shrinking due to commercialization of agriculture, the area of developmental projects and other related activities. Hence, the biodiversity need to be conserved to ensure its availability for future generations. A SERB Project, New Delhi *viz.,* Collection, evaluation, purification and multiplication of indigenously inherited millets crops of tribal farmers of Eastern Ghats of Telangana & Andhra Pradesh was conducted during 2016-17 & 2017-18 (one year). In which I have collected more than 150 millets germplasm lines by travelling hundreds of kilometers along the Eastern Ghats by climbing hills and reaching the unreached tribal farmers with the help of local government teachers and health department personnel. The collected lines during 2016-17, were sown at College Farm, Agricultural College, Aswaraopet during 2017-18 *kharif*. Duplicate lines were identified and discarded. About 23 lines of different millet crops were isolated, purified and submitted to the NBPGR, New Delhi along their passport data. It is concluded from the SERB project, New Delhi that the more of genetic erosion in millet crops has been identified even at the saved seeds of the tribal farmers who were living on the hills from generations together. The improved varieties of millet crops have also been find place in few hamlets of these tribal farmers. It emphasizes that the identification of hotspots for the natural cultivation of indigenous millets lines owned by the tribal farmers by the concerned organisations working at national and international level. The families of the tribal farmers should be extended economic support so as to allow them to cultivate the same

indigenous millet lines for years to come; so that we can protect and preserve these naturally evolved millets germplasm lines of the Eastern Ghats for the future generations.

ADVERSE EFFECT OF TRANSGENICS THROUGH POLLINATION OR GENE FLOW

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Abstract

The rapid progress of transgenic biotechnology has significantly promoted the development and production of genetically modified (GM) crops. The current area under GM crops in world is 190 million hectares. The extensive global cultivation of GM crops has generated great benefits, which may provide opportunities for solving the problems inherent in world food security, but, it has also aroused considerable biosafety concerns worldwide. Among these, the potential environmental consequences created by possible transgene escape from a GM crop to its non-GM crop counterparts (crop-to-crop) and wild or weedy relatives (crop-to-wild) via gene flow are the most debated biosafety issues internationally. Gene flow indicates the movement of genes or genetic materials from one plant population into another. The creation of the first transgenic organisms during the early 1970s initiated the debate about their risks that continues today. The major concerns of those who oppose GM foods center on the potential danger to the environment and possible health risks to humans. There are a range of predicted possible environmental consequences caused by crop-to-crop and crop-to-wild transgene flow. Through pollen-mediated gene flow, a transgene can move from a GM crop into populations of a wild relative, and persist or disseminate in the wild population through further hybridization and introgression between the GM crop and wild relative and make the wild population more invasive and competitive. Without the consent of society at large, GM crops will fail in market place. While questions remain to be answered about the risk of each proposed trait on a case by case basis, there is little evidence that GM crops poses an inherent risk to food, feed, or the environment. The proper combination of transgene confinement and mitigation strategies will provide an effective management tool for minimizing any environmental consequences created by transgene escape to wild relatives via pollen-mediated gene flow.

INTEGRATION OF INDIGENOUS AND COMMERCIALLY AVAILABLE ENTOMO- PATHOGENS FOR ECO-FRIENDLY MANAGEMENT OF MAJOR PESTS OF CRUCIFEROUS VEGETABLES

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Abstract

Cruciferous vegetables *viz.,* cabbage, cauliflower, knol khol, brocolii etc. are the major component of human diet in India and being eaten as a fresh or after processing. Cabbage butterfly, *Pieris brassicae* (Lepidoptera: Pieridae); Diamond back moth, *Plutella xyllotsella* (Lepidoptera: Plutellidae); tobacco caterpillar, *Spodoptera litura* (Lepidoptera: Noctuidae) and aphid, *Brevicoryne brassicae* (Hemiptera: Aphididae) are the important pests of cruciferous vegetables in India and cause huge losses. Chemical pesticides are usually recommended to reduce their damage. Besides cost, protective measures by using these chemicals can cause undesirable side effects to human health. Since many brassicaceous crops are being eaten as raw or uncooked form, it is essential to develop management practices based on bio-pesticides, so that use of chemical pesticides and related health hazards can be minimized. Therefore, field experiments were conducted during 2016-17 at entomology farm of ICAR Research Complex for NEH region, Umiam, Meghalaya. Different indigenous and commercially available entomopathogens were evaluated against major pests of cole crops under field conditions. Alternate foliar spray of entomopathogenic (EP) fungi, *Nomuraea riley* (1×10^8 cfu/ml) @ 5ml/l and *Lecanicillium longipsorum* (1×10^8 cfu/ml) @5ml/l at 20 days interval was found promising against *Spodoptera litura* and *Brevicoryne brassicae*, respectively during rainy season in knol-khol; which reduced 67.33% and 71.67% plant damage, respectively over control. In cabbage, two foliar sprays of EP bacteria, *Bacillus thurengiensis* (Lipel 8WP) @ 2g/l at 15 days interval were found reducing 79.33% and 48.67%

damage of *Pieris brassicae* and *Plutella xylostella*, respectively during winter. Therefore, these entomopathogen based bio-pesticides have tremendous potential for eco-friendly management of cruciferous pests.

DEVELOPMENT AND NUTRITIONAL EVALUATION OF LITTLE MILLET BASED *IDLI* AND *DOSA*

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Abstract

Minor millets grains are not only nutritious but they also play an important role in controlling the various nutritional disorders/diseases viz., constipation, diabetes, cardiovascular etc. In view of this, present study was planned to prepare the some fermented products based on little millet (*Panicum sumatrense*) a common minor millet of Madhya Pradesh.*Kutki* (little millet), grains were dehusked and debranned either by traditional mill by commercial flour mill which separate two fractions, one husk-bran (22.1%) and other kutki rice (78.4%). This kutki rice, two common traditional products were made in different ratio (4:1, 2:1, 1:1 and 1:2) with black gram dhal (*idli* and *dosa*) after mixing with other ingredients and proper processing. Subsequently, they were subjected to sensory and nutritional evaluation. The results showed that the average values for all the sensory quality characteristics were rated higher for the product made in the ratio of 2:1 for *idli* and *dosa*. The various nutrient contents were ranged from 8.8 to 9.9% protein, 1.9 to 3.7% fat and 3.8 to 4.7 fiber with an average value of total energy 245 kcal. Beside having nutritious property, these fermented products may also be beneficial in the above diseases/disorders due to their various nutritional characteristics such as low in fat, higher in high biological protein and high proportion of carbohydrates in the form of non-starchy polysaccharides and fiber. Hence, it was concluded that the instant flours for making these products can be made available, recommended and popularized as diabetic/therapeutic or health food at house-hold and/or commercial level.

DESCRIPTION AND MANAGEMENT STRATEGIES OF IMPORTANT PEST AND DISEASES OF APPLE (*MALUS DOMESTICA)* IN UTTARAKHAND

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Abstract

Apple (*Malus domestica*, Family – Rosaceae) is one of the earliest horticultural crops to be cultivated on earth. Highest production of apple comes from the USA and China. In 2013, among the top 10 apple producing countries India ranked 3rd in production; however, its contribution to the world apple production is only 3.8% as against 47.6% by China. In India, Apple is cultivated mainly in Kashmir, Himachal Pradesh and Uttarakhand. Jammu and Kashmir possesses 70% of the apple production while Himachal Pradesh, Uttarakhand, Arunachal Pradesh respectively covers 21.5, 6.4 and 1.6% of the share.In Uttarakhand, the entire hill region comes under temperate agro-ecological conditions and hence, considered congenial for apple cultivation. Here, apple is grown in 10 out of total 13 districts, majorly in Uttarkashi, Almora, Chamoli, Nainital and Dehradun districts and total area under apple cultivation is 33.76 thousand hectares, which produces about 61.94 thousand metric ton apple production. However, the production and quality of apple is poor as compared to that of the developed countries because of several factors including insect and diseases. Insect pests found in apple orchards can be classified intotwo groups depending upon plant parts which they attack. Direct pests are those insects that feedon apple fruits while indirect pests are those that attack leaves, trunk and other parts of the tree. Major pest in apple of national importance areSan-Jose-scale (*Quadraspidiotusperniciosus*; Hemiptera: Diaspididae), Woolly apple aphid (*Eriosomalanigerum;* Hemiptera: Aphididae), Root borer (*Dorystheneshugelli;* Coleoptera: Cerambycidae), Apple stem borer (*Aprionacinereal;* Coleoptera: Cerambycidae), Indian gypsy moth (*Lymantria obfuscate;* Lepidoptera: Lymantridae), Spider mites (*Tetranychusurticae;* Acarina: Tetranychidae), European red mite (*Panonychusulmi;* Acarina : *Tetranychidae*). Planting of resistant rootstocks, suitable intercultural operations and ground application of phorate, spraying with chloropyriphos, fenitrothion,dimethoate, oxydemetonmethyletc. have been found to be effective in controlling the pests. Major diseases of

apple which hold national importance are Apple scab (*Venturia inaequalis*) Marssonina leaf blotch (*Marssonina coronaria*), Black rot and canker (*Botryosphaeria obtuse*), Collar rot (*Phytophthora cactorum*), Powdery mildew (*Podosphaeraleuco tricha*), Sooty blotch and fly speck (*Gloeodespomigena* and *Schizothyriumpomi*), Apple mosaic and other virus diseases (*Apple mosaic virus* and *Apple chlorotic leaf spot virus*). Plants resistant to the diseases should be used for cultivation. The infected plant parts need to be destroyed. Application of copper oxychloride, carbendazim, mancozeb, chlorthalonil and difenaconazole etc. have been found to be effective in controlling the diseases.Intensive agricultural practices relying heavily on chemical pesticides are a major cause of wide spread ecological imbalances resulting in serious problems of insecticide resistance, pest resurgence and pesticide residues. Integrated Pest Management (IPM) is a globally accepted strategy for promoting sustainable agriculture. During last century, IPM relied substantially on economic threshold level (ETL) which has now been consciously shifted to more ecologically sustainable Agro-Eco System Analysis (AESA) based IPM strategies. The AESA based IPM focuses on the relationship among various components of an agroecosystem with special focus on pest-defender dynamics, innate abilities of plant to compensate for the damages caused by the pests and the influence of abiotic factors on pest build up. The ecological approach stresses the need for relying on bio intensive strategies prior to use of chemical pesticides.

EARLY MATURING, RED SEEDED AND HIGH YIELDING FINGER MILLET VARIETY 'GN-8' FOR CULTIVATION IN GUJARAT

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Abstract

The proposed culture, WN-585 is early maturing and have been developed through selection from local germplasm collected from the Dangs district. WN-585 was tested under various categories of trials at Waghai, Varanasi and Dahod centers in 12 different state MLT trials and under IVT trial (during 2017-18) at 12 AICRP small millets locations across seven states at national level. The early maturing culture WN-585 (3065 kg/ha) performed well with 21.3 % and 13.7 % grain yield superiority over national check 'VL-149' and 'VL-352', respectively in Gujarat. At national level, it showed 20.2 % grain yield improvement over national check 'VL-352'. The proposed culture was found to have good nutritional properties particularly high calcium, iron, phosphorous and also good amount of protein, fibre and minerals. With respect to pest and diseases, it was found superior to checks and moderately resistant for the same. Considering the increasing demand of early maturating as well as for late cultivations *ie.,* after rice plantation the culture WN-585 (GN-8) with early maturing, high yield potential culture, desirable grain quality and moderately resistant to foot rot and blast disease. It is proposed to release this culture for early maturing Nagli growing dry lands, hill and tribal areas of South and Middle Gujarat.

RELATIONSHIP BETWEEN ATTITUDE OF THE FARMERS TOWARD MIX FARMING AND THEIR SOCIO-ECONOMIC AND SITUATIONAL PROFILE OF THE FARMERS OF BHAL REGION

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Abstract

The study was conducted to know the attitude of the farmers of Bhal region towards mix farming and its economics. Total 125 farmers of Ahmedabad district from five talukas were interviewed with well-prepared interviewed schedule. Majority of farmers belong to middle age group having primary to secondary level of education with large size of land holding and having more than fifteen years of experience in farming with 3 to 6 animal and without membership of any organization and having high to very high level of information source utilized with low to very low level of extension contact and had medium level of achievement motivation. Farmers have favorable to neutral attitude towards mix farming. Out of 12 independent variables, the variables viz., age (0.3224**), farming experience (0.2108*), social participation (0.3115**), source of information utilized (0.3431**), extension contact (0.2751**) and achievement motivation (0.3399**) exerted positive and significant influence for determination of attitude towards mix farming. The rest like education, land holding, total annual income, annual income from animal husbandry, annual income from agriculture, herd size and social participation those six variables had no any influence in shapping the attitude of the farmers towards mix farming.

RESPONSE OF LINSEED GENOTYPES TO DIFFERENT LEVELS OF FERTILIZER

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Abstract

Different promising genotypes of linseed across the country are tested by the Project Coordination Unit (Linseed), Kanpur under Advanced Varietal Trial to check their suitability and yielding potential at different parts of the country, and to determine their response to nutrient application. Hence four different were tested at Nagpur center to access their yielding potential and optimum nutrient requirement under AVT during rabi season 2017-18. The experimental design was FRBD with three replications in which Factor A consist of four linseed genotypes i.e. RLC156, T397, NDL 2014-1 and Padmini whereas Factor B consist of three fertilizer levels i.e. 50, 100 and 150% RDF i.e. 60:30:0 kg NPK ha^{-1}. The results recorded reveals that the nutrient levels were failed to influence the plant stand, seed yield, NMR and net monetary returns per rupee invested significantly. Except for entry RLC156, zonal check Padmini was found to be significantly superior over remaining verities for recording higher plant stand, seed yield (941 kg/ha), NMR (Rs.37345/ha) and net returns per rupee invested (2.61). Entry RLC156 behaves statistically similar to zonal check Padmini for all these said parameters. Although, entry RLC156 has not recorded any yield advantage over zonal check Padmini, but being statistically superior over national check T397 it has recorded 14.2% higher seed yield over it. Another test entry NDL2014-1 was found to be significantly inferior among all varieties in respect of all growth and yield parameters.

ENHANCING THE PRODUCTIVITY OF CHICKPEA THROUGH CFLD'S IN SAWAI MADHOPUR OF RAJASTHAN

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Abstract

Chickpea is one of the most important pulse crop and occupies a major position among pulses in Rajasthan state. Indian government imports large quantity of pulses to fulfill domestic requirement of pulses. In this regard, to sustain this production and consumption system, the Department of Agriculture, Cooperation and Farmers Welfare had sanctioned the project "Cluster Frontline Demonstrations on Rabi Pulses 2015-16, 2016-17 and 2017-18" to ICAR-ATARI, Jodhpur through National Food Security Mission. This project was implemented by Krishi Vigyan Kendra, Sawai Madhopur with main objective to boost the production and productivity of pulses through CFLDs with latest and specific technologies. Frontline demonstration (FLDs) is one of the most important and powerful tools for transfer of technology. Keeping in view of an effective extension approach, FLDs on gram crop were conducted by KVK, Sawai Madhopur, Rajasthan was assessed. The performance of frontline demonstrations, the extent of adoption level, the extent of satisfaction level of respondent farmers over extension services and constraints in adoption of gram production technologies that perceived by the respondents was measured in the study. Cluster Frontline demonstrations on chickpea were conducted by using variety GNG 1581, GNG 1958 and RSG 44 in an area of 96 ha at 240 farmer's field in Sawai Madhopur block. The need based inputs provided to farmers per hectare were high yielding varieties GNG-1581, GNG 1958 and RSG 44 seed @ 80 kg, seed treatment with carbandazim 50% @ 2.0 g/ kg seed, Rhizobium spp. , soil treatment with trichoderma viride @ 2.5 kg/ha mixed with 20 kg FYM, recommended doses of fertilizers as per recommended of practices(PoP) and need based plant protection measures. Results concluded that average highest yield 24.05 q/ha found in demonstration plot followed by 16.66 q/ha in control plot. The same trend found in case of CFLDs gross and net monetary returns, was Rs. 92282/- and Rs. 67819/- ha and for control Rs. 73575/- and Rs. 49498/-ha, respectively. Benefit cost ratio for demonstration and control was 3.69, 3.46 and 3.05, respectively. This improvement in yield might be due to the application of seed treatment, use of fertilizers, timely weed and water management and integrated pest management practices. The findings of the study also revealed that they had increase in adoption level ranging from 22.45 percent of storage and marketing to 51.38 percent of irrigation scheduling after conducting the FLD programmes. The majority of the respondent farmers expressed medium to the high level of satisfaction for extension services

and performance of technology under demonstrations. The *Helicoverpa armigera* and *Fusarium* wilt, non-availability of improved and quality seed, crop damage by bluebell, non-availability of reliable insecticide/fungicide and lack of knowledge of gram production technologies were most important constraints in adoption of gram production as perceived by the respondents. It can be concluded that the FLD is playing one of the important role in motivating the farmers for adoption of production technology resulting in increasing their yield and profit. 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.

ANALYSIS FUNCTIONAL AND PROXIMATE COMPOSITION OF TAMARIND SEED (*TAMARINDUS INDICA*)

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Abstract

Legume seeds are valuable source of protein, oil, carbohydrates, minerals and vitamins. They are playing an important role in human nutrition mainly in developing countries. In the present study, analysis the functional and nutritional properties of tamarind seed (*tamarindus indica*) was investigated. For this raw seeds were collected for the study different processing methods such as roasting, dehulling, grinding were used. All the processed seeds were dried and powdered before chemical analysis. Results depicts that functional analysis of tamarind shows water absorption capacity 20.0 percent and oil absorption capacity 16 percent shows and gelatinization concentration was 10 percent. Proximate composition of tamarind seed shows that moisture, protein (g), fat (g), fiber (g), ash (g), carbohydrate (g) and energy (kcal) was 8.4±0.25 (g), 20.5±1.25 (g), 9.5±0.35 (g), 8.6±215 (g), 3.2±0.76 (g), 57.8±1.92 (g) and 364.0±4.89kcal respectively.

AGROMETEROLOGICAL ADVISORY SERVICES IN CHANGING CLIMATE

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Abstract

Climate change and food security are currently key challenges in India. Climate plays a critical role in the lives and livelihoods of people as well as contributing to socio-economic development as a whole. As per a recent report of the IPCC (2013), there has been an increase in temperature of 0.89°C over the period 1901–2012, that has been mainly caused by anthropogenic activities. The newer findings indicate that warming is more pronounced than expected. As per consolidated analysis by the World Meteorological Organization (WMO), globally averaged temperature in 2016 was about 1.1°C higher than the pre-industrial period. It was approximately 0.83° C above the long-term average (14°C) of the WMO 1961-1990 reference period, and about 0.07°C warmer than the previous record set in 2015. India has also shown warming trends, as analysis of data from the India Meteorological Department of Climate Research and Services (CRS), Pune indicates that the annual mean surface temperature of the country has increased by 0.65° C during 1901 to 2016. The year 2016 has been the warmest on record since 1901.Changing climate and variability has always troubled across India: Change the onset of monsoon, shift production seasons, onset of sowing rains, quantum of rainfall and total, spatial and emporal distribution of number of rainy days. Deviate climatic events, frequency of heavy rainfall events, occurrence of floods in areas like the Indo-Gangetic plains. The withdrawal of monsoon and its erratic distribution results in break-in-period, dry spell, etc. The water stress of various intensities.Dry spell events and occurrence of droughts in the season. Vary temperature during *Rabi* season.Impact in agro-climatic zones in addition to district level.Shift pest and disease patterns.

Weather-based Agro Met advisory services to the farmer have the potential to reduce the weather related losses to a large extent by adopting suitable measures of dissemination to the farmer and planner's community. The farmers can use these advisories for sowing and transplantation of crops, fertilizer application, predictions regarding pests and diseases and measures to control them, weeding/thinning, irrigation (quantities and timing), and harvest of crops.Weather and climate services, particularly under extreme weather conditions, can be strengthened through awareness programmes for the farming communities.

Climate Smart Agriculture *viz.* technologies, methods and methodologies need to be used for thesustainable increase in

productivity, support farmers adaptation to climate change, and reduce levels of greenhouse gasses. Modern ICT tools should be incorporated to facilitate decisions; systems, monitoring, modelling and prediction to support the farmers for enhancing their adaptive capacity to combat climate risks.

APPLICATION OF NANO-ZINC AND MAGNESIUM PARTICLE TO SEEDS THROUGH POLYMER COATING

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Abstract

Nano particles were applied to seed through thin layer of polymer coating. Doses applied were 100mg, 150 mg and 200mg nano zinc or magnesium per kg seed. Seed germination testing in laboratory as well as soils in pots was studied. Seed germination was improved from 68% in control to 78% in case of nano magnesium treatment and up to 78% in nano zinc. Nano rock phosphate at the rate of 100, 200, 300, 400, 500, 600 and 700mg per kg seeds were applied through thin layer polymer coating. Nano Zinc and Nano Magnesium was applied to seed at the rate of 100, 150 and 200 mg per kg seed and Nano rock phosphate was applied @ 100, 200, 300, 400, 500, 600 and 700mg per kg through polymer coating. The effect of nano zinc and magnesium was significant to improve germination at the tune of 12% over control. The increase in seedling vigour due to nano particles was about 20%. There was an yield increase of 17% due to nano magnesium @ 200mg/kg seed. The effect of zinc sulphate and magnesium sulphate to increase seedling vigour and seed yield signifies the role of minerals and sulphur for seed germination and seedling growth. The effect of nano rock phosphate on seed germination or seed yield was not significant. The effect of zinc sulphate and magnesium sulphate to increase seedling vigour and seed yield signifies the role of minerals and sulphur for seed germination and seedling growth.

MAXIMIZATION OF SEED YIELD AND QUALITY BY APPLICATION OF ZINC AND FUNGICIDAL SEED TREATMENT IN INDIAN MUSTARD (*BRASSICA JUNCEA* (L.) CZERN AND COSS.

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Abstract

A field experiment was conducted in Split Plot Design and seed quality parameters were assessed by using Complete Randomized Design with four replication during two subsequent years *i.e*. 2012-13 and 2013-14 at New Dairy Farm, Kalyanpur and Seed Testing Laboratory of Department of Seed Science and Technology, C. S. Azad University of Agriculture and Technology, Kanpur, respectively, with mustard variety Urvashi. Five doses of Zinc *i.e*. 0.0, 2.5, 5.0, 7.5, 10.0 kg ha^{-1} and Fungicidal Seed Treatment *i.e*. Control, Ridomil @ 6 g/kg of seed and Carbendazim @ 2 g/kg of seed were applied. Observations were recorded on morpho-physiological characters, seed yield and yield attributing characters as well as on seed quality parameters. Significantly best performance was recorded in 7.5 kg Zn ha^{-1} and fungicidal seed treatment of Carbendazim @ 2 g/kg of seed during both years with respect to plant height (165.97 and 155.47 cm), days to 50% flowering (60.13 and 62.95), chlorophyll intensity (45.57 and 44.88 %), number of primary branches $plant^{-1}$ (6.00 and 5.58), number of secondary branches $plant^{-1}$ (22.58 and 19.98) number of siliqua $plant^{-1}$ (443.29 and 421.80), number of seed siliqua (15.00 and 14.18), raw seed yield $plot^{-1}$ (2.65 and 2.53 kg), raw seed yield ha^{-1} (29.41 and 28.10q), graded seed yield $plot^{-1}$ (2.60 and 2.47 kg), graded seed yield $plot^{-1}$ (28.90 and 27.46q), seed recovery (98.09 and 97.72%) , benefit : cost ratio (2.13 and 2.10), 1000 seed weight (6.34 and 6.05g), standard germination (97.87 and 97.05%) , dry weight of seedling (48.29 & 47.38 mg), seedling vigour index (4725.17 and 4594.63) and oil content (39.82 and 39.47 %) as well as 7.5kg Zn ha^{-1} also showed significant effect on canopy temperature depression (4.84 ^{0}C). The interaction combination *i.e.* 7.5 kg Zn ha^{-1} x Carbendazim @ 2g kg^{-1} of seed showed significant better values for plant height (168.28cm), days to 50% flowering (59.25), number of siliquae $plant^{-1}$ (458.00), 1000 seed weight (6.46 g), standard germination (98.49 %), dry weight of seedling (50.38mg) and seedling vigour index (4961.88). Thus, i is concluded that application of 7.5 kg Zn ha^{-1} and Carbendazim @ 2g kg^{-1} of seed treatment before sowing either singly or in combination of both have been found most appropriate and economical for achieving the maximum seed yield, quality with best results of morpho-physiological characters of mustard variety Urvashi.

ANTI-PROLIFERATIVE AND ANTI-HYPERGLYCEMIC ACTIVITY OF *TINOSPORA CORDIFOLIA* STEMS EXTRACT ON HELA CELL LINE

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Abstract

The present investigation was carried out to evaluate the anti-hyperglycemic effect and anti-proliferative activity of 50% hydroethanolic extract of *Tinospora cordifolia* stem (HETC) on HeLa cell line. In this study, HeLa cells treated with HETC showed a reduction in glucose intake with the passage of time. In MTT based cell cytotoxicity assay, doxorubicin produced a dose dependent decrease in cell viability to approximately 2% at 100 µg/ml where as HETC showed 18% cell viability at the same concentration. IC_{50} value of doxorubicin was found to be 57.65 µg/ml at 24 hours and IC_{50} values of HETC was found to be 66.38 µg/ml at 24 hours. This reduction in cell viability was also observed by formation of vacuoles in cells and reduced cell growth 24 hours post treatment. Thus, reduction in cellular proliferation and glucose consumption by HETC may lead to the conclusion that HETC can be effective in reducing growth of cancerous cells.

POST HARVEST MANAGEMENT OF GUAVA CV. SARDAR BY ENHANCING SHELF-LIFE THROUGH THE APPLICATION OF DIFFERENT NUTRIENTS

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Abstract

Present investigation was carried out at Horticulture Research Centre, Patharchatta and Department of Horticulture, G.B. Pant University of Agriculture and Technology, Pantnagar to find out effect of pre-harvest nutrients sprays of calcium, boron, zinc on shelf life of guava cv. Sardar. Two foliar sprays of each nutrient concentration were done in the month of September and October, respectively.After harvesting in winter season physico-chemical attributes and organoleptic evaluations were carried out at the day of harvest and at 3 days interval during 9 days of storage. The minimum percentage physiological weight loss and minimum percent volume loss were found in 1 per cent calcium nitrate and maximum were found in control. The organoleptic evaluation was found highest in 1 per cent calcium nitrate followed by 1.5 per cent calcium nitrate at the day of harvest and also at 9th day after harvest, in comparison to other treatments including control. In all the treatments including control, in general, organoleptic rating was decreased with the increase in storage period. Calcium nitrate (1%) resulted maximum shelf-life of the fruits over all other treatments including control.

PERFORMANCE OF IMPROVED VARIETY OF ONION AT FARMER'S FIELD IN DISTRICT GONDA, UTTAR PRADESH

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Abstract

A field experiment was conducted by Krishi Vigyan Kendra, Gonda (U.P.) at the farmer's field in Gonda district during rabi season 2016-17. There were fifteen farmers assigned to cultivate the onion variety Agri found Light Red. The plot size was maintained 800 sqm/trail. All treatments were replicated three times in randomized block design. The observation was recorded on average diameter of bulb (cm), and yield (q/ha), net income (Rs/ha) and B: C ratio. The results showed significant variation in average diameter of bulb (cm) and yield (q/ha) among all the treatments. The highest average diameter of bulb (4.56 cm), yield (252.55 q/ha), net income (Rs.163511/ha) and B: C ratio (2.94) was recorded in F_9 followed by F_{13}. The

lowest average diameter of bulb (3.75 cm), yield (229.76 q/ha), net income (Rs. 146200/ha) and B:C ratio (2.79) was recorded in F_{14} followed by F_5.

A STUDY ON CREDIT UTILIZATION PATTERN OF AGRICULTURAL LOAN BORROWERS THROUGH COMMERCIAL BANKS

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Abstract

Agriculture is one of the predominant pillars of the Indian economy. To meet the requirements of the growing population and rapidly developing economy, agriculture has to grow fast and get modernized. This requires the use of high pay off inputs. Adoption of high yielding varieties requires large quantities of fertilizers, plant-protection chemicals, modernized equipments, and machineries, which in turn needs huge investment. Though agriculture provides employment to about three-fourths of the working population and contributes the major share of the national income, yet, in India, it is more a way of life than a pure business. As Cultivation becomes uneconomic, the cultivator is forced into a hand-to-mouth existence, which, in turn, presses him to borrow either for consumption or for investment in agriculture. Individual tend to use different credit utilization pattern for obtaining the technology. For accepting any innovation by the farmers in varying socio-personal and farm situation, different types of credit utilization pattern are required. Thus by keeping this view the study was conducted in purposively selected Bundi district of Rajasthan. Total of 500 agricultural loan borrowers were formed the sample for the study. The primary data were collected through personal interview method with the help of pre-tested interview schedule, which was prepared on the basis of objectives of investigation and variables. The statistical tests and procedures were used for analyzing the data with the help of statistical tools like- mean, S.D., percentage, and Karl Pearson's coefficient of correlation, multiple correlation and regression analysis. We found that that 47.20 per cent of borrowers had used their credit only for Agricultural productive purpose. It was observed that correlation coefficients in respect of social participation, sources of information, Cosmo-politeness, scientific orientation and risk preference were found positive and highly significant with credit utilization pattern of farmers. Co-efficient of determination value of 0.6112 with highly significant 'F' value revealed the significance of regression equation in the prediction of credit utilization of farmers. Out of sixteen traits viz., annual income, scientific orientation and risk preference were found positive and highly significant relationship with credit utilization pattern of farmers. Crop raze due to natural hazards as major constraints for effective credit utilization pattern by borrowers and Curb less financing, effective crop insurance and procedure of loaning should be more sophisticated were the main suggestion offered by borrowers for effective credit utilization pattern of the borrowers.

NTEGRATED FARMING SYSTEM FOR RAISING FARMERS PROFITABILITY

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Abstract

Reduction in cost of production is urgency of intellect to discuss and finds a solution, farming system approaches to use different enterprises at one place and optimizing the available limited resource to get higher benefits. In fact market input can reduced from 70%-80% to only 20-30%. Ifs model is beneficial for farmer's family and filling the need of them. Techniques of Farming system is powerful tool to manage natural and human resources in developing country like India. This technology addressing various problems of small and marginal farmers and aiming to increase employment and income from on small-holdings by integrating various farm enterprises and recycling of crop residues and by-products within the firm itself. The management of cropping is operated by farmer's family itself on small and fragmented land which creates problems in mechanization hence total production decreases. Synergy of technological, institutional, biophysical, and socio-economic condition lead to improve system of farming temporally which helps in enhancement of productivity and profitability in farming system making available quality diet. The advantage of advance agriculture is utilized by small group of large and medium category of the farmers who were rich of resources. Almost 84% farmers are marginal and small in India. The soil,

water, climate, marketing, labor, transport and local demands of people are the main criteria to select the farming systems as example in western plain zone of Uttar Pradesh the irrigation facilities are adequate, hence cultivation of sugarcane is common for farmers other than rice, maize, wheat. The second most preferable crop are pulses like pigeon pea, urd bean and moong bean. However, the legume crops like *lobia*, and *dhaincha* is used as green manure and fodder. fruit crop like guava, mango, jackfruit, *jamun* etc. are important parts of integrated farming system. IFS model also includes vegetable crop like cauliflower, okra, french bean cabbage, tuber crops, floriculture, medicinal, aromatic and forest plants (used for timber /fuel/ fodder), grasses and fodder crops.

EFFECT ON SENSORY PROPERTIES OF SANDESH FORTIFIED WITH WHEY PROTEIN CONCENTRATE

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Abstract

The main objective of present investigation was to study the effect of different levels of *WPC* on sensory properties of sandesh. During the study cow milk sandesh fortified with *WPC*was analyzed for sensory properties such as colour and appearance, body and texture, flavour, taste and overall acceptability. Sandesh was prepared by using different levels of *WPC* (0, 5, 10 and 15 percent with constant sugar level i.e 30%). The data were statistically analysed by using Completely Randomized Design (CRD).The sandesh prepared by adding 10% (*WPC* showed highest overall acceptability sensory score 8.27. The sensory quality of sandeshprepared by addition of 10% *WPC* having score forcolour and appearance 8.38, body and texture 8.46,flavour 8.03, taste 8.20 and overall acceptability**.**

GENETIC EVALUATION OF VEGETABLE TYPE FRENCH BEAN (*PHASEOLUS VULGARIS* L.) CULTIVARS FOR POD YIELD AND QUALITY TRAITS UNDER HILLY REGION OF GUJARAT

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Abstract

Genetic analysis by using path coefficient and correlation studies of nine released bushy type cultivars (Arka Anoop, Akra Komal, Arka Arjun, Arka Sharath, Arka Suvidha, Pant Anupama, VL Beans-2, Phule Surekha and Kashi Sampan) of French bean (*Phaseolus vulgaris* L.), a high valued vegetable genotypes was studied by using variability, correlation and path coefficient analysis to find out the variation, association among characters and to measure the direct and indirect contribution of twelve characters on fresh pod yield per plant. Genotypic and phenotypic coefficient of variation were of high magnitude for plant height, 100 green pod weight, 100 green seed weight, days to 50 % flowering, pod length, pod width as well as for number of primary branches per plant. The estimate of high heritability (bs) accompanied with high-expected genetic advance for green pod weight per plant and days to 50 % flowering indicating the presence of additive gene action in the expression of these characters which indicates that such traits can be improved by direct selection. The genotypic correlation studies of pod length (0.2266), pod width (0.1127), number of seeds per pod (0.0026), 100-green pod weight (0.0383), 100-green seed weight (0.3583), pod thickness (0.4283) and seed size (0.2260) indicated that green pod yield per plant exhibited stable positive association with traits expect days to 50 % flowering (-0.1917), number of primary branches (-0.0479) and plant height (-0.0342). While the phenotypic correlation revealed that, days to 50 % flowering (-0.1731), number of primary branches (-0.0358) and days to maturity (-0.0387) were negatively correlated and the rest of all characters were positively correlated with green pod yield per plant. The direct effects of path coefficient analysis revealed that the green pod yield per plant had positive and was significant with days to 50 % flowering (0.0588), pod width (0.9276), pod length (0.4526), number of seeds per pod (0.0062), 100 green pod weight (0.0652), 100 green seed weight (0.2128), pod thickness (0.3972), seed size (0.3709) and the rest of the effects of few characters were negative for number of primary branches (-0.0246) and days to maturity (-0.0068). Moreover, it was noticed that high indirect contribution was contributed through green pod yield per pod

with most of the yield contributing traits. Hence, the traits *viz.*, 100 green pod weight, days to 50 % flowering, number of seeds per pod and 100 green seed weight should be given more consideration while deciding about selection criteria for vegetable type genotypes in French beans.

EUCALYPTUS-BASED AGROFORESTRY SYSTEM UNDER SEMI-ARID CONDITION IN NORTH-WESTERN INDIA : AN ECONOMIC ANALYSIS

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Abstract

The compact block with smaller spacing currently used for Eucalyptus plantations in the Northern India does not permit economical intercropping from succeeding year. This discourages the small landholders who need regular income from taking up Eucalyptus plantations and benefiting from the expanding market for pulpwood & plywood. Therefore, Eucalyptus planted in three spacing geometry of compact block (3×3), wider (6×1.5m) and paired row (17×1×1m) was compared with sole Eucalyptus stands and sole agriculture cropping system at a constant density of 999 trees ha^{-1} . In experiment, cropping seasons of Dhainchya *i.e. Sesbania aculeata* (*Kharif*) and *Hordeum vulgare* (Barley) *rabi* were intercropped in three spacing geometry of Eucalyptus (till the harvesting of trees) and also compared with mono cropping up to eight years of plantation. The standard package of practices developed by CCS Haryana Agricultural University, Hisar (India) was followed to cultivate annual crops. The growth and yield parameters of annual crops and trees were recorded for every year. The economic analysis indicators namely Net present worth (NPW), Benefit : Cost (B:C) ratio and Internal rate of return (IRR) was calculated on the basis of input-out data from the different agroforestry systems. Yield of agricultural crops is significantly reduced in different spacing geometry over control and, it reduced from 15% in first year and 70% in eighth year of plantation. The results showed that 17m×1m×1m spacing of Eucalyptus registered the highest NPW @ 12 percent discounting of INR 185336 followed by spacing of 6×1.5m (Rs.140975). The B:C ratio of these agroforestry system was recorded maximum in wider spacing (17m×1m×1m) and ranging from 1:1.57 and followed by 1:1.44 (6m×1.5m), 1:1.25 (sole Eucalyptus) and 1:1.2 (sole agril. crops). The all the agroforestry system had an IRR ranging from 15 to 32 percent. Therefore, on the basis of economic analysis, the study conclude that the Eucalyptus based agroforestry intercropped with *S. aculeata* and *H. vulgare* cropping system performed most efficient in 17×1×1m as compared to other eucalyptus spacing and sole cropping of Eucalyptus and crops.

THE ROLE OF CONSERVATION AGRICULTURE IN SUSTAINABLE AGRICULTURE PRODUCTION

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Abstract

Conservation agriculture (CA) is a sustainable agriculture production system comprising a set of farming practices adapted to the requirements of crop and local conditions of each region. Whose forming and soil management techniques protect the soil from erosion and degradation, improve its quality and biodiversity and contribute to the preservation of the natural resources, water and air, while optimizing yields.

Worldwide, conservation agriculture plays a vital role in sustainable agricultural production. Even after realizing the full potential of irrigation, a major part of the farming areas in most of the countries will remain rainfed. Land holdings of poor, small and marginal farmers are mostly dependent upon rainfall. Rainfed areas have, assumed great importance for adequate and equitable food and livelihood security of the increasing population of the country like India. Land degradation is another threat to our food and environmental security. Almost 150 million hectare land is degraded due to erosion, water-logging and salinization. The pace of soil erosion accelerates withincreasing slope percentage. Tillage practice in modern agriculture of developed countries had most concern to sustain production in conservation of natural resources. Recycling of crop residues, growing crops of high volume biomass, change in cropping

pattern, agro-forestry, Silviculture are the some of the modules in CA. Annually 400 m ha m water is available through rainfall, out ofwhich 75 m ha m water lossed in erosion and courtly facing problem for drinking water, Industrial use and very limited water (30%) is available for irrigation. Harvesting of water in-situ and collecting through various mechanical measures and use of it for at least one protective irrigation during entire life spell needs at most attention in CA. Crop management in changing weather and efficient utilization of bio-diversity to develop ideal plant genotypes for biotic and abiotic stress tolerance is another challenge in CA. India is a rich country for natural resources like soil, water, climate and plant diversity. Climate, soil, water and energy are key inputs in agriculture production. CA is an approach to managing agro-ecosystem for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment through the applicating of three CA principles-Continuous minimum mechanical soil disturbance, Maintains of permanent soil cover, Crop system diversity, Crop rotations. CA principals are universally applicable to all agriculture land scapes and land uses with locally adopted practices. CA enhances biodiversity and natural biological process.

HYBRID NAPIER-A BETTER OPTION FOR HIGH YIELD POTENTIAL OF GREEN FODDER

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Abstract

The fodder production in the country is not sufficient to meet the requirements of the growing livestock population and also the forages offered to animal are mostly of poor quality. At present, the country faces a net deficit of 63.5 % green fodder, 23.5 % dry crop residues and 64 % feeds. Feed and fodder are one of the most important contributing factors for the growth of livestock sector. Fodder production and its utilization depend on the cropping pattern, climate, social-economic conditions and type of livestock. The cattle and buffaloes are normally fed on fodder available from cultivated areas, supplemented to a small extent by harvested grasses and top feeds. The three major sources of fodder supply are crop residues, cultivated fodder and fodder from common property resources like forests, permanent pastures and grazing lands. The available forages are poor in quality, being deficient in available energy, protein and minerals. Among the *Kharif* forages crops *like* Hybrid Napier, Para grass (grasses), sorghum, maize and cowpea have wide amplitude. However, during Rabi, the choice is limited. Green forages become available in plenty during rainy season and become scarce after rainy season, which affects the health and productivity of animals. Hybrid Napier is best alternative to supply adequate fodder for the animals round the year because of its perennial nature. It provides sustained fodder yields for four to five years thus save frequent expenses on repeated tillage and sowing operations. Hybrid Napier is resourceful forage grass due to its perennial nature, high yielding ability, nutritional quality, palatability, suitability for silage making and low oxalate content than any other grasses. The excess green fodder yield of hybrid Napier can be preserved as silage for mitigating the acute shortage of green fodder during lean season. Besides, it produces more nutritious fodder with good palatability, taste and succulence, which is relished by the animals. Hence, it fulfils the nutritional needs of the animals, reduces expenditure on feed procurement, increases the milk productivity and hence, makes the dairy farming more feasible and profitable.

RICE FORTIFICATION : A SOLUTION FOR MALNUTRITION

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Abstract

Rice is consumed as a staple food by nearly half of the world's population, with globally over 440 million metric tonnes of rice being consumed annually. Paddy rice is naturally a good source of thiamine (vitamin B_1), riboflavin (vitamin B_2), and niacin (vitamin B_3). However, paddy rice undergoes several processing steps before consumption (such as dehulling, milling, washing, and cooking) that lead to a significant loss of its vitamins and minerals. As a result, milled rice (i.e., polished rice) is a poor source of micronutrients. Rice accounts for at least one-third of the daily caloric intake (corresponding to at least 70 kg of

rice per capita per year or 200 g per day) in 17 countries in Asia and the Pacific. In South-East Asian countries, the average per capita rice consumption is 129 kg per year or 354 g per day, corresponding to an estimated 61% of total caloric intake. However, average per capita rice consumption in India is only 187 g per person per day. The consumption of rice reflects at the same time a lack of dietary diversity, which is a risk factor for developing micronutrient deficiencies.

Increasing the micronutrient density of rice through fortification has great potential to increase the daily intake of essential vitamins and minerals for the general population, thereby addressing widespread micronutrient deficiencies. Breeding for micronutrient rich cultivars (particularly iron and zinc) of rice is emerging as a powerful to fight against malnutrition of micronutrient. Crop Research Station, Masodha of Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad selected 10 rice varieties among 200 entries for higher iron and zinc content. Higher iron and zinc content entries selected were IR 36, Khitish, NDR 6279, CSR 840, ADT 43, Jhelum, MTUIJ 226, Karthika, R-979-67-2 and Aghonibora. Subsequent trials revealed that the entries NDR 6279, Karthika and Khitish were found superior in terms of yield and yield parameters particularly micronutrients (zinc and iron). The study also reveals that genetic variations were also exists among germplasm for micronutrients content and uptake. Therefore, breeding work for development of fortified rice varieties should also be enhanced.

IMPACT OF ENVIRONMENT AND ROLE OF VARIOUS BIOFERTILIZERS OVER FIELD CULTIVATED BANANA C.V. GRAND NAINE UNDER SUBTROPICAL REGIONS OF PUNJAB

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Abstract

Banana (*Musa* spp.) is an essential nutritional rich fruit crop confined to the regions of tropics and sub-tropics for local consumption and export. An investigation was performed to study the impact of impact of environment and role of various biofertilizers over field cultivated banana cv. Grand Naine at Lovely Professional University, Punjab during 2017-2018. The results revealed clearly the impact of prevailed winter season over the banana plants cultivated under open field condition. Due to it, the crop suffered a lot due to major of problems *viz.,* pseudostem breakage, withering and major physiological disorder like 'Choke throat'. Even though, the application of various organics along with biofertilizers in addition to inorganics, the crop expressed positiveness with the treatment 100% RDF + Azospirillum (200g/plant) + PSB (50g/plant) upto initial stage in terms of plant growth, bunch and finger characters alone.

A STUDY ON ROLE OF SOCIAL MEDIA IN AGRICULTURE MARKETING AND ITS SCOPE

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Abstract

Social media is the new upcoming area in agricultural marketing that has blogs, micro blogs, pages, groups etc. This study adopted a descriptive research and the primary data collection tools were structured questionnaire and in depth interviews from farmers who uses social media. From the analysis it is found that social media is very useful tool in agricultural marketing. It saves time and cost of the farmers for getting information. Face book is the most likely social media for pages and profiles. YouTube videos are most popular for information getting with applications. Whats App is the handy use of social media and mostly preferred for related groups. Many officials are having their official pages, blogs, and groups on social media and it helps in getting information and solving the problems. Challenges were adoption of social media as tool of marketing. People are less trusted one-buying, e-selling of agricultural commodity on social media. The main purpose of social media. is sharing information and creating awareness. The most popular social media among farmers is Facebook, Twitter, YouTube, LinkedIn, WhatsApp etc. Social media is very different form traditional media. The users of social media are creating their own groups, pages, community, and blogs to share information. In this group they are also selling, buying agricultural commodities. It can be done by sending images, pictures, links videos etc. This sharing of information facilitates the marketing of farmers produce and formation of network.

QUALITY ASSESSMENT OF DIFFERENTLY DRIED ONION (*ALLIUM CEPA* L)

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Abstract

Drying of sliced onion (var. Agrifound light red) was carried out in tray dryer (50 ± 5 0C temp. for 6-8 hrs), solar dryer (10 hr), microwave drying (800 W, 4 minute) and shade drying (room temperature) at Fruit Research Station, Entkhedi, Bhopal (Department of Horticulture, RAK College of Agriculture, Sehore M.P.). Onions were uniformly sliced to a thickness of 4 mm before being blanched in boiling water for 10-15 seconds followed by dipping in 0.2 per cent potassium meta sulphite for 5 minute at room temperature, this was called treated sample. The treated samples and untreated samples (control) were subjected to different drying techniques followed by evaluation in terms of product recovery, rehydration ratio, cutting strength, colour, tritatable acidity and ascorbic acid content. Experiments were designed using the Factorial Completely Randomized design. It was observed that product recovery and rehydration ratio was maximum for micro wave drying. Oven dried onion slices exhibited maximum deviation in colour and also had the highest cutting strength. Titratable acidity and ascorbic acid content was best for the shade dried samples. All the results were statistically valid.

NUTRITIONAL SECURITY AND PROFITABILITY OF MARGINAL AND SMALL FARMERS OF BUNDELKHAND REGION THROUGH GROWING OF UNDER-UTILIZED FRUIT CROPS

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Abstract

Under-utilized fruit crops are neither grown commercially nor traded on large scale are often categorized under underutilized or less known fruit crops. These fruit crops are very hardy in nature and it can be grown very well on degraded lands. Underutilized fruit crops have high nutritional value, excellent production potential, and immense potential of commercialization especially in Bundelkhand region of Uttar Pradesh because of arid and semi-arid climatic condition with various types of soil (Raker, Mar, Padwa). Most of the efforts and works have been done on improvement of major fruit crops but during last one decade new vistas has open on horticultural growth in general and arid and semi-arid regions in particular for increasing the profitability and nutritional security of marginal and small farmers. In Bundelkhand region, there are plenty of underutilized fruit crops viz., Karonda, Bael, Custard apple, Khirni, Ber, Jamun, Chironji, Wood apple, Tamarind, Jackfruit, Mulberry etc. are available in scattered manner either grow wildly or farmer grow on their field bunds as a wind breaks or to protect crops from wild animal as bio-fencing. These fruit crops are rich source of carbohydrates, protein, fat, iron, vitamins, antioxidant, etc. Presently there are so many varieties and genotypes of less known fruit crops have been developed which are most suited to climatic conditions of Bundelkhand region. For nutritional security and increasing the income of marginal and small farmers of Bundelkhand region, establishment of systematic orchards of minor fruit crops along with intercropping with suitable vegetables are the need of today.

PHYSIOLOGICAL STUDIES IN SORGHUM UNDER DECREASING LEVELS OF SOIL MOISTURE CONDITION AT FIELD CONDITION

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Abstract

Sorghum [*Sorghum bicolor* (L.) Moench] is one among the five major cereals of the world, being grown extensively in tropical and sub-tropical climate. In the present investigation six existing and recently released cultivars of Sorghum were taken to test their water stress tolerance. These cultivars are presently used extensively in the commercial production in Indian farmers. The field trials was laid out in The field experiment was laid out in a Factorial Randomized Blok Design (FRBD) with three replications in field Condition involving with six genotypes viz., Phule Yashoda, Phule Revati, Phule Chitra, Phule Vasudha, Phule Anuradha and Phule Maulee and four moisture regimes (25%, 50%, 75% and > 90 % of field capacity). The

effect of moisture stress was assessed using various physiological parameters. Among the six genotypes, the Phule Yashoda and Phule Revati showed significantly maximum mean chlorophyll a, b and total, RLWC, rate of photosynthesis, rate of transpiration, A-PAR, stomatal conductance and resistance at 25 % of F.C. It could be inferred that the genotype Phule Chitra and Phule Maulee are more suited under limited soil moisture condition (which moisture regime). While, the genotype RSV-1006 and Phule Yashoda found well suited for medium soil for stress as well as non stress condition. Irrespective of moisture regime Phule Yashoda and RSV-1006 found to better than rest of genotypes based on physiological parameters. However, Phule Chitra and Phule Maulee had some physiological parameters which suited under water stress condition (M_1). The resilience to drought shown by recent varieties is a good premise for their use in areas subjected to dry spells.

COMBINING ABILITY EFFECTS AND HETEROSIS FOR GRAIN YIELD AND ITS COMPONENT TRAITS IN WINTER MAIZE

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Abstract

The combining ability of the breeding material helps the breeders in selection of elite parents and identification of superior single cross combinations. A field experiment was conducted to generate the information on combining ability and heterosis of 61 newly developed maize inbred lines for winter season. The 122 F_1 hybrids generated in line × tester mating design by crossing 61 maize inbred lines with two testers (BML-6 and BML-7) were evaluated along with three checks (DHM-117, DKC-9081 and P-3396) during winter 2016 and 2017 at IIMR regional centre, Begusarai. Pooled analysis showed that mean squares due to genotypes, general combining ability (GCA) and specific combining ability (SCA) effects for grain yield were significant. Out of 61 inbred lines, 29 inbred lines had positive GCA with maximum GCA effect value of 25.64. On the basis of GCA effects inbred lines IMLSB-1299-5, IMLSB-406-2, IMLSB-334B-2, IMLSB-814-2 and IMLSB-285-1 were identified as best combiners which can be further used in breeding programme. Out of 122 crosses 26 crosses showed positive and significant SCA effect among them IMLSB-219-2 × BML-6, IMLSB-173-2 × BML-7 and IMLSB-343-3 × BML-7 were found promising for yield.9 hybrid combinations, showed significant and positive heterosis over the three checks for yield. The economic heterosis was estimated over the promising three national checks. Eight hybrid combinations *viz*., IMLSB-114-1 × BML-7, IMLSB-219-2 × BML-6, IMLSB-285-1 × BML-7, IMLSB-334B-1 × BML-7, IMLSB-406-2 × BML-6, IMLSB-814-2 × BML-6, IMLSB-1299-5 × BML-6 and IMLSB-1299-5 × BML-6 were found significantly superior for grain yield over the check DHM-117. Five combinations namely, IMLSB-23-2 × BML-6, IMLSB-93-2 × BML-7, IMLSB-173-2 × BML-6, IMLSB-507-1 × BML-6 and IMLSB-561 × BML-6 were found significantly superior for grain yield over the check DKC-9081 whereas only one combination IMLSB-219-2 × BML-6 was found significantly superior over P-3396 for grain yield. After multi-location testing, these hybrids combinations can be recommended for commercial cultivation.

EFFECT OF ORGANIC AND INORGANIC FARMING UNDER RICE BASED CROPPING SYSTEM IN GODAVARI DELTA DURING KHARIF SEASON

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Abstract

The field experiment was conducted at RARS, Maruteru on the effect of organic farming and inorganic farming during Kharif season from 2011 to 2017. The experiment was laid out with two plots consists of Inorganic farming package and organic farming package. The inorganic farming package consists of recommended dose of fertilizers for Kharif 90:60:60 Kg/ha and Rabi 180:90:60 respectively. The organic package contains incorporation of green manuring with daincha + FYM @ 10 t/ha + top dressing of Neem cake and vermicompost @ 500 Kg ha^{-1} in two splits. The variety cultivated under this is MTU 7029. The grain yield and straw yield observed to be more with the application of organic farming package during Kharif season. The

organic carbon and nutrient status of the soils improved with the organic farming practice when compared to inorganic farming. The nutrient content and uptake was maximum with organic farming plot when compared with inorganic farming.

INFLUENCE OF GA_3 AND NAPHTHALENE ACETIC ACID ALONE AND IN COMBINATION ON FRUIT DROP, YIELD AND QUALITY OF MANGO CV. AMRAPALI

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Abstract

Mango (*Mangifera indica* L.), an important and delicious fruit of the tropical regions which hold a premier position amongst all the commercial fruits in the country. Mango industry has vast potentiality and play vital role in the development of economic status and better linkage in the international trade. The mango is cultivated in almost all the states of India. Foliar application of plant bio-regulators such as GA_3 and NAA, play an important role in fruit set, fruit growth and development, yield, and quality improvement. It is one of the essential elements for the formation of chlorophyll and hence useful towards photosynthetic activity. Naphthalene acetic acid is helpful in the induction of flowering, prevent shedding of buds, flower and unripe fruits, whereas, application of GA_3 is found more effective in retaining the maximum fruit percentage per panicle with increase in fruit size and fruit weight in Mango and in many other fruits. The intensity of damage caused by fruit dropping can also be minimized by the foliar application of plant bio-regulators which helps in improving yield and fruit quality of mango. The present investigation has been carried out in the department of horticulture, CSAUAT, Kanpur (U.P.) India, during the cropping season 2016-2017. The experiment was laid out in Randomized Block Design with three replications and Nine treatments *viz.,* T_1-GA_3 (25 ppm), T_2-GA_3 (50 ppm), T_3-NAA (20 ppm), T_4-NAA (40 ppm), T_5-GA_3 (25 ppm) + NAA (20 ppm), T_6-GA_3 (25 ppm) + NAA (40 ppm), T_7-GA_3 (50 ppm) + NAA (20 ppm), T_8-GA_3 (50 ppm) + NAA (40ppm), T_9-Control (water spray only). From the results obtained during experimentation it is recorded that combined application of GA_3 (50 ppm) + NAA (40 ppm) results in significant decrease in fruit drop (85.5%) with increase in fruit retention (15.70 %) and fruit yield (54.70 kg/tree). So for as the physico-chemical attributes of fruits are concerned plants sprayed with the combination of GA_3 (50 ppm) + NAA (40 ppm) results in significantly more fruit length (9.88 cm), width (4.62 cm), weight (99.30 g), volume (250.43 g/cc), specific gravity (1.08 g/cm^3), and pulp per cent (70.25 %) with decrease in peel per cent (12.25 %) and stone per cent (14.80%) in GA_3 (25ppm) + NAA (20ppm) treatment. Increased total soluble solids (18.60 ^{0}Brix), total sugars (17.30 %), ascorbic acid (48.23 mg/100) were also found maximum with the same treatment *viz., combined* application of GA_3 (50ppm) + NAA (40 ppm), whereas titratable acidity (0.32%) contents in the fruit was drastically reduced under this treatment.

ROLE OF SENSOR IN THE FOOD PROCESSING INDUSTRIES

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Abstract

Food processing industry faces various challenges; one of the foremost challenges is monitoring of safety and nutritional quality of the food. The conventional analytical techniques for quality and safety analyses are very tedious, time consuming and require trained personal. Improper handling and storage might cause food poisoning so it is not possible to depend on this system. Therefore there is a need to develop quick, sensitive and reliable techniques for quick monitoring of food quality and safety. This can be overcome by using the sensor automation technique in the food processing industries. Obtaining reliable results depends on selecting the appropriate sensor technology for the application. To accommodate these demands, sensors must be durable, flexible, sensitivity,linearity of response, reproducibility, accuracy, quick response time and recovery time, stability, and reliable, regardless of the environment. Proper selection of the sensors requires careful consideration of the sensor's capabilities, limitations, and suitability for the intended application. Common applications of sensor in the food manufacturing process include process monitoring, shelf-life investigation, freshness evaluation, authenticity assessmentand other quality control studies. Because of their versatility and high level of functionality or application different sensor are used in the food processing industries some of them are proximity sensors (inductive, capacitive, and ultrasonic), temperature sensor (resistance temperature detector, infrared sensor, thermistor and thermocouple), humidity sensors (optical, gravimetric,

capacitive, resistive, piezoresistive, and magnetoelastic sensors), bio-sensor (amperometric, conductometer, thermometric biosensor and potentiometric biosensor), chemosensor,pressure sensors, E-tongue taste sensors,torque sensors,freshness sensor, pH-sensorand gas sensor are explained in this review paper. Sensors technology play a significant role in the detection and identification of contaminants during the food manufacturing processes and it increasethe food quality, safety, production and profitability in the food processing industries.

BATHINDA'S MIGRATED SON BECAME PROGRESSIVE BEEKEEPER : A SUCCESS STORY

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Abstract

This story recounts an uplifting tale of heartening success of a beekeeper that should be an inspiration to all migrating youth of Punjab to foreign countries. Due to continuous crop failure Mr Chamkaur quit conventional farming and migrated to Dubai ten years ago. Skill development training provided by Krishi Vigyan Kendra, Bathinda triggered his interest in beekeeping during 2010. He adopted beekeeping as profession with only thirteen bee hives whose number has been rise to 600 presently with thirty five folds higher net annual income then the initial.

EFFECT OF FOLIAR SPRAY OF MICRO-NUTRIENTS ON FRUIT YIELD AND QUALITY OF AONLA (*EMBLICA OFFICINALIS* GAERTN) CV. NARENDRA AONLA-6

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Abstract

The present investigation entitled on "Effect of foliar spray of micro-nurient on fruit yield and quality of aonla (*Emblica officinalis* Gaertn) cv. Narendra Aonla-6" was carried out at the Mains Experiment Station Department of Horticulture NDUAT, Kumarganj- Faizabad (U.P.) during the year 2014-2015. The experiment was conducted with seven treatment and replication thrice consisting of various levels of nutrients $ZnSO_4$ (0.5%), $CuSO_4$ (0.4%), $MnSO_4$ (0.5%), $ZnSO_4$ (0.5%) +$CuSO_4$ (0.4%), $CuSO_4$ (0.4%)+ $MnSO_4$ (0.5%), $ZnSO_4$ (0.5%) +$MnSO_4$ (0.5%) and control (Water Spray) in RBD (Randomized Block Design). The foliar application of these nutrient were applied two times after fruit set in the month of mid June and mid July. The observation was recorded on percent fruit drop, fruit retention, fruit size, fruit size, fruit weight, pulp: stone ratio and fruit quality at different stage of fruit development. The minimum (73.47%) of fruit drop and maximum (26.53%) of fruit retention (was recorded with $ZnSO_4$ (0.5%) + $CuSO_4$). Significant increase in fruit size, fruit weight, Pulp: stone ratio was also recorded with the foliar application of $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%) as compared to other treatment. The maximum (12.85%) reducing sugar (3.37%), non- reducing sugar (2.57%) and total sugar (6.13%) Vitamin 'C' (676.00mg/100g pulp) were recorded with treatment of $ZnSO_4$ (0.5%) + $CuSO_4$ (0.4%) and fruit yield (73.03kg/tree) where as the lowest acidity was (2.07%).

STUDY ON THE PARTICIPATION OF ELECTED WOMEN IN PANCHAYATI RAJ SYSTEM IN BIHAR

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Abstract

The present study was an effort to know the extent of participation of elected women members in Panchayati Raj institutions. A total seventy five women representative randomly selected from all the panchayats of Pusa and Kalyanpur Block of Samastipur district in Bihar in which fourty villages in the total were drawn randomly from the two selected blocks (20

villages from each block). A schedule was used to collect the data by personal interview method. In order to determine the conditions governing the participation of women the data were subjected to multiple correlation, regression and path analysis. Participation was taken as dependent variable. The finding revealed that maximum 8.0 percent of these elected women village Pantheist members were "Always" participated with regard to "Construction, repair and maintenance" of public property and overall positive impact of increased participation of elected women members in gram panchayats as the representations of the society. That is why more than ninety percent respondents spoke positively with respect to different life situation which was the consequence of their association with Gram Panchayats. There is enough evidence that the Gram Panchayats are capable of providing a right platform from where a substantial change might take place in the status of women. However, a concrete impact on the life of either elected women members of Gram Panchayats or ordinary women in the society will take some time to take place. In order to determine the conditions governing the participation of women in Panchayati Raj institutions and influence of various factors over the data were subjected to coefficient of correlation, multiple regression and path analysis. The results of correlations and multiple regression analysis between Participation and Socio-economic and Psychological variables of elected Village Panchayat was positively and significantly correlated with caste ($r = 0.668$, $P>0.01$) and interaction style ($r = 0.353$, $p>0.01$) at 1 present level of probability and value of social linkage was negative but significant at 5 present level of probability.

GENE EDITING AND CROP IMPROVEMENT USING CRISPR-CAS9 SYSTEM

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Abstract

Advancements in Genome editing technologies have revolutionized the fields of functional genomics and crop improvement. CRISPR/Cas9 (clustered regularly interspaced short palindromic repeat)-Cas9 is a multipurpose technology for genetic engineering that relies on the complementarity of the guideRNA (gRNA) to a specific sequence and the Cas9 endonuclease activity. It has broadened the agricultural research area, bringing in new opportunities to develop novel plant varieties with deletion of detrimental traits or addition of significant characters. This RNA guided genome editing technology is turning out to be a groundbreaking innovation in distinct branches of plant biology. CRISPR technology is constantly advancing including options for various genetic manipulations like generating knockouts; making precise modifications, multiplex genome engineering, and activation and repression of target genes. The review highlights the progression throughout the CRISPR legacy. We have studied the rapid evolution of CRISPR/Cas9 tools with myriad functionalities, capabilities, and specialized applications. Among varied diligences, plant nutritional improvement, enhancement of plant disease resistance and production of drought tolerant plants are reviewed. The review also includes some information on traditional delivery methods of Cas9-gRNA complexes into plant cells and incorporates the advent of CRISPR ribonucleoproteins (RNPs) that came up as a solution to various limitations that prevailed with plasmid-based CRISPR system.

ADVANCES IN VEGETABLE BREEDING AGAINST CLIMATE CHANGE

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Abstract

The effect of climate change is very harsh on the horticultural crops, particularly the vegetables. Abiotic stress such as salinity, drought, extreme temperature and chemical toxicity, leads to a series of morphological, physiological, biochemical and molecular changes which severely affected the plant growth and productivity. The water shortage including precipitation and soil moisture storage capacity, in quantity and circulation during the plant life cycle hinders the expression of full genetic potential of the plant. The span and harshness of environmental action and the developmental stage of plant contributes to difference in responses shown by affected plants. Therefore, the breeders need to focus on these aspects while breeding for stress tolerant crop varieties. Primarily, the wild species of some important vegetables crops like tomato (*Solanum pennellii*, *S.*

Cheesmanii, *S. Chilense* and *S. habrochaites*), chilli (*Capsicum cilianum*, *C. eximum* and *C. flexusosum*), pumpkin (*Cucurbita ecuadorensis* and *C. ficifolia*) and onion (*Allium karataviense* and *A. schoenoprasum*) can be utilized to develop abiotic stress resilient varieties. The other tools which can be utilized for stress breeding includes screening, marker assisted selection (via high-throughput markers like SSR, CAPS or SNPs), plant transformation, phenotyping and conventional breeding methods. The recently developed techniques like gene silencing through RNA interference, CRISPR or transgenics provides huge scope of exploitation. Therefore, the climatic resilient breeding is the need of the hour and can be made possible by manifesting the proper techniques according to the requirement of the stress conditions.

QUALITY EVALUATION OF PROCESSED STAR FRUIT (*AVERRHOA CARAMBOLA*)

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Abstract

Fruits are highly perishable items which needs processing to make it durable. In the present investigation there were various types of processing techniques were used to determine the best processing method with the minimum loss of naturally present antioxidant in Star Fruits that can be uses in the development of food products. The findings revealed that, regarding organoleptic evaluation of processed star fruit, in context of high temperature treatment sensory attributes were higher in water boiling temperature (100^{o}C). Regarding the low temperature treatment, scores of deep freezer temperature were higher in comparison to others and for drying treatment; it was found that sun drying scores the highest. Anti-nutrient content which includes tannin and oxalic acid was found lowest in water boiling temperature (100^{o}C) i.e. 0.78±0.06 and 0.65±0.02 mg/100 g respectively in context of high temperature treatment. While in low temperature treatment anti-nutrient was 0.83±0.01 mg tannin and 0.73±0.02 mg oxalic acid per 100 g in deep freezer temperature, which was lowest among others. Regarding drying treatment lowest tannin and oxalic acid was recorded 1.10±0.55 mg and 0.72±0.05 mg per 100 g respectively for sun drying. Highest antioxidant activity of processed star fruit, was found with (100^{o}C) i.e. 77.64±1.50 % in context of high temperature treatment. While in low temperature treatment it was found 75.49±1.77 % for deep freezer treatment which was highest among others, and in drying treatment it was found highest in sun drying which was 92.14±1.02 %. The present investigation concluded that minimum loss of antioxidant activity in Star Fruit was found in water boiling temperature, Deep freezer temperature and sun drying comparison to other processing methods. These processing techniques can implement in the new food product development which will highly rich in antioxidants**.**

INTEGRATED PEST MANAGEMENT OF DIAMONDBACK MOTH [*PLUTELLA XYLOSTELLA* (L.)]

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Abstract

Diamondback moth, *Plutella xylostella* (L.), is the most destructive insect pest of brassica crops throughout the world. Although many studies have been conducted on this pest, the development of realistic integrated pest management (IPM) for it is not progressing as it should, and even less so on its practical implementation. The many reasons for this include overreliance on chemical control, overemphasis on basic and narrow-aspect research which lacks a holistic outlook, inadequate understanding of the farmer, particularly his pest perception and realistic needs, and the subtle influence of the existing socio-marketing factors. In this paper, these constraints are critically examined, with attempts also made to identify the positive steps to be taken to expedite the current initiatives in IPM development and implementation. The currently known integrating components/techniques are appraised and several common key elements important for successful IPM are identified. The latter mainly includes harnessing key natural enemy species, using microbials, and applying relatively safer insecticides when these are necessary as guided by appropriate action thresholds. Other useful but less commonly exploited elements include proper timing of planting, crop rotation, physical barriers and trapping. With respect to promoting greater IPM implementation, special emphasis is necessary to generate increased awareness and transfer of available practical IPM

programs. The strategic steps will include determination of farmers' pest management knowledge, attitude and practices, IPM trial demonstrations, and appropriate training of extension personnel and farmers. Particularly in farmer training, suitable development support communication is to be utilized, encompassing pre-tested posters and pamphlets, and other audiovisual media. Also, the field school approach should be adopted.

CONSTRAINTS IN ADOPTION OF IMPROVED TOMATO PRODUCTION TECHNOLOGIES IN BHOJPUR DISTRICT OF BIHAR

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Abstract

This study was conducted in Bhojpur district of Bihar during 2016-17. Tomato is one the important vegetable crop of Bhojpur district. After several promotional activities conducted by different extension agencies the improved tomato production technologies have not reached the farmers field. A study was conducted to identify the constraints faced by farmers in adoption of the improved tomato production technologies. The study was conducted in five purposively selected blocks i.e., Arrah, Barahara Bihiya, Shahpur, and Koilawar of the district where tomato was grown round the year, in each block two villages were selected purposively with 20 tomato growers selected as a respondents in each village covering 200 respondents in the study through proportional random sampling. Constraints identified were grouped into four categories i.e. input constraints, financial, technical and marketing. Results indicated that financial and marketing constraints were most perceived by the tomato growers followed by technical and input constraints perceive as least by the tomato growers.

EFFECT OF PLASTIC MULCH ON VEGETATIVE GROWTH AND YIELD OF GINGER (*ZINGIBER OFFICINALE ROSC.*) UNDER DRIP IRRIGATION SYSTEM

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Abstract

A field trial was conducted at the Krishi Vigyan Kendra, Bhojpur, Ara, Bihar for two consecutive years during 2016-2017 & 2017-2018 to determine the influence of different mulch materials on vegetative growth and yield of ginger (*Zingiber officinale Rosc.*) under drip irrigation system. The research trials for the consecutive two years showed that plastic mulch resulted significantly higher in plant height, No. of tillers clump^{-1}, Number of leaves clump^{-1}, No. of primary rhizomes, Length of primary rhizome (cm), Diameter of primary rhizome (cm), Number of secondary rhizome, Length of secondary rhizome (cm), Diameter of secondary rhizome (cm), Rhizome yield plant^{-1} (g) and Rhizome yield (t) ha^{-1} ,whereas days to maturity were lower in the treatment of control. The highest yield plant^{-1} and ha^{-1} was observed under the treatment of plastic mulch (434.13 gm plant^{-1} & 34.730 t ha^{-1}) with 124.20% increase in yield as compared to control without mulch (193.80 gm plant^{-1} & 15.49 t ha^{-1}). Followed by yield plant^{-1} and yield ha^{-1} were observed under the treatment of *Butea monosperma* and Paddy straw almost at par for both treatment (293.53 gm plant $^{-1}$, 23.480 t ha^{-1} & 272.617 gm plant^{-1}, 21.807 t ha^{-1}, respectively).

ANALYSIS OF GENETIC VARIATION AMONG DIFFERENT BANANA (*MUSA ACUMINATA SPS.*) VARIETIES USING INTER SIMPLE SEQUENCE REPEAT MARKERS (ISSR)

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Abstract

The identification of desired varieties in *Musa* is of prime importance for various crop improvement programs. PCR based molecular markers such as inter simple sequence repeats have become important genetic markers in a wide range of crops including banana. ISSR are excellent molecular marker system with the advantage of being codominant, high genomic coverage, and show higher levels of polymorphism than other genetic markers. Genomic DNA from 12 banana genotypes was

analyzed using 16 ISSR markers. High degree of polymorphism was expressed by all the primers. 6.75 bands per primer were amplified on an average. RP value of 16 ISSR primers ranged from 0.42-3.64 with an average of 0.87. Average PIC value was 0.74. The primer UBC 812 was reported as best one in distinguishing the 12 banana varieties. The 16 ISSR markers were used to construct the dendrogram based on UPGMA cluster analysis. The dendrogram indicated that the ISSR markers succeeded in distinguishing most of the 12 varieties in relation to their genetic background and geographical origin.

DIVERSITY AND RELATIVE ABUNDANCE OF INSECT POLLINATORS IN AONLA, *PHYLLANTHUS EMBLICA* (L.)

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Abstract

The underutilized plant species of economic importance are the key to sustainable agriculture in most of the developing countries facing resource constraints as well as rapid depletion of natural resources due to ever-increasing population pressure. Around 30 percent of human food is derived from bee pollinated crops. Pollination is one of the principal mechanisms in the maintenance and conservation of biodiversity and in general life of earth. Out of the total pollination activities, more than 80 percent is performed by insects and bees. Scanty information is available on entomophily in underutilized fruit crops such as Aonla (*Phyllanthus emblica* L.), from the family Euphorbiaceae and is native of tropical south eastern Asia. Fruits of aonla are very rich in vitamin C (500-600 mg/100g pulp) and have great importance in Ayurvedic medicine. Present study was carried out at Research Farm of the Department of Horticulture, CCS Haryana Agricultural University, Hisar during 2014 and 2015. Species diversity was documented by collecting insects visiting Aonla flowers. Abundance of different insect visitors/ pollinators was observed for 5 minutes from five randomly selected plants starting from 8 A.M with 2 hour interval at different day hours. Aonla flowers attracted wide varieties of insects belonging 5 orders, 7 families and 9 genera 12 species. Among them four belongs to order Hymenoptera, two from Coleoptera, four to Diptera, one to Hemiptera and one to Lepidoptera. The Dipterans were the major floral visitors comprising of three families *viz*., Syrphidae (*Sphaerophoria* sp. and *Episyrphus* sp.), Sarcophagidae (*Sarcophaga* sp.) and Muscidae (*Musca domestica*). They were followed in order of diversity by hymenopterans from one family *viz*., Apidae (*Apis florea, A. dorsata, A. cerana* and *A. mellifera*). Coleopterans belongs to family, Coccinellidae (*Coccinella septempunctata* and *Chilomenes sexmaculata*), Hemipteran to Scutellaridae (*Chrysocoris stolli*) and one Lepidopteran to Arctiidae (*Amata* sp.). Out of 12 insects, all were top foragers except *Amata* sp. which was side forager also. From the present pollination study, it is evident that dipterans were most abundant insect pollinators on aonla flowers. Irrespective of different day hours, significantly maximum number of *Episyrphus* sp. was recorded from aonla flowers followed by *Sphaerophoria* sp. and *A. florea.* Peak abundance of *Episyrphus* sp. was recorded between 1000h -1200h during full bloom. Irrespective of weeks, maximum abundance of *A. florea* was recorded at 1000-1200h and minimum abundance was recorded at 0600h -0800h.

PRODUCTION OF BIOMASS BRIQUETTES FROM MIXTURE OF SUGARCANE BAGASSE AND COW DUNG

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Abstract

India, with 66 million tons of production of sugarcane, is the second largest producer of sugarcane in the world. For each ton of sugarcane crushed around 300 kg of bagasse is retrieved. The utilization of this biomass from the extraction of sugarcane juice is utilized for application in the ethanol and sugar industry for energy generation and bio-based products synthesis. Sugarcane residues are basically composed of hemicellulose, cellulose and lignin – chemical structures that are tightly linked to each other and are responsible for the integrity of the vegetal biomass. The aim of the present work is to prepare a leafy biomass feedstock in the form of briquettes which can be directly used for combustion or to extract the combustible gas using a

gasifier. This biomass can also then replace some coal in power plants, which will reduce carbon emissions and greenhouse gas effects. Densification of low-density biomass (agricultural and agro-industrial waste) is called biomass briquetting. The briquette form facilitates easy transportation, enables better handling and storage, and is efficient to use as an alternative fuel to coal and firewood. Sugarcane bagasse and cow dung are considered as the feedstock for briquetting. Hand operated briquetting machine used for the densification process. Different proportions are selected on the basis of hit and trial method. The best suitable combination was found as 60:40 (60 % sugarcane bagasse and 40 % cow dung).

SOIL-LESS FARMING : THE FUTURE CULT OF VEGETABLE AND FRUIT CULTIVATION

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Abstract

No generation so far has been so health sensitized across the globe as the present community and in that too, the residents of metropolitan cities. The residents of metropolis are already under the ill-effects of air pollution, commutation problems, heavy traffic jams, the scarcity of potable water etc. which makes them more questioning and demanding in nature for the purchase of edible products of day-to-day food requirements. The need at everyone's end is for healthier and safer foods which are free from the harmful effects of chemicals and pesticides. This demand encourages research which is ever in search of new technologies. Hydroponics or soil-less farming emerges as an alternative farming system which is an effective way for cultivating vegetables and fruits in small spaces in sand, gravel or liquid with added nutrients but without soil. Soil-less farming implies that the produce is pest, chemical and disease -free ensuring richness in nutritional value. Instead of soil, coconut fibre is used in pre-treated water, potent with essential nutrients in controlled environment. Cultivators also use RO water to ensure that the plants get the required nutrients and minerals in right proportions. These controlled conditions also result in bountiful production. The benefits of soil-less cultivation are many particularly for urban population as it requires less water, small spaces like balconies, terraces, backyards etc.Urban dwellers of Gurugram and Delhi are enjoying the benefits of safe food despite the comparatively higher costs of organic food. Hydroponics thus promotes vertical farming leading to multi-storey towers of cultivation promoting a soil-less and healthier culture.

EVALUATION OF PHYSIO-CHEMICAL PROPERTIES OF SOIL UNDER DIFFERENT EUCALYPTS CLONES IN AN AGRI-SILVICULTURAL SYSTEM

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Abstract

The present study was carried outduring 2016-17 to studythe effect of already established one and half-year-old plantation of four different eucalyptus clones (C-7, C-413, C-288 and C-83) on physio-chemical properties of soil in an agri-silvicultural system. Soil samples were observed for macronutrients concentration (N, P and K), organic carbon percentage, electric conductivity and pH at two different depth (0-15 cm and 15-30 cm) and compare with control (sole crop). The growth parameters (DBH, Basal diameter, Tree height and Crown width) of eucalyptus clones were also measured at beginning and end of kharif and rabi seasons of 2016-17. The growth of all clones of eucalyptus increased with the advancement of age. The increment in tree height and crown width was recorded maximum in C- 413 and maximum increase in basal diameter and DBH was exhibited by C-7 clone. A considerable increase in soil available carbon and macronutrients content were observed under eucalyptus based agri-silvicultural system than under control (devoid of trees). The change in organic carbon percentage during the course of study was maximum under clone C-413 (0.08 %) at 0-15 cm soil depth. Similarly, the concentration of N, P and K at 0-15 cm soil depth was found maximum under C- 413, C-288 and C-288 respectively. The concentration of all three macronutrients N, P and K decrease with increase in soil depth from 0-15 to 15-30 cm. It was also observed that soil pH and EC decrease more under plantation of eucalyptus clones over control (sole crop). The maximum decrease in soil pH and EC at 0-15 cm was found under C-7 and C- 413 respectively. Therefore the agroforestry based system was recorded more sustainable and stable in terms of nutrient security and help to increase the productivity of soil.

IMPACT OF FLD,S ON INTEGRATED FRUIT FLY MANAGEMENT IN GUAVA CROP IN SAWAI MADHOPUR DISTRICT OF RAJASTHAN

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Abstract

Guava fruit is commercially grown throughout India with production of guava 2.59 million tons and an area coverage of 0.25 million hectares. Among the different guava growing districts of Rajasthan, Sawai Madhopur is main grower having 5000 ha area. However, guava fruit flies, *Bactrocera* spp., are most important insect pest of guava and this fruit crop is highly prone to damage by this pest in Sawai Madhopur particularly during rainy season. The fruit fly not only causes economic loss but is also of quarantine importance. Several biotic factors limit the production and productivity of guava during rainy season, of which guava fruit fly has been the most prominent pest over the last several decades. Depending on the environmental conditions and susceptibility of the crop, the extent of losses varies between 80 to 100% damage to rainy season guava crop as it is the most preferred host of fruit flies. The fruit flies are very difficult to manage as they are polyphagous, multivoltine, adults have high mobility and fecundity and all the developmental stages are unexposed. Only adults are exposed while eggs and maggots remain protected in the host tissues and most of insecticidal treatments are ineffective. Application of insecticides disrupts the ecosystem and causes numerous hazards, which in the present scenario warrants the need of integrated approach for fruit fly management.

A study was conducted to assess the impact of the integrated pest management (IPM) module involving crop sanitation; collection and destruction all fallen fruits at weekly intervals; placed one fruit fly trap or bait sprays and male annihilation technique (MAT) using methyl eugenol as lure in orchard between ten plant before fruit setting stage with repeated spray of neem based insecticide 1500 ppm @ 3 ml/ litre water at 10 days interval during flowering stage; spray of Trizophos whenever needed . Front line demonstrations on fruit fly management were conducted in 30 fields, 10 demonstrations per year during 2015-16, 2016-17 and 2017-18. The villages for FLDs were selected on the basis of extensive surveys made by KVK on incidence of fruit fly. It was evident that demo orchards recorded lower fruit fly infestation (7.20 %) as against 32.13 per cent in non-adapted orchards. The maximum average yield was 510 q/ha compared to 395 q/ha in local check which is 22.08 percent increase under demonstration orchards, as compared to farmers traditional way. The net return and Benefit Cost Ratio (BCR) are also more as local check. Front Line Demonstrations (FLD) on farmers field may be helpful in establishing the technology at farming community. The basic objective of this programme is to demonstrate improved proven technology through Krishi Vigyan Kendras (KVK) to bringing enhanced application of modern technologies to generate yield data with farmers feedback. Hence, the present study was conducted with the objective of comparing the yield levels of local check (unprotected fields) and FLD plots and recorded feedback information for further improvement in research and extension programme.

A STUDY ON ADOPTION AND CONSTRAINS OF DAIRY FARMERS ABOUT DAIRY MANAGEMENT PRACTICES

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Abstract

Basically India is an agricultural country and livestock sector is an integral part of agriculture. It is the back-bone of India's economy in the form of income, employment and foreign exchange earnings. Dairy is the most suitable production system that has enormous potential to improve the socio-economic status of the large percentage of the rural population. The study was conducted in Karauli district of Karnataka during year 2014-15. The totals of 80 dairy farmers were selected by proportionate random sampling. The findings of the study revealed that, 64.45 per cent of the dairy farmers had medium adoption level, Regarding breeding practice, most of the dairy farmers (52.70%) had regularly keep watch on estrous cycle and heat symptoms of cow/buffalo, Under miscellaneous management, majority of the dairy farmers (89.92%) regularly practicing full

hand method of milking. The majority of dairy farmers (88.40%) constraints expressed the non availability of labour. The constraints faced by the dairy farmers about improved dairy management practices. Structured interview schedule was used to collect the information through personal interview. Data was analyzed by using suitable statistical tools like mean, frequency, Standard deviation.

CONSTRAINTS IN ADAPTING ANIMAL HUSBANDRY PRACTICES BY THE DAIRY FARMERS IN THE EASTERN REGION OF RAJASTHAN

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Abstract

The study was conducted to review the situation of dairying in Eastern region with the objectives to identify major constraints of the dairy farmers in adapting the recommended animal husbandry practices. The survey work was carried out for the milk areas in four districts of the eastern region. Out of 150 dairy farmers, 111 farmers cared crossbred animals; 70 out of 90 dairy farmers adapted cooling arrangement to cross-bred cows during summer; 45 of 55 adapted washing their animals during summer; 109 of 225 dairy farmers followed vaccination to their animals; 75 of 225 dairy farmers followed de-worming their animals; 38 of 225 adapted to control the ectoparasite; 70 of 225 reacted for removal old debris; 110 of 225 dairy farmers adapted A.I. policy and only 90 of 225 dairy farmers were positive for the animals insurance. Higher proportion of the farmers has accepted the importance of crossbred cows. Higher numbers of farmers have positive response to cool their animals. Significantly more numbers of farmers did not care to vaccinate and accept other health measures for their animals. Non-significant differences between dairy farmers adapting and non-adapting A.I. practices were recorded while significant (P>0.01) difference was observed between the farmers adapting and not adapting the insurance policy.

ADOPTION OF DAIRY FARMING TECHNOLOGIES BY LIVESTOCK FARMERS IN KARAULI DISTRICT OF RAJASTHAN

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Abstract

Keeping in mind the role of external factors affecting adoption behavior of dairy farmers, a study was conducted in Karauli district of Rajasthan with the objective to analyze adoption of scientific farming practices by dairy farmers. Primary data were collected from 200 farmers from Patonda and Shop villages using random sampling method. Semi structured interview schedule was used to collect the data, using personal interview. Herd size, occupation, and social participation with the adoption were positively correlated and family education level of the respondent was highly positively correlated with adoption, while farm size was negatively correlated with adoption. Based on the results, it is concluded that the majority of livestock owners had medium level of adoption behavior with respect to dairy farming technologies. Information input and output, farmer intra-system communication, farmer-researcher communication, farmer-extension agent communication, availability of input facilities and overall knowledge level about dairy farming technologies had positive and highly significant relationship with overall adoption of dairy farming technologies by livestock owners.

KNOWLEDGE AND ADOPTION LEVEL OF IMPROVED TECHNOLOGY AMONG RURAL WOMEN OWING TO EXTENSION PROGRAMMES IN KARAULI

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Abstract

The study has assessed the impact of extension programmes on the adoption level of improved technologies in agriculture and animal husbandry in the Karauli district of Rajasthan for the year 20015-16. A significant difference has been observed in the

knowledge and adoption levels among SHG-beneficiary and non-beneficiary groups. The study has revealed that the importance or ranking attached to various agricultural practices has been almost the same by both the groups, though with a significant gap in the extent of their adoption. In cereals, timely harvesting, followed by seed selection and seed treatment are the most adopted practices by beneficiary group while seed selection, followed by timely harvesting and timely sowing are the preferred practices by non-beneficiaries. Chemical weed control, pre-sowing soil treatment, sowing in lines at proper spacing have been the most ignored practices, although the level of their adoption has been found higher among beneficiaries than non-beneficiaries. In the case of vegetables, use of HYVs and sowing in lines are commonly practiced by both the groups. Seed treatment, soil treatment and proper spacing are the practices where maximum chasm has been observed among the two groups. Similarly, in the case of animal husbandry, a significant gap in the adoption level of various practices has been observed among both the groups. The study has inferred that the extension programmes organized by various extension agencies for SHGs constitute appropriate educational tools for the transfer of technology and raising the socio-economic status of rural

FUTURE STRATEGY ON INCREASE CROP PRODUCTION AND ECONOMIC VALUE

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Abstract

In agriculture, sustainable farming is becoming the need of the hour the world over. India is still struggling with food security. According to data from the Food and Agriculture Organization, more than 190 million of the Indian population remains hungry on a daily basis. While the challenges for the required dramatic improvement lies in the inept rural transport system, need for awareness regarding crop treatment, dependence on irregular monsoons, and the receding agricultural land giving way to urbanization. The Indian farmer's access to modern farming technology is also limited. According to ICAR's reports, a staggering 37 per cent of India's total geographical area of 328.73 million ha is affected. A staggering amount of soil gets degraded annually. This is an irony considering the fact that a big amount of our fiscal budget is spent on defending our soil even as we lose the very same soil to rain and wind. Similarly, our water resources are also getting degraded. Only about 47.6 per cent of the net sown area is irrigated. Groundwater, which accounts for almost 60 per cent of the irrigated area in the country, is under severe strain. Subsidies for electricity consumed in agriculture have led to wasteful use of both energy and groundwater. This has led to depletion of the water table and deterioration of water quality. The good news is that we have a well-defined array of schemes for almost all the threats crippling agriculture. The Pradhan Mantri Krishi Sichayee Yojana aims to extend the coverage of irrigation and improve water use efficiency. The Micro Irrigation Fund focuses on "more crop per drop". The Long Term Irrigation Fund has the potential to bring an additional 76 lakh ha area under irrigation. The Rashtriya Krishi Vikas Yojana incentivises States to draw up plans for their agriculture sector more comprehensively, taking agro-climatic conditions, natural resource issues and technology into account. The Pradhan Mantri Fasal Bima Yojana is a comprehensive insurance scheme that covers the damage caused by natural calamities. Schemes like Dairy Processing and Infrastructure Development Fund reduce the dependence of farmers on agriculture.

ADOPTION LEVEL AND CONSTRAINTS IN BACKYARD POULTRY REARING PRACTICES AT KARAULI DISTRICT OF RAJASTHAN

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Abstract

Backyard poultry is one of the key sources of protein for the rural people of Rajasthan. This study was carried out in practices in Karauli district of Rajasthan with the aim of assessing the management system and production performance of backyard poultry. Regarding adoption of backyard poultry rearing practices it was found that, majority of the respondents (55.25%) were medium level adopters followed by high level (23.25%) and low level (21.50%) adopters. The practice wise adoption

showed that marketing (68.23%) were highly adopted followed by feeding and watering (58.28%), housing (50.82%), general management (47.73%) and breeds and breeding (44.52%). The least adoption as for health care practices (26.56%). The overall adoption of different backyard poultry rearing practices showed medium level adoption. High incidence of diseases, attack of predators, lack of knowledge about scientific practices, lack of time due to farm work, damage to vegetable crop by backyard poultry, complaints from neighbors, unhygienic condition and improper veterinary services were major constraints encountered by backyard poultry owners.

PARTICIPATION OF TRIBAL RURAL WOMEN IN DAIRY FARMING ACTIVITIES

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Abstract

Women from the backbone of Agriculture, comprising the majority of agriculture labourers in India. Women play a significant and crucial role in agriculture and animal husbandry development. Female agriculture labourers are still among the poorest section of Indian society**.** India is currently the largest producer of milk in the world, overwhelmingly thanks to the output of millions of smallholder farms. A survey based study was carried out to know the participation of rural women in various activities at Karauli district of Rajasthan. A simple random sampling technique was used in the selection of dairy farm women using interview schedule by personal interview for sample size of 180 rural women in Todabhim and Nadauti block of Karauli district. The data revealed that the participation of majority of women was high in activities such as cleaning of cattle shed, watering, milking, feeding the animals and disposal of cow dung. The farm women participation was least in dairy related record maintenance, getting loans or credits from the banks, taking animals for grazing, fodder collection and harvesting the fodder crops. Thus there is need to educate them about scientific management practices for increasing livestock production.

CONSTRAINT ANALYSIS OF TRIBAL LIVESTOCK FARMING IN KARAULI DISTRICT OF RAJASTHAN

Bachchu Singh, B.S. Meena, Roop Singh, Suresh Bairwa and Sankarlal Kaswa
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Abstract

A study was conducted to identify the constraints in tribal livestock farming by collecting data from 280 sample tribal farmers in two blocks of Karauli District. The data were analysed by Garett's ranking technique. Lack of sufficient pasture land, lack of marketing facilities, lack of adequate credit facilities, and unremunerative price for the livestock products and lack of scientific knowledge on livestock farming were observed to be the major constraints perceived by the tribal farmers. Establishment of milk co-operative societies, enhancing fodder cultivation, provision of loans to needy tribal livestock farmers at reasonable interest rate and conducting awareness programmes among tribal farmers on various scientific livestock management practices will lessen the prevailing constraints in tribal livestock farming, which in turn improve the tribal livestock production.

INDOOR GARDENING : MAKING HOMES GREEN

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Abstract

The concept of indoor landscaping is not new, but trending interest towards having a variety of greenery indoors has offered chance to go above and beyond with creative landscaping ideas. Indoorscaping involves bringing greenery in indoor living spaces creating a breeze of fresh pure air, color, coolness, mind relaxation with air quality enhancement. It's no secret that people find nature to be serene and visually pleasing, so it only makes sense to bring that tranquility inside. Using artistic designs and arrangements of living plants, we can use interior landscaping to create a natural, feel-good environment that appeals to the senses while adding aesthetic value to your space. Living green-walls literally transform a workplace in tropical

vacation theme, boosting productivity & mood upliftment of employees with best corporate habitat looks. With the growing trend, we have coined an ambitious term 'Indoorscaping' that relates to 'designed for you next-generation indoor landscaping'. Keeping in mind the essential workspace components we can design planters, wall gardens, partition gardens and other artistic offerings for the offices and homes. The possibilities are truly endless. Interior landscapes enhance a business' brand and personality. You can add color and texture to a corporate space with plants and decorative containers. If you've considered sprucing up your large atrium or lobby, indoor plantings and living walls are great for this type of space. Most people are surprised at how greenery can reimagine a professional space - whether residential, hotel, retail, hospital or office. Including plants in your office buildings is extremely beneficial for the effectiveness of your business. It has been proven that being surrounded by nature reduces stress,, increases productivity, and it gives happiness to the employees. Plants also absorb sound; therefore, background noise in your building can be reduced. Researchers found that patients in hospital rooms that are exposed to nature recover faster than those who are not! Owing to the reasons including increase in purchasing power of people and enhanced desire to remain in touch with nature has unleashed new and immense opportunities for indoorscaping.

MANAGING INSECT PESTS AND DISEASES OF CITRUS : ON FARM ANALYSIS FROM SATPURA PLATUN OF MADHYA PRADESH

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Abstract

Population pressure is increasing demanding more food for sustainable future but competition for key resources is high due to prevalence of insect pests and diseases. Numerous losses have been recorded due to diseases infestation in India particularly in case of citrus. On farm technicalities are increasing while farmers' technical knowledge is stagnant making insect pests and diseases pathogens resistant. Citrus is leading fruit and its better productivity is vital for the farmers and national economy but per acre production is lower that potential. Insect pests and diseases role is counted as significant in lowering the production. Therefore presents study was undertaken to explore growers concerns. 120 respondents were selected from Chhindwara District of Madhya Pradesh blocks Sausar & Pandurna using probability sampling technique under survey based research design. Findings indicated that growers were more familiar to insects/pests attack than diseases infestation. The adoption of cultural and mechanical control was found more prominent method to manage diseases impacts. Lack of technical knowledge, Finance shortage, and high cost of inputs were the major adoption militating factors among growers. Micro credit schemes should be started by the public sector to alleviate the finance problem and trainings should be impacted by the pathology and entomology experts along with extension agents to adopt alternate way to manage the viral diseases.

EFFECT OF MICRONUTRIENTS ON GROWTH, YIELD AND METABOLIC STUDIES OF CHICKPEA (*CICER ARITINUM* L.)

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Abstract

A field experiment were conducted during *rabi* 2015-16 at micro plot Department of Crop Physiology, C.S. Azad University of Agriculture & Technology, Kanpur with seed soaking and foliar spray of borax and zinc nutrition on growth, yield and quality of chickpea (*cicer aritinum* L.) variety KWR 108. Treatment was applied at 45 days viz. To control (dry), T_1 control soaked (water), T_2 seed soaking 0.2% borax, T_3 seed soaking 0.5% $ZnSO_4$, T_4- foliar spray (water), T_5 foliar spray 0.2% borax T_6 foliar spay 0.5% $ZnSO_4$, T_7 seed soaking + foliar spray (0.2%) borax + 0.2% borax), T_8 seed soaking + foliar spray (0.5% $ZnSO_4$ + 0.5% $ZnSO_4$). Result revealed that T_8 seed soaking + foliar spray (0.5% $ZnSO_4$ + 0.5% $ZnSO_4$) were enhanced growth attributes likes. Plant height, number of leaves, No. of branch plant^{-1}, leaf area index, total try matter plant^{-1} and yield attributes likes, number of pods plant^{-1}, number of seeds plant^{-1}. Yield likes seed yield q/ha and harvest index(%) and quality studies chlorophyll content mg/g of fresh weight, protein content (%) of chickpea variety KWR 108 were significantly higher in comparison to other treatment.

EFFECT OF MICRONUTRIENTS ON GROWTH, YIELD AND METABOLIC STUDIES OF CHICKPEA (*CICER ARITINUM L.*)

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Abstract

A field experiment was conducted during *rabi* 2015-16 and 2016-17 at Department of Crop Physiology, C.S. Azad University of Agriculture & Technology, Kanpur. The effect of micronutrients viz. control (dry seed), water soaked seed, seed soaking@ 0.2%, borax, seed soaking@ 0.5% $ZnSO_4$. Foliar spray of water @ 0.2% borax. Foliar spray@ 0.5 $ZnSO_4$, seed soaking + foliar spray @ 0.2% + borax for both and seed soaking + foliar spray @0.5% $ZnSO_4$ to both, on chickpea variety of KWR-108 in Randomized Block Design with three replications. Observation were recorded on no. of nodules/plant, chlorophyll content (mg/g of fresh wt.) of leaves number of branches per plant and dry matter/plant at 50% flowering stage, number of pods/plant, number seeds/plant, seed yield q/ha and harvest index. Results revealed that treatment by seed soaking + foliar spray @ 0.5% $ZnSO_4$ for both significantly showed highest no. of seeds/plant i.e. 83 & 84 and seed yield i.e. 18.10 & 22.95 q/ha as well as numerically highest no. of nodules/plant, chlorophyll content, no. of branches/plant, plant dry matter at 50% flowering, no. of pods per plant and harvest index during both the years of experimentation. Next of this treatment, was seed soaking + foliar spray@ 0.2% borax for both the improve the vegetative growth, seed yield and its related parameters.

EFFECT OF MICRONUTRIENTS ON GROWTH, YIELD AND METABOLIC STUDIES OF CHICKPEA (*CICER ARITINUM L.*)

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Abstract

A field experiment was conducted during *rabi* 2015-16 and 2016-17 at Department of Crop Physiology, C.S. Azad University of Agriculture & Technology, Kanpur. The effect of micronutrients viz. control (dry seed), water soaked seed, seed soaking@ 0.2%, borax, seed soaking@ 0.5% $ZnSO_4$. Foliar spray of water @ 0.2% borax. Foliar spray@ 0.5 $ZnSO_4$, seed soaking + foliar spray @ 0.2% + borax for both and seed soaking + foliar spray @0.5% $ZnSO_4$ to both, on chickpea variety of KWR-108 in Randomized Block Design with three replications. Observation were recorded on no. of nodules/plant, chlorophyll content (mg/g of fresh wt.) of leaves number of branches per plant and dry matter/plant at 50% flowering stage, number of pods/plant, number seeds/plant, seed yield q/ha and harvest index. Results revealed that treatment by seed soaking + foliar spray @ 0.5% $ZnSO_4$ for both significantly showed highest no. of seeds/plant i.e. 83 & 84 and seed yield i.e. 18.10 & 22.95 q/ha as well as numerically highest no. of nodules/plant, chlorophyll content, no. of branches/plant, plant dry matter at 50% flowering, no. of pods per plant and harvest index during both the years of experimentation. Next of this treatment, was seed soaking + foliar spray@ 0.2% borax for both the improve the vegetative growth, seed yield and its related parameters.

IMPACT OF DEMONSTRATIONS ON YIELD AND ECONOMICS OF MAJOR VEGETABLE CROPS

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Abstract

The present study was conducted in four blocks of Hapur and Saharanpur district of Western Uttar Pradesh. The total sample size was of 160 vegetable growers for the investigation. During the research study it was observed that increase the yield of vegetable crops from 16.66 to 22.45 percent under demonstrations in compare to farmers practice in summer and kharif season (2014-15). The highest cost of cultivation was found in tomato crop i.e. Rs.2,50,000/ha., lowest in spong gourd i.e.

Rs.77,413/ha., highest net return received in tomato crop i.e. Rs. 1,75000/ha., lowest in bitter gourd crop i.e. Rs. 17,379/ha. and benefit cost ration was higher in chilli crop i.e. 1:1.82 and lowest in bitter gourd crop i.e. 1:1.16. In Rabi season 2015-16 increase yield of demonstrations from 25.39 to 33.92 percent over the farmers practice. The highest cost of cultivation was found in tomato crop i.e. Rs.2,43,000/ha., lowest in bottle gourd i.e. Rs. 1,01,000/ha., highest net return received in cabbage crop i.e. Rs. 1,33,695/ha., lowest in chilli crop i.e. Rs. 47,200/ha. and benefit cost ration was higher in brinjal crop i.e. 1:1.77 and lowest in tomato crop i.e. 1:1.42. Increase yield of demonstrations from 25.00 to 36.90 percent over the farmers practice. The highest cost of cultivation was found in okra crop i.e. Rs.2,17,312/ha., lowest in sponge gourd i.e. Rs.80,000/ha., highest net return received in brinjal crop i.e. Rs. 1,95,000/ha., lowest in bitter gourd crop i.e. Rs. 55,625/ha and benefit cost ratio was higher in cucumber i.e. 1:1.97 and lowest in bitter gourd i.e. 1:1.30 in summer and kharif season 2015-16. The highest yield gap was found in brinjal and cabbage.

ROLE OF FLORICULTURE IN THERAPEUTICS IN TODAY'S ERA

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Abstract

Horticultural therapy is an activity using flower and plants as mediators to achieve the therapeutic treatment benefits. It consists of both passive and active activities as essential elements. Floricultural plants have positive physiological impact on human beings. These plants are helpful in air purification, water conservation, avoiding soil erosion and providing shelters to natural fauna. Hence, these plants play important role in proper functioning of ecosystems. In modern era, people are becoming more conscious about health. A trend has emerged to use medicinal plants and plant related activities instead of using synthetic drugs due to side effect and contradiction in use. Ornamental plants play important role in human health and psychology. The color, shape, fragrance, touch and taste of the plants stimulate the sensory organs leading the brain to activate and release several enzymes or chemicals which enhances mood and make the people to feel comfortable. Gardening is used in hospitals, recovery and rehabilitation centers, old age homes, public and private schools and correctional facilities, all with the goal of providing people living with physical, mental or social limitations full and unobstructed access to therapeutic gardening. This type of therapy utilizes various permutation and combinations to get relief from numerous ailments like depression, indigestion, headache, insomnia, muscular pain, respiratory problems, skin ailments, swollen joints, urine associated complications etc. The inhaled aroma from these "essential" oils is widely believed to stimulate brain function. This is very beneficial for children as the adults around them are working together as team for their development and welfare through horticulture therapy. Interaction with plants, both outdoor and indoor, can change human attitudes, behaviors and psychological responses.

RLOES OF EFFECTIVE MICROORGANISMS IN RECLAMATION OF SALINE-SODIC SOILS

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Abstract

A field experiment was undertaken to study the mechanism of EM in reclamation of saline-sodic loamy soil with the application of EM in all possible forms (soaking of seeds, 4.4 tons / acre composted FYM + PM, 130 Kg / acre EM Bokashi, EM irrigations and sprays) compared with conventional method of reclamation, which generally takes 2-3 years to fully reclaim such lands. EM Technology played a pivotal role in the reclamation of saline-sodic land and helped to obtain good yield of rice grain in the 1st year as compared to conventional method of reclamation. In the presence of easily decomposable organic matter the effective microorganisms (phototrophic bacteria, lactic acid bacteria and yeast) became in overwhelming majority and co-existed with other bacteria, fungi, actinomycetes and soil fauna and flora. During the decomposition of organic matter they synthesized and released useful substances such as organic acids (amino acids, nucleic acid, citric acids, acetic acids, lactic acids), alcohols, ethers, aldehydes, bioactive substances (vitamins, enzymes, hormones), sugars, polysaccharides, enhanced release of phosphates, fixed atmospheric N forming NH_4 and NO_3, broke down highly complex and resistant compounds (cellulose, starch, gums, lignins), released antibiotic (streptomycin, actinomycin, neomycin),

produced humus (fluvic acid, humic acids, humic) and released macro-and micro nutrients (N, P, K, S, Ca, Mg, Fe, Mn, Zn, Cu etc.) and other products (fatty acids, chelates) into the soil solution.

The reclamation and amelioration of saline-sodic soils as well as production of good crop is possible in the 1st year using EM Technology, whereas in the conventional method of reclamation not only leaching of soluble salts as in case of saline soils with excessive irrigations is required but also the removal of exchangeable Na^+ from the clay complex with the application of soil amendments such as gypsum and H_2SO_4 as in case of alkali soils, is needed. EM Technology is effective, easy to prepare and use and leaves behind enhanced bacterial population increasing soil fertility for all times to come.

EFFECT OF ADVANCEMENT OF CROP AGE AND HARVEST ON PLANT HIGHT AND DRY MATTER ACCUMULATION RESPECTIVELY IN MAIZE CROP

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Abstract

A field experiment entitled "Effect of advancement of crop age and harvest on plant hight and dry matter accumulation in maize crop" was conducted in Kharif season at the experimental farm of Amar Singh Post Graduate College, Lakhaoti, Bulandshahar, U.P. The findings of the experiment revealed that plant height and dry matter accumulation in maize increased with advancement of crop age and attained maximum at harvest during both the years. The mean plant height ranged from 40.83 to 72.86, 133.98 to 174.38, 135.62 to 175.49; 137.89 to 177.25 and 140.67 to 178.97 cm and average dry matter accumulation from 1.98 to 4.17; 47.14 to 86.19; 73.71 to 127.16; 106.74 to 145.24 and 120.01 to 161.01 g/ plant at knee high, tassel, silky, milky and harvest stages of crop growth, respectively. Plant height and dry matter accumulation were maximum in T_3 resulted due to integrated use of FYM + chemical fertilizer treatment which was *at par* with treatment that received FYM + Azotobacter + Rhizobium + PSB + Chemical fertilizers (T_8) and these were significantly superior to remaining treatments at all the stages of crop growth during both the years.

CROP RESIDUE MANAGEMENT TOIMPROVE SOIL HEALTH

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Abstract

As a consequence ofgreen revolution,soil fertility has been degraded due tointensive cultivation and at present time our country is facing many challenges to achievesustainable food security and quality of foodmaterial. In addition to advancing food securityand minimizing malnutrition, agriculture mustalso be an important solution to environmentalissues including globalwarming and non-pointsource pollution. It is widelyaccepted that high soil organic matter means highpotential productivity and health of soil.In this regard, theimpact of managing crop residuesin conjunctionwith no-till (NT) farming and conservationagriculture (CA) on increasing soil organic matter is well established. Crop residues aredefined as the non-economic plant parts that areleft in the field after harvest and remains that aregenerated from packing seed or that arediscarded during crop processing. Crop residue, the largest product of agricultural harvests, contains large amounts of assimilated carbon (C) and nutrients such as nitrogen (N), phosphorus (P), and potassium (K). Crop residues can be managed in two ways. One is tillage prior planting when plant residues are incorporated into the soil. Another modern farming practice is reduced tillage and no-till farming, where crop residues are left on the surface and planting is carried out without soil tillage. In addition to the ploughing of crop residue, cover crops can be grown*i.e.*legumes and green manures. It enriches the soil with organic matter, improves its biological activity, provides better accessibility of nutrients, and enables biological water drainage on heavier soils.Crop residue management serves a double function, both confronting global warming (by avoiding crop residue burning) and food security by increasing carbon sequestration in agriculture and increasing grain yields.

EFFECT OF INTEGRATED PLANT NUTRIENT SUPPLY (IPNS) ON DIFFERENT YIELD ATTRIBUTES IN MAIZE

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Abstract

A field experiment entitled "Effect of integrated plant nutrient supply (IPNS) on different yield attributes in maize" was conducted in Kharif season at the experimental farm of Amar Singh Post Graduate College, Lakhaoti, Bulandshahar, U.P. The findings of the experiment revealed that yield attributes of maize viz., total number of cobs in net plot, cob weight, number of rows/cob, number of grains/row, number of grains/cob and 1000 grain weight on average basis ranged from 57.07 to 71.67 thousand ha^{-1}, 38.85 to 60.62 q $ha^{-1,}$ 13.47 to 17.16; 32.70 to 35.07; 415.29 to 566.93 and 170.70 to 224.86 g, respectively. The values of these parameters recorded highest under treatment T_3 (FYM + Chem.) which were *at par* with T_8 (*Azotobacter* + *Rhizobium* + PSB + FYM + Chem.) and these were significantly superior to rest of the treatments during both the years of study.

COST EFFECTIVE PEST CONTROL USING LARVAL PARASITOID, *BRACONHEBETOR* SAY (BRACONIDAE, HYMENOPTERA)

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Abstract

Completely organic pest control cause no harm to people, animals and environment. Larval parasitoid, *Braconhebetor* is a highly polyphagous gregarious ecto-parasitoidattacking lepidopterans like *Helicover paarmigera, Spodoptera litura, Opisinia arenosella* etc. It can be easily mass multiplied in farmer's level in larvae of rice moth, *Corcyra cephalonica.* Powdered sorghum ormaize powderare taken in a jar, *Corcyra* eggs are sprinkled and host larvae is reared. Adults of *B. hebetor* is kept in a jar tightly confined by Ghadda cloth. Full grown larva of *Corcyra*are spread above the Ghadda cloth for ovipositionand are immobilised by placing a glass plate above. Paralysed *Corcyra* larvae are separated and kept for emergence of *B. hebetor*. Pupa or newly emerged adults are used for field release.

AGRONOMIC FORTIFICATION WITH ZINC AND IRON TO ENHANCING MICRONUTRIENT CONCENTRATION IN SWEET CORN GRAIN TO AMELIORATE THE DEFICIENCY SYMPTOMS IN HUMAN BEINGS

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Abstract

A field experiment was conducted at Main Agricultural Research Station, Dharwad, to study the agronomic fortification with Zinc and Iron to enhancing micronutrient concentration in sweet corn during *Kharif* 2015.-16 and 2016-17. The field experiment was laid out in split plot design with three replications and 21 treatment combinations involving three main and seven subplots. The pooled results indicated that, soil application of $ZnSO_4$ and $FeSO_4$ (10 kg each ha^{-1}) fortified with vermicompost (250 kg ha^{-1}) along with foliar application of $ZnSO_4$ and $FeSO_4$ (1.0 % each) at 20 and 40 days after sowing were recorded significantly higher zinc and iron concentration in grain and fodder during both seasons, which was on par with treatment combination of soil application of $ZnSO_4$ and $FeSO_4$ (10 kg each ha^{-1}) fortified with farm yard manure (500 kg ha^{-1}) along with foliar application of $ZnSO_4$ and $FeSO_4$ (1.0 % each) at 20 and 40 days. Similarly, significantly higher micronutrients uptake was also observed in above said treatments as compared to no fortification and no foliar application of micronutrients.

EFFECT OF DIFFERENT IRRIGATION LEVELS AND SPACINGS ON SUMMER GUAR GUM (*CYAMOPSISTETRAGONOLOBA*(L) TAUB.)

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Abstract

A field investigation entitled "Effect of different irrigation levels and spacings on summer guar gum (*Cyamopsis tetragonoloba* (L) Taub.)" was carried out on clay soil of Agronomy farm, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the summer season of 2015-2016. The experiment was laid out in split plot design with twelve treatments and three replications in order to study the effect of irrigation levels and spacings and their integration effect on growth, yield attributes and productivity for guar.The main plot consisted four irrigation levels viz., 0.6 IW/CPE, 0.8 IW/CPE, 1.0 IW/CPE and 1.2 IW/CPE while the sub plot treatments consisted of spacings viz., 30 x 15 cm, 45 x10 cm and 60 x 7.5 cm.Experimental results revealed that growth characters were significantly higher with irrigation scheduled at 1.2 IW/CPE followed by 1.0 IW/CPE, 0.8 IW/CPE and 0.6 IW/CPE. Yield attributes and seed yield were significantly higher with irrigation scheduling 1.2 IW/CPE. Water Use Efficiency (6.87) was higher with, irrigation scheduling 0.6 IW/CPE. The economic analysis viz. GMR and NMR was higher with irrigation scheduled at 1.2 IW/CPE, but B:C ratio (4.44) was higher in irrigation scheduled at 0.6 IW/CPE. The protein content, gum content, nutrient available at harvest, Uptake of nutrient was increase marginally with irrigation scheduled at 1.2 IW/CPE. Spacing of 45 x 10 cm recorded increased growth characters compared to 30 x 15 cm and 60 x 7.5 cm. Seed yield, straw yield and biological yield were increased due to spacing of 45 x 10 cm. Water Use Efficiency was found slightly improved with spacing of 45 x 10 cm. Nutrient uptake, nutrient availability after harvest of crop was notable higher with spacing of 45 x 10 cm followed by 30 x 15 cm and 60 x 7.5 cm. Spacing of 45 x 10 cm also produce higher GMR, NMR and B:C ratio compare to other spacings.

ROLE OF WATER FOR ANIMALS

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Abstract

Water is necessary for an animal's survival. An animal can live longer without food than without water. Water makes up about 75 percent of the weight of a mature animal and as much as 90 percent of a newborn. Water taken in by an animal should be clean and fresh. Water should be available to animals at all times. Water is necessary for maintaining body fluids and proper ion balance; digesting, absorbing, and metabolizing nutrients; eliminating waste material and excess heat from the body; providing a fluid environment for the fetus; and transporting nutrients to and from body tissues. It is found in every cell of the body. Water can enter the body in many different ways. Most of it enters by drinking. Water is also found in the feed an animal consumes and may be produced through biochemical reactions. Water may be lost from the body through urine, feces, sweat, and vapor from the lungs. The amount of water lost from the body of cattle is influenced by the activity of the animal, air temperature, humidity, respiratory rate, water intake, feed consumption, milk production and other factors.

BIOFERTILIZERS : A LIVING TOOL IN FLORICULTURE

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Abstract

Modern agriculture is getting more and more dependent upon the use of chemical pesticides and fertilizers. Intensive application of agrochemicals leads to several agricultural problems. Farmers use more chemical fertilizers than the recommended levels for many flower crops. Excessive use of chemical fertilizers not only imbalances soil fertility but also risks contaminating groundwater and atmosphere. So, use of natural products like biofertilizers in crop cultivation will help in safeguarding the soil health and also the quality of crop products. Biofertilizers are products containing living cells of different types of microorganisms that have an ability to convert nutritionally important elements from unavailable to available form through biological processes and helps in better seed germination *viz*. *Azospirillum*, *Azotobacter*, *Pseudomonas fluorescens*,

and several gram positive *Bacillus* spp.). Biofertilizers application enhances various growth parameters at all stages of growth compared to chemical fertilizer application alone. Application of biofertilizers along with 50% of NPK showed yield comparable with 100 % NPK fertilizer with respect to chlorophyll content, floral characteristics *viz.* days taken to flowering, number and weight of flowers per plant, diameter of flowers, ten flower weight and flower yield per plant and self life of flowers, indicating replacement of NPK chemical fertilizers to the extent of 50 per cent. There is a possibility of reducing NPK application by 25-50 % with the use of biofertilizers and organic manures, thus bringing down the cost of input resulting in a higher benefit cost ratio. They are cheaper, readily available and don't cause any nutrient toxicity to flower crops.

IMPACT OF INSECTICIDES APPLICATION ON FAUNAL COMPLEX IN RICE ECOSYSTEM UNDER EASTERN UTTAR PRADESH CONDITIONS

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Abstract

Ecological selectivity is the judicious use of pesticides, based on critical selection, timing, dosages, placement and formulations with the goal of maximizing bioagents populations. Insecticides are most common pesticides used widely in crop production. They are general biocides having ability to cause toxic to all living organisms threats to faunal biodiversity like insect pests and bioagents. Present study was undertaken primarily to know the impact of indiscriminate insecticides application on faunal complex in rice ecosystem under Eastern Uttar Pradesh conditions. The study were conducted 03 administrative divisions namely, Gorakhpur, Basti and Azamgarh in kharif season(rainy season) for two consecutive years, 2014 and 2015. Surveillance were conducted as per methodology of agro ecosystem analysis (AESA, FAO) modified as accessibility. There were several species of insect pests and bioagents observed during study under 03 rice growth stages *i.e.,* seedling, transplanting and flowering. The pest : defender (P:D) ratio were not decreased to the average (2:1) at flowering stage (3:1) from tillering stage (3.36:1). The abundance of lady bird beetles and spiders at transplanting stage were not sustained to the flowering stage. The mirid bugs considered as potential predator at tillering stage were found abundant at flowering stage.The egg parasitoids of yellow stem borer (*Scirpophaga incertulus*) were predominated by *Trichogramma* sp. And *Telenomus* sp. at flowering stage instead of tillering stage. The decreasing rate of insect pests populations from seedling stage (51.62%) and transplanting stage (31.32%) to flowering stage (17.04%) were efficacy of bioagents. Chlorpyriphos, Dimethoate, Acephate, Imidacloprid and Fipronil were observed mostly insecticides applied by farmers.

EFFECT OF DIFFERENT NUTRIENTS AND BIOFERTILIZER ON BIOLOGICAL YIELD OF HYBRID RICE (*ORYZA SATIVA L.*)

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Abstract

The present study was done to assess the biological yield of hybrid rice (*Oryza sativa L.*). It was conducted in the Pot culture house of department of Soil Science and Agricultural Chemistry, C.S. Azad University of Agriculture and Technology, Kanpur during the month of kharif season 2017. The experimental crop rice (*Oryza sativa L.*) was grown in the microplot (size 1×1 m^2each) with 9 different treatments T_1 (Control), T_2 (100% RDF), T_3 (100% RDF+ S_{40}),T_4 (100% RDF+Zn_5), T_5 (100% RDF+ Azotobacter), T_6(100% RDF + S_{40}+Azotobacter), T_7 (100% RDF + Zn_5+Azotobacter), T_8 (100% RDF+ S_{40}+ Zn_5+Azotobacter), T_9 (125% RDF) laid in randomized block design with 4 replicates. Hybrid rice variety PHB-71 was taken for study.The results obtained revealed that the biological yield of hybrid rice were significantly influenced by different treatment combinations. The total grain yield (q/ha) of rice is 54.5,71.8,74.0,75.8,77.7,80.2,82.0,85.0,84.0 and total straw yield (q/ha) of rice is 66.0, 94.0, 98.8, 101.4, 102.8, 104.5, 105.0, 107.0, 106.5 in different treatments respectively. The highest grain (85.0 q/ha) and straw yield (107.0q/ha) was obtained in T_8 (100% RDF+ S_{40}+ Zn_5+Azotobacter). The treatment T_8 cause 55.96% increase in hybrid rice grain yield and 62.12% increase in straw yield over T_1 (Control).The present findings concluded that the T_8 (100% RDF+ S_{40}+ Zn_5+Azotobacter) showed best result among all the treatments.

BREEDING FOR QUALITY IMPROVEMENT IN SMALL MILLETS

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Abstract

Small Millets are highly nutritious and even superior to wheat and rice in certain constituents, so they are now considered as nutria-cereals (nutritious grains). The ingestion of micronutrients in low-income rural families of millet-growing areas is less as compared to recommended diet intake. Any increase in quality of millets might have significant role in combating micronutrient malnutrition for human health over the world. Biofortified millets have a great potential to reduce micronutrient deficiency in the developing countries. The work done on biofortification of millets is still not much. Even after nutrient richness of millets, there is a need to work for more production with quality addition in millets to change the billions of people from nutrient insufficiency to nutrient adequacy. Small millets widely known as 'nutricereals' consist a number of distinct species of small-seeded grasses that are grown for grain purpose, each with their own unique traits and very good nutritional value.Poverty and diets poor in nutrition are prime reasons for prevalence of malnutrition, nutritionally dense crops offer an inexpensive and sustainable solution to the problem of malnutrition. Remarkably, millets are nutritionally superior to major non-millet cereals. They especially are rich in dietary fibers, antioxidants, phytochemicals and polyphenols, which contribute broad-spectrum positive impacts to human health. However, millets have received lesser research attention universally and considering this, the present review was planned to summarize the reports available on nutrition profile of millets.

EARLY MATURING, RED SEEDED AND HIGH YIELDING FINGER MILLET VARIETY 'GN-8' FOR CULTIVATION IN GUJARAT

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Abstract

The proposed culture, WN-585 is early maturing and have been developed through selection from local germplasm collected from the Dangs district. WN-585 was tested under various categories of trials at Waghai, Varanasi and Dahod centers in 12 different state MLT trials and under IVT trial (during 2017-18) at 12 AICRP small millets locations across seven states at national level. The early maturing culture WN-585 (3065 kg/ha) performed well with 21.3 % and 13.7 % grain yield superiority over national check 'VL-149' and 'VL-352', respectively in Gujarat. At national level, it showed 20.2 % grain yield improvement over national check 'VL-352'. The proposed culture was found to have good nutritional properties particularly high calcium, iron, phosphorous and also good amount of protein, fibre and minerals. With respect to pest and diseases, it was found superior to checks and moderately resistant for the same. Considering the increasing demand of early maturating as well as for late cultivations *ie.,* after rice plantation the culture WN-585 (GN-8) with early maturing, high yield potential culture, desirable grain quality and moderately resistant to foot rot and blast disease. It is proposed to release this culture for early maturing Nagli growing dry lands, hill and tribal areas of South and Middle Gujarat.

GENETIC EVALUATION OF VEGETABLE TYPE FRENCH BEAN (*PHASEOLUS VULGARIS* L.) CULTIVARS FOR POD YIELD AND QUALITY TRAITS UNDER HILLY REGION OF GUJARAT

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Abstract

Genetic analysis by using path coefficient and correlation studies of nine released bushy type cultivars (Arka Anoop, Akra Komal, Arka Arjun, Arka Sharath, Arka Suvidha, Pant Anupama, VL Beans-2, Phule Surekha and Kashi Sampan) of French bean (*Phaseolus vulgaris* L.), a high valued vegetable genotypes was studied by using variability, correlation and path

coefficient analysis to find out the variation, association among characters and to measure the direct and indirect contribution of twelve characters on fresh pod yield per plant. Genotypic and phenotypic coefficient of variation were of high magnitude for plant height, 100 green pod weight, 100 green seed weight, days to 50 % flowering, pod length, pod width as well as for number of primary branches per plant. The estimate of high heritability (bs) accompanied with high-expected genetic advance for green pod weight per plant and days to 50 % flowering indicating the presence of additive gene action in the expression of these characters which indicates that such traits can be improved by direct selection. The genotypic correlation studies of pod length (0.2266), pod width (0.1127), number of seeds per pod (0.0026), 100-green pod weight (0.0383), 100-green seed weight (0.3583), pod thickness (0.4283) and seed size (0.2260) indicated that green pod yield per plant exhibited stable positive association with traits expect days to 50 % flowering (-0.1917), number of primary branches (-0.0479) and plant height (-0.0342). While the phenotypic correlation revealed that, days to 50 % flowering (-0.1731), number of primary branches (-0.0358) and days to maturity (-0.0387) were negatively correlated and the rest of all characters were positively correlated with green pod yield per plant. The direct effects of path coefficient analysis revealed that the green pod yield per plant had positive and was significant with days to 50 % flowering (0.0588), pod width (0.9276), pod length (0.4526), number of seeds per pod (0.0062), 100 green pod weight (0.0652), 100 green seed weight (0.2128), pod thickness (0.3972), seed size (0.3709) and the rest of the effects of few characters were negative for number of primary branches (-0.0246) and days to maturity (-0.0068). Moreover, it was noticed that high indirect contribution was contributed through green pod yield per pod with most of the yield contributing traits. Hence, the traits *viz.*, 100 green pod weight, days to 50 % flowering, number of seeds per pod and 100 green seed weight should be given more consideration while deciding about selection criteria for vegetable type genotypes in French beans.

COMPARATIVE HAEMATOLOGICAL STUDIES USING PITUITARY GLAND EXTRACT AND OVAPRIM IN *CYPRINUS CARPIO*

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Abstract

Haematological parameters used as diagnostics tools to assess the health status of fish and these parameters varied according to season, sex, and hormonal change. The purpose of the present study was to know the effect of ovaprim and pituitary gland extract hormone injection in *Cyprinus carpio* by analysis of some parameters such as RBC, WBC, Hb, PCV, MCV, MCH, MCHC and blood glucose of the experimental fish and compared in relation to sex and pre and post spawning after hormonal injection. The brooders (male & female) were treated separately with ovaprim and PGE. The results show higher value of RBC, Hb, PCV, MCH, and MCHC in male before hormonal injection. After treatment RBC, PCV, Hb, MCV, MCH, MCHC were decreased, while glucose increased. The male & female brooders treated with ovaprim have higher value of WBC and glucose compare to PGE.

EFFECT OF CROP INTENSIFICATION AND ESTABLISHMENT TECHNIQUES ON WEED MANAGEMENT UNDER IRRIGATED RICE-WHEAT SYSTEM

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Abstract

The field experiments were conducted during 2015-16 and 2016-17 at Norman E. Borlaug Crop Research Center, Pantnagar G.B Pant University of Agriculture & Technology, Pantnagar, U.S. Nagar (Uttarakhand) India, to study intensification and establishment techniques influence on soil quality parameter under irrigated rice- wheat system**.** The highest bulk density of surface and sub surface soil was determined in T_1 [Rice (TPR) – Wheat] during both the years which was at par with T_2**.**The pH of surface and sub surface soil layer was obsesevred maximum in T_8 [Soybean (B) +Rice (DSR) (F)-2:1 - Wheat + Mentha (3:1) - Continue (NBS 60cm * 30 cm)], (7.74 and 8.12) during both the years. The highest organic carbon in surface (0.96%

and 1.09% during 2015-16 and 2016-17, respectively) and sub surface (0.93% and 1.04% during 2015-16 and 2016-17, respectively) soil layers was found in T_9, which was at par with T7. The maximum dehydrogenase activity in surface and in sub surface soil layers was recorded in treatment T_9, during both the years. The highest available nitrogen in surface and sub surface layers was found in T_9 (248.05 kg/ ha and 242.7 kg/ ha during 2015-16 and 276.23 kg/ ha and 242.55 kg/ ha during 2016-17, respectively). On the basis of two year experimentation it may be concluded among different intensification options, Maize (B) (cob + fodder) + Cowpea (B) +Sesbania (F)-2:1:2 - Vegetable pea (B) + Toria (F)-3:1 – Groundnut (B) +Mentha was found to be the best in terms of overall soil quality.

DEGRADATION PATTERN OF SOME HERBICIDES IN ACID SOILS OF ASSAM

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Abstract

Herbicides are toxic xenobiotics, which have been used for managing the weeds in the agricultural lands and aquatic bodies. Reports are available to show that many herbicides leave their residual effect for longer time and thus cause undesirable affect on the succeeding crop(s) or the environment. Farmers often used the herbicide(s) without considering either long or short term effects in soil, water, food chain as well as on its natural habitats. Residual effect of herbicides in the environment is mostly influenced by the degradation pattern and their half life ($T_{1/2}$). However, the half-life is not absolute because it depends on the soil type, temperature, and concentration of the herbicide applied. Microbes play an important role in degradation as well as counteracting the residual effect of herbicides. In cognizance to the above, a laboratory study was undertaken to evaluate the degradation pattern of five commonly used herbicides in soil. The soils under study was sandy loam in texture with p^H- 5.2, CEC - 6.28 c mol(p^+)/kg, Organic Carbon - 0.92 % , available N–260 kg/ha, available P_2O_5 - 19 kg/ha and available K_20 - 86 kg/ha. Six kg soils were taken in each earthen pot and moisture was maintained at 40% water holding capacity. The recommended rate of application of herbicides were viz. metribuzine - 500 g/ha, quizalofop – ethyl - 50 g/ha, Butachlor–1000g/ha, Pretilachlor–750g/ha and Pretilachlor-1500g/ha. Herbicides were applied at recommended and double the recommended doses. Soil samples were collected periodically from the day of herbicide application (within 4 hours of herbicide application) till 30 days after application (DAA) of herbicides, processed and stored in polythene bags for analysis of various physico – chemical parameters and herbicide residue by following standard protocols.

By analysing the residues of herbicides after extraction, in the GC-1000 with Electron Capture Detector (ECD), it was observed that the degradation of the herbicides in soil followed a first order kinetic. Among the five herbicides, butachlor, pretilachlor and pendimethalin recorded significantly higher degrees of herbicide residues from the DAA to the 30th DAA of the herbicides over metribuzine and quizalofop–ethyl(Prakash and Suseela Devi, 2000) due to reduced rate of degradation at higher initial concentration . It was also evident from degradation pattern that the single herbicide doses degraded slower at the beginning of the experiment (during the first 15 days of the experiment) than the doubled the herbicide dose. It can probably be explained by the microorganisms' adaptability to the double the herbicides doses. Photodecomposition, volatilization and microbial degradation were the major pathways of degradation and dissipation of the herbicide. From this study, it can be concluded that butachlor and pretilachlor retains significantly higher residues with shorter $T_{1/2}$ throughout the process of degradation and metribuzine as well as quizalofop – ethyl retains lower residues with longer $T_{1/2}$ in soil.

EFFECT OF CLIMATE CHANGE ON AGRICULTURE

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Abstract

The present scenario show that the effect of the climate change on agriculture, climate change and agriculture are interrelated processes, both of which take place on a global scale. Climate change effects agriculture in a number of ways., including through change in average temperature, rainfall and climate extremes (e.g., heat waves,) changes in pests and disease, changes in atmospheric carbon dioxide (CO_2) and ground level, ozone concentrations; change in nutritional quality of some food, and

change in sea level. Climate change is already affecting agriculture, with effects unevenly distributed across the world. FAO projects that the inpact of climate change on global crop production will be about 10 per cent by 2030 and by more than 20 per cent in 2050. Agriculture production is sensitive to weather and thus directly affected by climate change. Climate change affects all dimensions of food security in term of food availability, food access food utilization and food stability. Climate change will probably increase the risk of food insecurity for some vulnerable groups, such as the poor. So it can be stated that there is need sustainable agriculture to maintain the ecological balance. We have some ways to face this problem such as, agriculture practices, through change of water use (irrigation) and agriculture inputs such as herbicides, insecticides and fertilizer environmental effects, in particular in relation of frequency and internist of soil drainage, soil erosion, reduce of crop diversity rural space.

BIO-INTENSIVE NUTRIENT MANAGEMENT IN TULIP (*TULIPA GESNERIANA* L.) CV. RED BEAUTY

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Abstract

Biofertilizer is a substance which contains micro-organisms which when applied to seed, plant surface or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. The present investigation entitled "Bio-intensive nutrient management in Tulip (*Tulipa gesneriana* L.) cv. Red Beauty" was conducted at the Regional Research Station, Wadura, Sopore, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir during 2015 and 2016. Biofertilizers were applied to the bulbs at planting time using the dip method followed by shade drying before planting. The experiment was laid out in Randomized Complete Block Design with 12 treatments replicated three times. The treatments comprised of 100% NPK of recommended fertilizer dose (RFD), 75% NPK(RFD), 50% NPK(RFD), 25% NPK(RFD), Biofertilizers (PSB+KSB+VAM) + 100% NPK, Biofertilizers (PSB+KSB+VAM) + 75% NPK, Biofertilizers (PSB+KSB+VAM) + 50% NPK, Biofertilizers (PSB+KSB+VAM) + 25% NPK, Vermicompost + 100% NPK, Vermicompost + 75% NPK, Vermicompost + 50% NPK and Vermicompost + 25% NPK. The results revealed that tulip responded well to the biofertilizers and significant improvement was observed in vegetative, floral, bulb characteristics and nutrient status of soil. Treatment combination containing biofertilizers (PSB+KSB+VAM) + 100% NPK resulted in highest plant height (49.72 cm), highest leaf area (155.50 cm^2), minimum number of days taken to flower bud appearance (26.47 days), longest scape length (46.92 cm), longer flower duration (28.56 days), highest number of bulbs $plant^{-1}$ (1.91), maximum weight of bulbs (779.33 g m^{-2}), highest phosphorous (31.00 kg ha^{-1}), highest potassium (215.56 kg ha^{-1}). Highest net profit and benefit cost ratio was also recorded under the same treatment. Results of the present investigation has led to the conclusion that treatment T_5 (Biofertilizers (PSB+KSB+VAM) + 100% NPK) proved to be superior in terms of increasing vegetative, floral and bulb attributes. Combined application of biofertilizers and inorganic fertilizers not only showed substantial improvement in soil biological health, nutrient status but also improved the benefit cost ratio by producing highest number of bulbs m^{-2}.

CONSTRAINTS OF VEGETABLE PRODUCTION AND MARKETING IN MEERUT DISTRICT OF WESTERN UTTAR PRADESH

Krishna Kant and J.P. Singh
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Abstract

Vegetables may be described as those plants, which are consumed in relatively small quantities as a side dish with the staple food. India is the second largest producer of the vegetables (162.19 Million tonnes) in the world, contributing 14.0% of the total world production of vegetables respectively. Uttar Pradesh occupies second place in area with 326.2 million hectares and production (5176.1 million tonnes) about 12.1 per cent of total vegetables production during 2012-13. Meerut district of western Uttar Pradesh was selected purposively in order to avoid operational in convenience. One block (Kharkhoda) having highest area under vegetables crop was selected purposively and from selected block 5 villages were selected randomly. The

respondents were stratified into three size groups i.e., (i) marginal (blow 1 ha), (ii) small (1-2 ha) and (iii) medium (2-4 ha). The data were collected during the agricultural year 2015-16.

CONSTRAINTS OF VEGETABLE PRODUCTION AND MARKETING IN MEERUT DISTRICT OF WESTERN UTTAR PRADESH

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Abstract

Vegetables may be described as those plants, which are consumed in relatively small quantities as a side dish with the staple food. India is the second largest producer of the vegetables (162.19 Million tonnes) in the world, contributing 14.0% of the total world production of vegetables respectively. Uttar Pradesh occupies second place in area with 326.2 million hectares and production (5176.1 million tonnes) about 12.1 per cent of total vegetables production during 2012-13. Meerut district of western Uttar Pradesh was selected purposively in order to avoid operational in convenience. One block (Kharkhoda) having highest area under vegetables crop was selected purposively and from selected block 5 villages were selected randomly. The respondents were stratified into three size groups i.e., (i) marginal (blow 1 ha), (ii) small (1-2 ha) and (iii) medium (2-4 ha). The data were collected during the agricultural year 2015-16. Production problems, On overall average for vegetables, Technical problems were found as the first rank with 70.58 per cent followed by 67.42, 63.95, 61.04, and 43.58 in case financial problems, miscellaneous problems, marketing problems and management problems respectively.

ASSESSMENT OF TECHNOLOGICAL GAP AND PERFORMANCE OF INTEGRATED DISEASES MANAGEMENT APPROACH FOR WILT IN CUMIN

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Abstract

The experiment was carried out to assessment of technological gap and performance of integrated diseases management approach as a resistant variety, chemical seed dressing, soil and seed treatment as a bio-agents for antagonistic fungi on growth of cumin *Fusarium oxysporum f. sp. cumini* pathogens under field conditions. This experiment was conducted on farmer field villages Bhusi, Patelo Ki Dhani and Baldo Ki Dhani in Pali distract. This area is major growing cumin cultivation and here major problem face farmer every year cumin wilt disease due to reduction of yields. During this experiment disease incidence of wilt was observed to be lowest (Disease Incidences 5.00%) when resistant variety GC-4, seed dressing Carbendazim @ 2.0gm/ kg with *Trichoderma harzianum* @ 6gm/ kg seed + application of 100 kg FYM enriched with *T. harzianum* @ 3.0 kg/ha for soil treatment before 15 days of sowing cumin. Maximum disease incidence (24.00%) was observed when traditional farmers practice (no seed treatment). The adoption of recommended improved crop production technology and plant protection measures was poor. The OFT was effective in changing attitude, skill and knowledge of integrated diseases management approach and yield increased upto 28.64% more over the traditional farmers practices**.** Results indicates that integrated diseases management approach increased net income by Rs. 20593/-ha over farmers practices.

EFFECT OF NANO ZINC AND MAGNESIUM TO IMPROVE SEED GERMINATION OF SOYBEAN (*GLYCINE MAX* L. MERRILL)

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Abstract

The effect of nano particle on seed germination was tested in sterile sand medium supplemented with different concentration of like 1, 5, 10, 15, 20, 30, 40 and 50 ppm nano ZnO and nano MgO solutions. Low vigour seeds of NRC 7 and high vigour seeds of JS 95-60 were taken for this study. The effect of nano ZnO and MgO was found to improve seed germination

significantly in case of low vigour seeds of NRC 7. Higher germination and seedling growth was observed with higher concentration of 40 and 50 ppm. In case of high vigour seeds of JS 95-60, the germination was not significantly improved but seedling quality was improved. Seedling diameter in case of nano particles varied from 2.39 to 3.59 mm as compared to control 2.05mm. none of the concentrations showed any toxic effect on seedlings. There are several reports of synthesis of new mRNAs in cells due to nano particle. Soybean seeds were soaked in moist medium containing different concentration (5 ppm, 10 ppm, 15 ppm, 20 ppm) of nano particles of ZnO and MgO. After 24 hours of incubation, seeds were oven dried and seed proteins from treated seeds was extracted and studied through SDS-PAGE analysis. It was found that nano particles were effective to increase expression of few proteins.

VALUE ADDITION OF FINGER MILLET IN HILLY AREA OF KOLHAPUR DISTRICT

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Abstract

The area, production and productivity of finger millet in Maharashtra was 966 thousand hectares, 1008 thousand tone and 1043 Kg/ha during the year 2014-15. This study was under taken following specific objectives viz, costs and returns of finger millet, marketing and value addition of finger millet. Kolhapur district is purposively selected for study because maximum area under Radhanagari and Panhala tahsils was under hilly area out of the 12 tahsils two tahsils Radhanagari and Panhala purposively selected for study purpose. In two 45 each samples selected on the basis of highest area under finger millet. The total sample consists pertained to the year 2016-17 for the purpose of value addition each tahsil one SHG Group is selected for collection of information of value added product. The major items of cost of cultivation of finger millet was Interest of fixed capital (29.70) rental value of land (23.38), male and female fired labour was (6.12) percent and other items re negligible contribution to the cost C.The per hectare gross income received Rs. 53181 and cost C generated to Rs 40161 and margin received to the farmer was Rs 13020. The profit at cost A was Rs 36913, cost B was Rs.15722 and cost C was Rs. 13020 respectively. Per farm finger millet production was 10.07 and quantity sold in channel I was 2.79 and channel II it was 3.61 quintals. The per quintal total marketing cost of channel –I was Rs. 62.35 and in channel it was Rs. 183.45. The producer share in consumers rupees was found to be 94.66 percent in channel – I and 83.77 percent in channel –II, The channel – I is most profitable and high shares in consumer rupee. Therefore finger millet is profitable corp. there is need to educate the finger millet growers regarding improved production management practices.

The monthly sale of malt 240 kg, Laddu 200 kg, Chakkali 150kg, Hirrihitth 50 kg Biscuits 200kg and Papad 110 kg. The selling price malt, Laddu,Chakkali, Hirrihitth, Biscuits and Papad was Rs. 80,135,,85,64,90 and 85 and the net profit of malt, Laddu, Chakkali, Hirrithitth, Biscuits and Papad was 145,135,125,86,30 and 35 respectively. The highest margin of value added products like malt (145), Laddu (135) and Chakkali (125) and lowest margin was made in Hirrihitth (86) Biscutis (30) and Papad (35) respectively.

ROLE OF CLAY ON ENHANCEMENT OF WATER PRODUCTIVITY UNDER RAINFED AND WATER STRESS CONDITION

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Abstract

Water is one of the most useful natural resource that is needed to be conserve and increase today not only for human consumption but also to increase food security. Now a days climate change is a major threat to agriculture input, especially Water. The annual rainfall of world is 840mm, whereas, in India it is 1150mm but In U.P. it is 1025 mm. Only 1% fresh water is available, of which India uses nearly 83% for irrigation where in Western countries it is just around 30%. Under rainfed condition crops like Rice is major in India. During puddling of soil in rice cultivation stagnation of water is needed in rainfed situation. Puddling is useful at >20% clay content and above the lower plastic limit. When clay is more in soil then puddling

intensity affects downward movement of water in rice. When standing water in field, smaller the downward water loss and more the lateral water loss. Downward water flow is less at higher elevation improves water availability. Retention of high standing water depends on high seasonal rainfall and lateral movement. In stress condition, addition of nano-clay composite(benitonite, monmorillonite), prepared by polymerisation reaction having 300 times more water absorbing capacity and less releasing capacity also mitigate drought and enhance water productivity of soil. If the clays are used in such a scientific way then physical properties of soil as well as water conservation and productivity also can be improved.

EFFECT OF SEED TREATMENT BY ETHYL METHANE SULPHONATE (EMS) ON FRUIT QUALITY OF PAPAYA (*CARICA PAPAYA* L.) CV. PUSA DWARF

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Abstract

The papaya seeds of cv. Pusa Dwarf were treated with different doses (0.25 %, 0.50 %, 0.75 % and 1.00 %) of Ethyl Methane Sulphonate (EMS) to observe the influence of treatment on fruit characters and quality of papaya. The results revealed that fruit attributes effectively improved with seed treatment of Ethyl Methane Sulphonate (EMS). EMS treatment @ 0.50 % had fruits with minimum central cavity, maximum fruit length, fruit girth, fruit weight and pulp thickness. However, untreated seeds (control) had minimum fruit length, fruit girth, fruit weight and pulp thickness. The fruit quality obtained from the seeds treated with 0.50 % EMS had significantly maximum TSS, sugar, fat, ash, carbohydrate, protein, carotene during both the years of study. Under the minimum moisture was also said treatment observed in fruit.

STUDIES ON PERFORMA OF NEW TIMELY SOWN WHEAT GENOTYPES UNDER RESTRICTED IRRIGATION CONDITION

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Abstract

A Field Experiment was Conducted on During Rabi season 2016-2017 at crop research Farm, Nawabganj Chandra Shekher Azad University of Agriculture and Technology Kanpur-208002 to find out the performance of Timely Sown Genotype at different irrigation schedule, the Experimental field having PH (8.1), normal salt concentration, low Organic carbon, medium in available phosphorus and potassium. The experiment conducted split design with three replications . In main plat three irrigation level viz, without irrigation, one irrigation at crown root initiation at 20-25 days after sowing and two irrigation at crown root initiation and booting stage. It was observed that the significantly maximum grain yield (40.05 q/ha) was recorded under the treatment when applied two irrigation at crown root initiation stage (21 days after sowing) and booting stage (80 days after sowing) and significantly minimum grain yield (23.90 q/ha) were recorded under the treatment of without irrigation application. Among the varieties significantly higher grain yield (38.07 q/ha) was recorded in variety of H 11612 and significantly minimum yield (28.15 q/ha) recorded under variety of K 8027. The variety H 11612 along with two irrigation at crown root initiation and booting stage significantly higher grain yield (46.31 q/ha) and significantly minimum grain yield were recorded (19.72 q/ha) under the variety of K8027 along without irrigation application .

PHOSPHORUS MANAGEMENT IN URDBEAN[*VIGNA MUNGO* (L.) HEPPER

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Abstract

A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner in Jaipur district of Rajasthan during *kharif* season of 2014 on loamy sand soil. The experiment consisted of four levels of phosphorus (0, 20, 40 and 60 kg/ha) and four biofertilizers (control, PSB, VAM, PSB + VAM). The total 16 treatment combinations were tested in

randomized block design with three replications. Urdbean variety T- 9 was sown on 15th July, 2014 in the rows spaced 30 cm apart.

Results revealed that progressive increase in level of phosphorus upto 40 kg/ha significantly increased the growth and yield determining characters of urdbean*viz*., plant height, number of branches/plant and crop dry matter accumulation/m row length at most of the stages, number and weight of root nodules/plant, CGR and RGR, number of pods/plant, grains/pod and test weight over lower levels. It also recorded significantly higher grain (1160 kg/ha), straw (2340 kg/ha) and biological yield (3500 kg/ha) of urdbean over 20 kg/ha and control. However, it showed statistical equivalence with 60 kg P_2O_5/ha, wherein, the maximum values of most of the growth and yield attributes as well as yield were obtained.

Nitrogen, Phosphorus and Potassium concentration in grain and straw, their uptake by crop and protein content in grain were also improved significantly due to phosphorus fertilization upto 40 kg/ha. It also fetched 14.5 and 70.9 per cent higher net returns over 20 kg/ha and control, respectively with the highest B: C ratio of 2.44. Every increase in level of phosphorus upto 40 kg/ha significantly increased the available phosphorus in soil after harvest of urdbean crop over lower levels. Agronomic efficiency, apparent recovery and physiological efficiency of P responded negatively to phosphorus fertilization and declined with increasing levels of phosphorus. Whereas, organic carbon in soil after crop harvest did not differ significantly due to varying levels of phosphorus. Results further indicated that dual inoculation with PSB + VAM significantly enhanced the plant height, number of branches/plant, dry matter accumulation, total and effective nodules/plant, fresh and dry weight of nodules, CGR, number of pods/plant, grains/pod and test weight over PSB, VAM and control. It also produced the highest grain, straw and biological yields of urdbean (1144, 2281 and 3425 kg/ha). Dual inoculation with PSB + VAM also registered significantly higher concentration of N, P and K in grain and straw and their total uptake as well as protein content in grain and available P_2O_5 in soil after crop harvest. Combined inoculation of seed and soil with PSB + VAM also fetched additional net return of ` 4040, 5856 and 11481/ha over PSB, VAM and control, respectively with the highest B: C ratio of 2.40.

STUDIES ON GENETIC VARIABILITY, CORRELATION AND PATH COEFFICIENT IN FENNEL GERMPLASM (*FOENICULUM VULGARE* MILL.)

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Abstract

Fifteen genotypes were used to studies the genetic variability, heritability, genetic advance, correlation and path coefficient for growth and yield attributing characters in fennel. The highest PCV and GCV were recorded in seed yield per plant (45.62 & 43.70), number of secondary branches per plant (17.26 and 16.37) and number of primary branches per plant (15.12 & 13.62). The highest heritability was noticed for seed yield per plant (91.11%), number of umbelles per plant (91.50%) and number of secondary branches per plant (90.01%). Plant height (24.02), days to 50% flowering (8.61) and days to first flowering (8.48) exhibited highest genetic advance as percentage of mean. The seed yield per plant had significant and positive correlation with number of secondary branches per plant (0.877), plant height (0.837), number of umbellates per umbel (0.534) and test weight (0.465). Number of secondary branches per plant (2.600), days to 50% flowering (1.558), test weight (1.420) and number of umbellates per umbel (0.331) had direct effect on seed yield per plant. Therefore, greater emphasis should be given on these characters for genetic improvement of fennel.

BIOCHEMICAL RESISTANCE IN BER AGAINST POWDERY MILDEW (*OIDIUM ERYSIPHOIDES* F. SP. *ZIZIPHI,* YAN AND WANG) AND IT'S CONTROL

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Abstract

Powdery mildew incited by*Oidiumerysiphoides*f. sp. *ziziphi,* Yan and Wang is the most important disease that causes maximum reduction in yield and quality of ber (*Ziziphusmauritiana*Lamk) fruits grown under semi-arid and arid regions of India.Indian jujube or ber (*Ziziphusmauritiana*Lamk.) is one of the most common fruit, indigenous to an area joined from India to China. The genus *Ziziphus* has been derived from '*Zizaif'* which is the Arabic name of the fruit. The ber belongs to the

family *Rhamnaceae* which has about 50 genera and more than 600 species. It has been under cultivation for over 4000 years in China and India. The ber fruits are palatable, delicious and highly nutritive. An increase in total phenols and decline in total soluble solids and ascorbic acid content were observed both in fruits and leaves of infected plants with *Oidiumerysiphoides*compared to the healthy ones. Biochemical changes in total soluble solids, ascorbic acid and phenol content wereplayed a very important role in imparting relation to resistance against this disease.In twenty one ber cultivars were observed for resistant at Asalpur Farm. Among these Darakhi-2 and Nazuk showed resistant, while ten were moderately resistant and nine were showed susceptible reaction against powdery mildew.Among natural products, two spray of garlic extract (10%) was found most effectivein reducing disease intensity followed by neem oil (0.5%).In fungicides, two spray of dinocap (0.1%) is found most effective in reducingdisease intensityfollowed by hexaconazole (0.1%).

SOIL HEALTH CARD: KEY FACTOR FOR SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

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Abstract

Continuous cultivation in the field of agricultural lands shows continuous deterioration in soil health in every state of the country. For permanent solution of this problem, arrangement has been made to provide recommendation of balanced use of fertilizer after soil testing from the farmer's field in district / Tehsil level soil testing Laboratory from the year 2016-17. Soil testing is done under Soil Health Card Scheme of National Mission for Sustainable Agriculture Scheme. In the year 2016-17, on basis of grid from the selected region 34.72 lac sample were collected against the annual largest of 33.15 lac and 65.90 Soil Health Cards was provided to the farmer after analysis. Soil Health Management (SHM) is one of the most important interventions under National Mission for Sustainable Agriculture (NMSA). Farmers will be able to build up his income significantly with the help of soil health card by giving the appropriate dose of fertilizers/manures to the soil as per recommended in the soil health card.

CHARACTERS CONTRIBUTING TO SEED YIELD OF LINSEED IN CENTRAL PLAIN ZONE OF UTTAR PRADESH

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Abstract

The characters contributing to the seed yield of linseed were identified through path analysis. The analysis was carried out with 73 genotypes of linseed evaluated during *Rabi* season of 2012-13. Observations on quantitative characters were recorded. Days to 50% flowering and days to maturity were recorded on plot basis, however, plantheight, number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, seeds per capsule and seed yield per plant were recorded on five randomly selected plants in each plot. 1000-seed weight (g) and oil content (%) were recorded from the randomly chosen seed samples from the plot yield. The data were subjected for the path analysis, method suggested by Dewey and Lu (1959). Results recorded for the different quantitative characters studied, number of secondary branches per plant is the major seed yield contributing character with highest positive direct effect (0.283) and positivecorrelation (0.370**)with seed yield. Moreever, capsules per plant exhibited the direct effect (0.226) equal to the correlation (0.234*) which explains the true relationship with seed yield. Number of primary branches per plant also had positive direct effect (0.181) with positive correlation (0.269*) indicating that, the positive selection for these characters will help in identifying the high yielding genotypes. Days to maturity also had positive direct effect (0.181) with positive correlation (0.165)with seed yield. Days to 50%flowering had high negative direct effect (-0.226)with positive correlation (0.125) which indicate that this character is contributed positively for seed along with days to maturitywhich had indirect effect (0.106). Plant height,1000-seed weight and oil content did not contribute to the seed yield of linseed.This study indicated that linseed genotypes with more number of secondary branches, number of capsules per plant and number of primary branches per plant are more desirable characters to enhance the seed yield of linseed.

IDENTIFICATION AND MANAGEMENT STRATEGIES OF SUGARCANE WILT IN BIHAR

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Abstract

Wilt of sugarcane, fungal disease is known to cause significant damage production and productivity in India. Although sugarcane wilt is known in India for a long time, research work on this important disease is totally lacking. Wilt is sugarcane is caused by the fungal pathogen, *Fusarium sacchari* (Butler) W. Gams. This disease was reported for the first time in India by E. J. Butler (1906) from Bihar. Butler and khan (1913) for the first time described a stem rot disease in India in sugarcane under the term wilt and noted *Cephalosporium sacchari* as the causal agent, after this disease was reported to cause damages in the states of Uttar Pradesh, Punjab and Haryana in sub-tropical India. Symptoms first appear on 4-5 months old sugarcane. Eventually plants become completely dry and die leaving hollow stalks leading to loss of millable canes. Externally the affected canes show shriveling and breaking of stalks at any point depending on the severity. After splitting sugarcane stalks longitudinally then internal pith tissue, particularly of the lower internodes, is light to dark purplish- brown. Varying shades of pinkish red or brownish red tissue, discoloration can be seen in the internodes. The wilt affected canes do not emit a foul odour. This pathogen is primarily transmitted through infected seed canes in the fields and secondary spread from field to field occurs through rain and irrigation water. Management strategies to control wilt can be catalogued in to five categories, *viz*., resistant varieties, agronomical, physical, biological (*Trichoderma viride and T. harzianum*) and chemical (Aretan 0.1% and Carbendazim 0.1%).

WOMEN EMPOWERMENT : A PIVOTAL ROLE TO DEVELOP THE NATION

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Abstract

The empowerment of women means psychological sense of personal control in the persons, domestic, social and political realms. It is a process by which one is authorized to think, act and control resources in an autonomous way. The most critical component of women's empowerment is found to be education. It leads to improved economic growth, low fertility rate, health and sanitation and an awareness of factors that disempowered women. Work participation rate and political participation also grows in women's education. The expansion of the market economy and industrialization and globalization brought increased inequalities, resulting in lose of livelihoods, erosion of natural resources and with it decreased women's access to water, fuel, fodder and traditional survival resources. It also brought new forms of exploitation-displacement, tourism, sex trade and retrenchment to mention a few. Women are being pushed into less productive sectors. Increased pressure on rural resources accelerated migration to urban areas in search of livelihood. People from backward regions, tribal communities, disadvantaged castes and the displaced communities were being pushed against the wall. If Women empowered means the country has empowered.

RURAL DEVELOPMENT FOR NATION BUILDING

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Abstract

Rural Development is not only needed for ensuring food security but also to boost the Gross National Product of the nation. Fortunately, India has plenty of natural resources, idle labour, necessary technology and good market both in India and abroad. Presently, the people engaged in agriculture lack motivation and organisational strength at the grass-root level. The rural developmental programmes intend to reduce the poverty and unemployment, to improve the health and educational status and

to fulfil the basic needs such as food, shelter and clothing of the rural population. Industrial development and adoption of modern technologies are likely to generate additional employment in urban areas and pay rich dividend to elite and rich investors. This in turn might widen the gap between the urban and rural as well as the rich and the poor, with respect to wealth accumulation, resulting in further hardship to the poor. Therefore, we need to address the problems of the poor to ensure social justice and better quality of life.

IMPACT OF WEATHER FACTORS ON POPULATION BUILD UP OF APHIDS INFESTING RAPESEED MUSTARD (*BRASSICA CAMPESTRIS* L.)

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Abstract

The present investigations were conducted at the experimental site of entomological research farm, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh during 2011-12 and 2012-13. Correlation between population of Mustard aphid, *Lipaphis erysimi*, and weather factors i.e. temperature (minimum and maximum), morning and evening humidity and rainfall were worked out. The 'r' value of different correlated factors expressed that highly significant negative correlation was found between aphid and weather factors like maximum temperature (r= -0.692) and minimum temperature (r= -0.648) but highly significant positive correlation was noted with morning humidity (r=0.665) and evening humidity (r=0.599) and simple positive association with rainfall (r=0.020**)** during 2011-12. Almost similar correlation was observed during 2012-13 in relation to maximum temperature (r= -0.547), minimum temperature (r= -0.446), morning humidity (r=0.528), evening humidity (r=0.552) and rainfall (r=0.060**).**

EFFECT OF GERMINATION AND SEEDLING VIGOUR FOR THE MOST IDEAL SOIL MEDIA OF DIFFERENT VARIETIES OF DRUMSTICK (*MORINGA OLEIFERA* .L) UNDER NET HOUSE CONDITION

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Abstract

The investigation was carried out in *kharif* season 2017-18 conducted at the College nursery, Department of Horticulture, College of Agriculture, Indore (M.P.) to study the germination and emergence parameters , seedling vigour, as influenced by different varieties and media's . The experimental materials for the present investigation were practiced with factorial experiment in completely randomized design replicated thrice with different combinations of variety and media. The experiment was comprised of two varieties i.e. Bhagyalaxmi and local in combination with six different potting media's viz. V1T1 (Bhagyalaxmi with only soil 100 percent), V2T2 (Bhagyalaxmi with only sand 100 percent) , V1T3 (Bhagyalaxmi with soil+ cocopeat 3:1), V1T4 (Bhagyalaxmi with soil+ FYM 3:1),V1T5 (Bhagyalaxmi with soil+ Poultry manure 3:1), V1T6 (Bhagyalaxmi with soil+ vermicompost 3:1), V2T1 (Local with only soil 100 percent), V2T2 (Local with only and 100percent), V2T3 (Local+soil+cocopeat 3:1), V2T4 (Local+soil+FYM3:1), V2T5(Local+soil+poultry manure 3:1), V2T6 (Local+soil+ vermicompost 3:1). The treatment V2T2(Local+ only sand) was found to be significantly superior in days taken to emergence in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM) whereas treatment V1T6 (Bhagyalaxmi +soil + vermicompost 3:1) shows lowest in days taken to emergence. However, in germination percentage treatment V1T6 (Bhagyalaxmi +soil + vermicompost 3:1) was found to be significantly surpassing in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM) and minimum was observed in V2T2(Local+ only sand). The treatment V1T6 (Bhagyalaxmi +soil + vermicompost 3:1) shows superiority in terms of seedling Vigour parameters as compared to rest of the treatments in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM) viz., Vigour index-1, Vigour index -2, root length, root fresh weight, root dry weight, shoot fresh weight, shoot dry weight, total fresh weight, total dry weight, and leaf area. Whereas, treatment V2T2 (Local+ only sand) was found to be lowest in contrary to with other treatments in seedling Vigour parameters.

EVALUATION OF ANTI-NUTRITIONAL FACTORS IN SELECTED SMALL MILLETS

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Abstract

Millet is a collective term referring to a number of small seeded annual grasses which is cultivated as grain crops, primarily on marginal land areas in temperate, sub tropical and tropical regions. Millets are important foods in many underdeveloped countries because of their ability to grow under adverse weather conditions like limited rainfall. In contrast, millets are major source of energy and protein for millions of people in Africa. In addition to their nutritive value, millets have high levels of antinutritional factors. Presence of anti-nutrients such as phytates, oxalates, polyphenols, lectins, hemagglutinins, saponins, trypsin inhibitors and tannins limit the quality of plant origin food grains by reducing the essential micronutrients absorption due to their metal chelating and enzyme inhibition activities such as phytic acid, tannin and polyphenol hindering the minerals availability. Hence the present study was undertaken with an objective to find the antinutritional factors in small millets. Small millet such as finger millet, foxtail millet, kodo millet, proso millet, little millet and barnyard millet were selected for the study. Antinutrients such as phytic acid and tannin content were studied. Phytic acid content in small millet was estimated by wade reagent method and tannin content was estimated by AOAC 1980 method. The results revealed that Phytic acid content of selected millets ranged from 765.13 to 1318.85 mg per 100g. Tannin content ranged from 90.92 to 218.46 TAE/100 g. Among the millets finger millet (218.46 TAE/100g) and kodo millet (206.92 TAE/100g) showed higher tannin content than that of other millets and little millet had lowest tannin content of 90.92 TAE/100g.

PHYSICO-CHEMICAL PROPERTIES OF PROSO MILLET ((*PANICUM MILIACEUM*)

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Abstract

Minor millets are considered as 'Foods of Future' for better health and food security and are low water consuming crops. Proso millet *(Panicum miliaceum)* is important minor millet grown in India. Proso millet belongs to one of the first cultivated plants which is more commonly known as white millet or hog millet. Proso millet is also called broomcorn millet or common millet. It is generally cultivated in the cooler regions of Asia, eastern Africa, southern Europe, and the United States. Proso millet has adapted well to temperate plains and high altitudes compared to other millets. Recently, it has become a new alternative crop and new raw material for food production in many developed and developing countries. Also changes in climatic conditions can support the growth of this drought resistant plant. Among the minor millets, proso millet has unique properties and health benefits. Nutritional quality of food is the most important parameter for maintaining human health and complete physical well being. Since nutritional well being is the driving force for development and maximization of human genetic potential. Hence the present study was undertaken with an objective to evaluate the proso millet for physico-chemical properties. The result revealed that moisture content in proso millet found to be 9.2 per cent, Protein 12.3 g, Fat 0.9 g, Total ash 1.4 g, Crude fibre 2.3 g, Carbohydrate 74.0 g and energy 353 Kcal per 100g. Specific gravity and bulk density were 1.43 and 1.55 g/ml respectively. Thus, it clearly shows that Proso millet is a highly nutritious and is used for improving the nutritional quality to promote millet utilization for future prospective.

PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF GADDI GOATS UNDER TRANSHUMANCE PRODUCTION SYSTEM IN HIMACHAL PRADESH

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Abstract

Goats are important component of animal genetic resource diversity of India particularly in the stateof Himachal Pradesh.

"Gaddi" also referred to as *"Chamba or White Himalayan goats*"is a medium to large sized goat breed. The animals are well built, hardy, long hairy and sturdy. Itis the most prominent goat breed of high altitude in Western Himalayan region with its true home tract across the hills of Himachal Pradesh but distribution extending to adjoining hilly areas of Jammu and Kashmir and Uttrakhand.Majority of Gaddi goats are managed under migratory (transhumance) production system. The present study was conducted in the selected Gaddi Goat flocks under AICRP on Goat Improvement. All the animals were managed under migratory field conditions and were identified by ear tagging. Strategic breeding, feeding and preventive health care inputs were provided at farmer's doorsteps. The data pertained to the period 2011-18. The least square means for overall body weights at birth, 3 month, 6 month, 9 month and 12 months of agewere 2.96±0.03, 15.02±0.14, 19.28±0.19, 23.53±0.14 and 27.14±0.21 Kg, respectively. Significant effects of sex of kid and years were observed. The males were found to be significantly heavier at birth, three, six, nine and twelve months of age (3.14, 15.51, 20.29, 24.49 and 29.49 kg. respectively) than their female counterparts (2.86, 14.70, 18.95, 23.39 and 26.90 kg., respectively). The reproductive performance of Gaddi goats indicated that out of overall average of685 available does during the year 2011-17,482actual kidded representing 71.1 % kidding percentage. A total of 573 live kids were born (375 single and 99 twins) and kidding rate of 1.18 was observed. The incidence of twin births was observed to be 18.39%. It could be inferred that if strategic breeding, feeding and preventive health measures are undertaken, overall improvement in performance is feasible.

COST OF CULTIVATION OF MUSTARD CROP IN FATEHPUR DISTRICT OF UTTAR PRADESH

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Abstract

Mustard become an essential oilseeds crop with its positive nature of suitability to climatic condition for its cultivation, being an important cooking medium according to the test of human diet and having various industrial uses of its main and by product. Since it is a low cost and high price crop can be cultivated in water stress and low soil fertility condition, mustard become a nice alternative to the farmers in place of wheat in rabi season crops. Keeping in view the importance of the crop a study on Economics of production of mustard was conducted in distt. Fatehpur Uttar Pradesh. One hundred respondents were selected through purposive cum proportionate random sampling technique from five villages of Hathgam block of Fatehpur district. Personal interview was done on pre-structured schedule for primary data collection. Tabular and functional analysis were used to draw the inferences. Respondents were categorised as marginal, small and medium size of farm. Costs of cultivation was increases with farm size, highest cost incurred in the production of mustard was found in medium farm size Rs.32555.94, per ha.and highest share of cultivation of mustard was human labour Rs. 8870.95, per ha. and overall cost of cultivation of mustard crop was Rs. 30448.01 per ha. and maximum share in cultivation of human labour Rs. 8613.84 per ha. On overall average, gross income was recorded Rs. 43994.73 and net income came to Rs.13847.75. On marginal farms, gross income was highest, which was recorded Rs.44173.71, followed respectively. On an average input output ratio the basis costs A_1/A_2, B_1, C_1, C_2 and C_3 were recorded 1:3.06, 1:2.96, 1:2.06, 1:2.07, 1:1.58 and 1:1.44, respectively At last mustard cultivation was found profitable and showed the further increase in profit per unit of time and area if the constraints of production and marketing is solved.

KADAKNATH : A SUITABLE BIRD FOR DIVERSIFIED POULTRY FARMING

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Abstract

In India among the many subsectors of agriculture livestock sector is gaining momentum, within the livestock sector, poultry occupies a premium position. In total poultry production,70% was contributed by organized commercial broiler farming. Thus the market was flooded with customized and homogenized broiler meat. In general this kind of mass market approach neglects to focus on customers with divergent preferences. The consumers develop a negative attitude on mass market food items. Further consumer's unfavorable attitude on mass towards broiler meat on account of taste, rearing pattern and health aspects prefer native chicken meat as it is reared in natural environment. In this situation niche market for native chicken products emerges for addressing the need of particular segment of the people which are not provided by mass market. Thus a niche market has emerged for desi bird meat and eggs in late 2000s. Among all the diversified poultry farming the native chicken

rearing is gaining momentum among the farmers as an alternative enterprise Krishi Vigyan Kendra (KVK), Gwalior has started the promotion of Kadaknath Poultry farming among the different unemployed rural youths as an income generating activity under the ICAR sponsored ARYA scheme. For the supply of chicks to different farmers a small hatchery unit has also been established at KVK, Gwalior. KVK has trained about 50 farmers in Kadaknath poultry farming. A total of 4 small entrepreneurial Kadaknath poultry farming units are established at adopted village under ARYA project. Farmers are selling the adult birds at around Rs.500/- bird and eggs at around Rs.10/egg. These are now considered as the viable livelihood option for small and marginal farmers.

STUDY ADAPTATION PRACTICES IN AGRICULTURE FOR GLOBAL CLIMATE CHANGE AND ITS EFFECT ON FOOD SECURITY IN INDIA

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Abstract

Mean global temperature has been increasing since 1850 mainly in concern to green house gasses. Climate change increases the frequency of disaster such as droughts and floods. This would have adverse impact on livelihood and food availability. According to World Bank (2013) severe drought will pose in S-W part of India and the southern part will experience an increase in wetness. Impact of climate change is mainly on water availability for irrigation and its serious impact on food security in 4 ways such as food availability, accessibility, utilisation and food system stability. By 2080 global population of 200-600 million could suffer from hunger as according to IPCC report. Adaptation to the climate change to mitigate the risk of food shortage is the best managerial technique. This paper concentrates on adaptation practices in changing food preferences, production, and preparation. Avoiding declines in food supply can be done through better agricultural practices such as water management, sustainable livestock management. Use of degraded land for forest development, cellular mass and watershed development, developing specific adaptation techniques and specific varieties of crop and livestock will also combat the effect of global warming on food security. Food and agriculture adaptation and mitigation of climate change go hand in hand and hence integrated strategic approach represent best way forward during these days.

ADVANCES IN GREENHOUSE PRODUCTION TECHNOLOGY FOR HORTICULTURAL CROPS

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Abstract

Greenhouse cultivation in India is of recent origin and is being increasingly practiced for production of quality produces in the off-season for export. The commercial utilization of greenhouses started from 1988 onwards and now with the introduction of Government's liberalization policies and developmental initiatives, several corporate houses have entered to set up 100% export oriented units. The development of a distributed in-field drip irrigation system is used, which offers the potential to increase yield and quality while saving water, but the irrigation control, data interface, and software design are the challenging issues. Spraying potentially toxic chemicals in the confined space of a hot and steamy glasshouse is achieved by the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial greenhouses. In particular, precision spraying and precision fertilization applications have been developed and tested. Automation of agricultural processes will be the challenge of the next years, especially in structured environments such as greenhouses. Yet with the development of technology, various robots for different purposes like automated harvesting systems, robots for weed control, robots with autonomous systems for navigation in the fields, robots mowing, pruning, seeding, spraying and thinning, robots in nurseries have been developed and are being used successfully. For an optimum plant production and product quality light intensity, light spectrum and photoperiod have to be adapted to the needs of the plants at every moment. Within that optimization it has to be taken into account that controlled and fully artificial light

conditions are totally different from greenhouse conditions. Experimental results obtained under fully artificial light conditions are often not transferrable to greenhouse conditions.

SOIL HEALTH MANAGEMENT AND PRACTICES : KEY FACTOR OF CROP PRODUCTIVITY

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Abstract

Soil health is the state of soil or the capacity of soil to meet the plant demand (nutrient status) and maintain a certain microbial population as a vital living eco-system. Healthy soils are foundation for profitable, productive, and environmentally sound agricultural systems. By understanding how the soil processes that support plant growth and regulate environmental quality are affected by management practices, it is possible to design a crop and soil management system that improves and maintains soil health over time. Soil is a complex ecosystem where living microorganisms and plant roots bind mineral particles and organic matter together into a dynamic structure that regulates water, air, and nutrients. In an agricultural context, soil health most often refers to the ability of the soil to sustain agricultural productivity and protect environmental resources. A healthy soil provides many functions that support plant growth, including nutrient cycling, biological control of plant pests, and regulation of water and air supply. These functions are influenced by the interrelated physical, chemical, and biological properties of soil, many of which are sensitive to soil management practices. Maintaining the soil health should help to conserve the soil physical, chemical properties of the soil like as maintaining the soil salinity, alkalinity and acidity of the soil as per the requirement of some particular crops which are grown in a particular with maintaining their productivity (with proper nutrient availability for crop). Cultural and mechanical practices like residue inversion tillage and soil traffic, addition of organic matter, cover crop, crop rotation with pulses, nutrient management, cropping system, salinity, weed management, proper layout etc will play key to in crop productivity and to maintain the soil health. CEC, decomposition**,** Mineralization, soil minerals and use of composts are also the determining factor for the productivity of crop. Soil is the important resource for various basic needs of human and essential for our sustenance. But the soil is continuously losing its quality parameters at the cost of development and industrialization. Microorganisms, minerals and nutrients directly influence the agricultural developments and economy. Lack of awareness and poor uptake of technologies is result into nutrient deficiencies and deterioration of soil, low productivity and economic losses. Soil health should be maintained to maintain and enhance the crop productivity by influencing its key factors which are maintained in above. Therefore, soil management practices are important in sustainable agriculture to maintain the productivity.

PRECISION FARMING TECHNOLOGIES TOWARDS ENHANCING PRODUCTIVITY AND INPUT USE EFFICIENCY

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Abstract

The human population continues to grow steadily with the shrinking resources being used for agricultural production situates great challenge against Indian agricultural system to attain food and environmental security. To counter these twin challenges in the country there is urgent need of application of modern Hi-tech technologies for enhancing the productivity for long term on scientific basis. Precision farming (PF) looks a win technology towards improving the capability of agricultural land to produce crops on sustainable basis. The PF is based on the concept of determination of spatial and temporal variability in the crop production which in turn aimed for increasing crop productivity and reducing environmental menaces. It is innovative technology which comprises the application of several Hi-tech tools like Geographical Information System (GIS), Global Positioning System (GPS), Remote Sensing (RS), Variable Rate Technology (VRT), Decision Support System (DSS), and Farmer. Precision land leveling, precision planting, precision nutrient management by using Green Seeker, Crop Circle, leaf color chart (LCC), site specific nutrient management has a lot of potential for enhancing crop yield and input use efficiency under field conditions while reducing the cost of production and deleterious impacts on environmental.

IMPROVING N USE EFFICIENCY BY USING GREENSEEKER

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Abstract

Crop growth and fertilizer N requirement vary temporally among and within seasons and spatially among and within fields. Uniform application of nitrogen fertilizer can lead to some areas of a given field receiving excessive nitrogen fertilizer while other areas are left under fertilized. Fertilizer N management that does not accommodate temporal and spatial variability may lead to suboptimal yields and net returns, poor N use efficiency and escape to the environment of excess fertilizer nitrogen. Application of N based on spatial variability by using optical sensors helps to increase yield and input use efficiency. GreenSeeker is an integrated optical sensing and application system that measures crop status and variably applies the crop's nitrogen requirements. Yield potential for a crop is identified using a vegetative index known as NDVI (normalized difference vegetative index) and an environmental factor. Nitrogen (N) is then recommended based on yield potential and the responsiveness of the crop to additional nitrogen. The GreenSeeker applies the right amount of N at the right place and at the right time thereby optimizing yield and N input expense. Thus, quantifying the optimum in-season N requirement by using GreenSeekeris an important step towards economically and environmentally viable crop production systems.

EFFECT OF CALCIUM, BORON, AND ZINC APPLICATION ON GROWTH AND FRUIT PRODUCTION OF TOMATO (*LYCOPERSICON ESCULENTUM*) CV. PUSA RUBY

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Abstract

Tomato (*Lycopercicon esculentum*) is one of the most important vegetable crop belong to solanaceae family being grown all over country. It is a good source of vitamin A, vitamin C, ca, fe, protein, Na, K, Mg, antioxidant and carotenoids that helps in retarding cancer and degenerative disease. Tomato plants requires macro and micro nutrients for growth and development as well as to complete it's life cycle. This experiment was conducted college of Agriculture Gwalior (M.P.) during 2016-2017 to study the "Effect of Ca, Bo, and Zn application on growth and fruit production of tomato c.v. Puss Ruby. The experiment was conducted in Randomized Complete Block) Design with 3 replication. Different concentration of calcium (0, 0.3, 0.6, and 0.9%) , boron (0, 0.25, and 0.5%) and zinc (0, 0.25 and 0.5%) were applied as dollar spray three time during the season. The interaction between Ca, Bo, and Zn also showed significantly results for the most of the attributes. Therefore application of Ca (0.6%), Bo (0.25%) and Zn (0.5%) as a dollar spray can be used alone or in combination to improve growth and fruit production of tomato.

EFFECT OF BIOFERTILIZER ON GROWTH, YIELD AND QUALITY OF CHILLI (*CAPSICUM ANNUM* L.)

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Abstract

Chilli (*Capsicum annum* L.) Is an important spice cum vegetable crop of commercial importance in India. The principal colouring matter in chilli is carotenoid pigment capsanthin, constituting about 35% of the total pigment. Oleoresin permits better distribution of colour and flavour in food as compared to chilli powder. Application of biofertilizer produce higher crop yields without deterioration of soil health. This experiment was conducted college of agriculture gwalior to study the "Effect of biofertilizer on growth, yield and quality of chilli (Capsicum annum L.). The experiment was conducted in RBD (Randomized block design) with 9 treatment and 3 replication. The different concentration of biofertilizer viz., Azospirillum

and VAM (vehicular arbuscular mycorrhizae) with 4 levels (25, 50, 75 and 100%). There was significant increase in the number of fruit per plant, fresh fruit yield per plant, dry fruit yield per plant and per hectare with the application of biofertilizer along with 100% RDF. Based on the results, it could be concluded that the application of biofertilizer along with 75% RDF could increase the growth yield and quality component of chilli.

EVALUATION OF SORGHUM GENOTYPES AGAINST STEM BORER (*CHILO PARTELLUS* SWINHOE) IN MADHYA PRADESH-INDIA

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Abstract

Field trials were carried out during Kharif 2014-15 to evaluate resistance for stem borer in 25 genotypes of sorghum. Based upon hierarchical clustering considering parameters of stem borerper cent plant infestation, dead heart caused by stem borer, stem tunneling, peduncle tunneling, number of larvae/plant and number of tunnel per plant eleven genotypes viz; Gird-36, CMSxS-654, Gird-36, CMSxS-633, CMSxS-654, CMSxS-633, DSSV-37 x NSSV-14, NSSV-04 x DSSV-196, CSH-2255 DSSV-37 x NSSV-14, NSSV-04 x DSSV-196 and CSH-2255 were found less susceptible to stem borer and genotype IS-25298 was found highly susceptible to stem borer.

INCOME THROUGH HORTICULTURAL TECHNOLOGIES IN SUBTROPICS

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Abstract

Pointed gourd is a tropical vegetable crop with origin in the Indian subcontinent. It is known by the name of parwal, palwal, or parmal in different parts of India and Bangladesh and is one of the important vegetables of this region. This fruits is the edible of the plant. Pointed gourd fruits use for the preparation of sweets. It is most nutritive and wholesome vegetables. Pointed gourd well in warm and humid climate. Grow well at day temperature between 25-35°C. Grow best in sandy loam to loam soils which should be well drained. The pH of the soil should be 5.8 and 7.5. Pointed gourd grows well in warm and humid climate. The plant is a perennial, dioecious, and grows as a vine. The average yield is 200-270q/ha. Major insects are pointed gourd such as white fly, Aphids, & Red Pumpkin bettle. And major disease is Anthracnose. These are well managed through IPM practices.

EFFECT OF ORGANIC, INORGANIC FERTILIZERS AND PLANT DENSITIES ON PERFORMANCE OF RADISH (*RAPHANUS SATIVAS* L.)

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Abstract

A field experiment entitled "Effect of Organic, Inorganic Fertilizers and Plant Densities on Performance of Radish [*Raphanus sativus* L.]" under loamy sand soils was conducted at Horticulture farm, S. K. N. college of Agriculture, Jobner during *rabi* season, 2014. It consisted of 18 treatment combinations with three levels of organic manures (Control, vermicompost @ 5 t ha^{-1} and FYM @ 15 t ha^{-1}), three levels of inorganic fertilizers (Control, 50% RD of NPK and 100% RD of NPK) and different spacing(20x10 cm & 30 x10 cm) in Randomized Block Design with three replications.The application of vermicompost @ 5 t ha^{-1} with 100 per cent RD of NPK among the different treatments of organic and inorganic manures proved significantly superior over rest of the treatments in respect to plant height, plant spread, number of leaves per plant, chlorophyll content in leaves, leaf area index, fresh weight of leaves, fresh weight of root, diameter of root , length of root, shoot : root ratio, total

yield per plot and per ha ascorbic acid, nitrogen content in root and leaves ,net return and B: C ratio as compared to control, 15 t FYM ha^{-1} , 50 per cent RD of NPK.Result further indicated that sowing of crop at 30 x 10 cm spacing also significantly enhanced the plant height, plant spread, number of leaves per plant, leaf area index, fresh weight of leaves, fresh weight of root, diameter of root, length of root, shoot : root ratio, total yield per plot and per ha ascorbic acid, nitrogen content in root and leaves ,net return and B: C ratio as compared to sowing at 20 x 10 cm spacing.

INFLUENCED OF ORGANIC, INORGANIC MANURES AND PLANT DENSITY ON GROWTH AND YIELD OF RADISH (*RAPHANUS SATIVAS* L.)

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Abstract

A field experiment was conducted during *rabi* season of 2014-15 on sandy loam soil to "Effect of organic, inorganic fertilizers and plant densities on performance of radish (*Raphanus sativas* L.)". The experiment consisted three treatment of organic manures (control, VC @ 5 t/ha and FYM @ 15 t/ha), three treatment of inorganic manures (control, 50% RDF of NPK and 100% RDF of NPK) and two treatment of plant densities (20 x 10 cm and 30 x 10 cm), thereby making eighteen treatment combinations tested in randomized block design with three replications. Results indicated that application of vermicompost @ 5 t/ha and 100% RDF of NPK significantly higher growth parameters, yield attributes and yield of radish over control, FYM @ 15 t/ha and control, 50% RDF of NPK, respectively. However, the application of FYM @ 15 t/ha significantly increased the root to shoot ratio and remained at par with vermicompost @ 5 t/ha over control. But, the application of 50% RDF of NPK significantly increased the root to shoot ratio and remained at par with 100% RDF of NPK over control.

The result also indicated the plant spacing 30x10 cm significantly higher the growth parameters, yield attributes and yield of radish over plant spacing 20x10 cm. However, the plant spacing 20x10 cm significantly increased the root to shoot ratio and remained at par with plant spacing 30x10 cm. But, chlorophyll content unchanged under different plant densities.

INTEGRATED WEED MANAGEMENT STUDIES IN ONION (*ALLIUM CEPA* L.) DURING RABI AND KHARIF SEASON

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Abstract

Onion is one of the most important commercial vegetable crops grown all over the world. In India onion occupies about 1.23 million hectare area having 19.40 million metric tonnes of production and average productivity of 16.10 metric tonnes ha-1 (Anonymous 2013-14). Onion has culinary, dietary and medicinal importance in daily life of Indian people and due to its export trade, it is also a major vegetable crop to gain foreign currency. Onion crop is slow growing, shallow rooted, narrow, upright leaves and non branching habit. Due to this type of growing habit, onion crop cannot compete well with weeds. In addition to this, frequent irrigation water and fertilizer application allows for successive flushes of weeds in onion. The reduction in crop yield has direct correlation with weed competition. Onion exhibits greater susceptibility to weed competition as compared to other crops due to its inherent characteristics such as their slow growth, small stature, shallow roots and lack of dense foliage. The effective weed control involves identification of weed flora, method of weed control and judicious combination of effective weed control methods. Hand weeding in onion is a common practice in India, but it is a tedious, expensive and time consuming task due to closer spacing and shallow root system. Non-availability of labourers during critical period of crop makes hand weeding difficult leading to heavy yield losses. Spraying of pre-emergence herbicides keeps the crop in weed free conditions during the early stages. At later stage, second flush of weeds will affect the bulb formation. Hand weeding helps to keep the weed population below economic threshold level throughout the crop growth period. Pre-emergence combined with hand weeding may be costly because of the reduced labour availability and higher labour cost. After bulb formation manual or mechanical methods of weed control will damage the bulb. Application of early post emergence may be helpful to reduce damage to the bulb, weed competition and cost of weeding. Hence a brief review was presented to find out the effect of different weed management method in onion.

PERFORMANCE OF COW PEA VARIETY KASHI KANCHAN AT FARMER'S FIELD IN DISTRICT GONDA, UTTAR PRADESH

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Abstract

A field experiment was conducted by Krishi Vigyan Kendra, Gonda (U.P.) at the farmer's field in Gonda district during kharif season, year 2017 on cow pea. There were ten farmers assigned to cultivate the cow pea, variety kashi kanchan. The plot size was maintained 800 sqm/trail. All treatments were replicated three times in randomized block design. The observations were recorded on pod size (cm) and yield (q/ha), net income (Rs/ha) and B: C ratio among all the treatments. The maximum pod size (38.5 cm), yield (98.7q/ha), net income (62650 Rs/ha) and B: C ratio (3.25) was recorded F_2 followed by F_7. The minimum pod size (31.7 cm), yield (93.5q/ha), net income (55235 Rs/ha) and B:C ratio (2.85) was recorded F_5 followed by F_9.

STUDIES ON VARIETAL PERFORMANCE OF GROWTH AND YIELD ATTRIBUTING TRADE IN TURMERIC (*CURCUMA LONGA* L.)

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Abstract

An experiment was carried out with ten varieties of turmeric during Kharif season 2016 in Randomize Block Design (RBD) with three replications at Deendayal Research Institute Lal Bahadur Shastri, Krishi Vigyan Kendra, Gopalgram, Gonda (U.P.) under irrigated conditions. The ten varieties highly differed in their growth characters, production potential aspects. The observations were recorded attribute like Plant height (cm), number of leaves per plant, number of tillers per plant, leaf length (cm), leaf width (cm), number of rhizome per plant, length of rhizome per plant (cm) width of rhizome per plant (cm), fresh weight of rhizome per plant (gm), fresh weight of rhizome (q/ha), dry weight of rhizome (q/ha), curing percentage (%). The experimentation was revealed that, Variety Roma exhibited maximum value of plant height (111.16 cm), Leaf length (60.83 cm), leaf width (16.60 cm), number of rhizome per plant (15.22), Length of rhizome per plant (9.12 cm), weight of rhizome per plant (3.18 cm), Fresh weight of rhizome per plant (484.80 gm), Fresh weight of rhizome (306.95 q/ha), dry weight of rhizome (64.90 q/ha) and curing percentage (24.74 %). On the basis of test performance, Roma is adjudged as a promising turmeric cultivar for general cultivation in area of North East region of Uttar Pradesh.

INTEGRATED WEED MANAGEMENT IN TURMERIC

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Abstract

An experiment was conducted during Kharif season 2017-18 at the Deendayal Research Institute Lal Bahadur Shastri, Krishi Vigyan Kendra, Gopalgram, Gonda (U.P.) Main Station in Randomize Block Design (RBD) with three replications under irrigated condition. Having five deferent treatments to study the bio-efficacy of pre and post emergence herbicide in IWM on weed control and morphological growth turmeric. The soil of the experimental field was sandy loam and sandy in texture, low in nitrogen medium in phosphorus and potash. The turmeric variety NDH -18 was planted at spacing of 45x20 cm on 26 June 2017 with the recommended dose of fertilizer NPK 200:100:100 kg/ha. The results revealed that during kharif season in turmeric crop both broad and narrow leafs weeds were observed, however dominance of broadleaf weed was observed in entire field. All the weed control treatments significantly reduced the weed population and weed biomass when compared with unweeded control. The hand weeding (20, 40 and 70 DAP) recorded significantly lower weed count, dry matter accumulation and weed control efficiency of 91.70% followed by integrated weed management treatments of Metribuzin 0.7 kg/ha pre emergence followed by straw mulch 10 ton/ha followed by one hand weeding which recorded lowest weed population and

weed dry weight at harvest and weed control efficiency 56.30% IWM practice resulted in increase of rhizome yield over the weedy check. Maximum rhizome yield was observed in weed free treatment (20.30 ton/ha), while among the IWM treatments applications of Pendimethalin 1 kg/ha (0-2 DAP) followed by straw mulch 10 t/ha (15 DAP) followed by one hand weeding recorded higher rhizome yield. (20.12 t/ha) which was closely followed by Metribuzin 0.7 kg/ha pre emergence followed by straw mulch (10 DAP) followed by hand weeding being per with each other.

EVALUATION OF VERITIES FOR RESISTANCE AGAINST POTATO APICAL LEAF CURL VIRUS IN RAJASTHAN

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Abstract

Potato Apical Leaf Curl Virus of Potato is an important disease of potato throughout the word .Symptoms appear as curling/ crinkling of apical leaves with distinct mosaic symptoms due to primaryinfection and in case of secondary infection, the entire plant show severe leaf curling and stunting symptom. A field experiment was conducted at ARS Kota, during 2 consecutive winter (rabi) season of 2012-13 to 2013-4. In this experiments ten potato varieties (K. Gaurav, K. chipsona-4, K. Garima, K. Pukhraj, K. Bahar, K. Pushkar, K. Satluj, K. Surya, K. Sadabahar and K. Khyati) used in three replication A field experiment was conducted at ARS Kota, during 2 consecutive winter (rabi) season of 2012-13 to 2013-4. Based on 2 years mean data revealed that maximum incidence apical leaf curl virus was in variety Kufri Khayati (72.17%) followed by Kufri Sutlej (29.34%), K. Surya (4.00%) and K. Kufri Goaurav (3.84%) while other varities did not showed any incidence of potato apical leaf curl virus. The maximum total mean yield obtained from variety K. Surya (24.07t/h) while minimum from K. Bahar.

COMBINING ABILITY AND HETEROSIS FOR YIELD AND OIL CONTENT IMPROVEMENT IN SESAME (*SESAMUM INDICUM L.*)

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Abstract

Eight distinct accessions of sesame were employed in a diallel mating to study combining abilities, heterosis and assess potentials for seed yield and oil content improvement. Specific combining ability (SCA) mean square values were greater than general combining ability (GCA) for most traits indicating the preponderance of noadditive gene action except for test weight and seeds per capsules. TKG 306 was the best general combiner for number of pods per plant, number of seeds per pod, number of seeds per plant and oil content. Cross TKG-55 x TKG-306 exhibited good combination for seeds per pod, test weight, seed weight per plant and oil content (%). Cross ES-230 x TKG-306 had the highest significant positive mid and better parent heterosis for seeds per plant, primary branches, plant height while cross SI-1147 x TKG-306 for test weight and oil content (%).This indicated that there was a preponderance of additive genetic effects. Based on these results, it is suggested that emphasis should be placed on these traits for formulating reliable selection indices for the production of better genotypes.

EFFECT OF PLANT EXTRACTS TREATMENT ON *IN VITRO* MYCELIAL GROWTH OF *TRAMETES VERSICOLOR* L. CAUSING WHITE ROT FUNGI

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ABSTRCT

The present investigation conduct on “Effect of plant extracts treatment on in vitro mycelial growth of *Trametes versicolor* L. causing white rot fungi” (Poison Food Technique). Two plants are selected for the preparation of plant extract *viz*. *Acorus calamus* L. and *Parthenium hysterophorus* L. both the plants possess antifungal property. The perusal of data revealed

significant difference among different concentrations and plant extracts and solvents for extraction at 5 per cent level of significance. The data for the different concentrations revealed the highest inhibition (96.85%) at 2.00 per cent concentration (T_5). and lowest inhibition (70.51%) was found at 0.25 per cent concentration (T_1). Among the plant extracts maximum value (95.46%) was found for *A. calamus* L. (E_1) treated wood sample, whereas the minimum (80.07%) was recorded for the *P hysterophorus* L. (E_2). Among the solvents used for extractions, highest value (88.06%) was found for the wood samples treated with petroleum ether extract (S_2), whereas the minimum (87.48%) was noticed for the wood samples treated with methanol extract (S_1).Interactions between plant extracts and concentrations, concentrations and solvents used for extraction and plant extracts and solvents used for extraction were found statistically significant at 5 per cent level of significance. The second order interactions between concentrations, extracts and solvents for extraction were also found to be significant at 5 per cent level of significance. The present investigation is help in development of new wood preservatives which is ecofriendly with environment and degradable after using the wood and this investigation also help in the biopulping.

FARMER SUICIDES IN MADHYA PRADESH

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Abstract

The study comprises 50 Households related to victims' family of Rewa district of Madhya Pradesh as numbers of victims were found to be maximum in this particular district in the year 2014-15 and intensive survey of these respondents was carried out in the year 2015-16. It is observed from the data that the prominent causes of farmer suicides in Madhya Pradesh as recognised by the majority of the respondents were found to be family problems i.e. illness (46%), drug abuse/alcoholic addiction (32%), fall in social reputation (22%), extra martial affairs (36%) and frequent quarrel between victims and family member (20%). None of farmers was found to commit suicides due to poverty and property disputes. The main problems of suicides were found to be lack of access to mental health services in rural areas and shame attached to treatment (82%), lack of rehabilitation centres for drug and alcoholic addition (78%) and lack of avenues for off/non farm income (52%). Therefore it is suggested that the government should remove the bottlenecks and increase access in remote areas. In addition to these a psychologist must be appointed in Govt. Hospitals and rehabilitation centre for drug abuse and alcoholic addiction should be established at least at block level particularly in identified hot spots of farmer suicides districts of the state. Efforts should also be made so that crop insurance scheme should reach at individual level and health insurance should be made mandatory with Govt, support for the farming community. A campaign should also be launched for crop/varietal diversification in various agro climatic regions of Madhya Pradesh. The role of various social institutions must be increased for this in future for increasing awareness of different development programmes of state and central govt. amongst the farmer community.

PERFORMANCE OF DIFFERENT GENOTYPES OF GAILLARDIA (*GAILLARDIA PULCHELLA*FOUG.) IN RESPECT TO FLOWERING, QUALITY AND YIELD PARAMETER

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Abstract

An experiment was carried out at the Instructional Farm, Department of Floriculture and Landscaping, College of Horticulture & Forestry, Jhalrapatan, Jhalawar, (Agriculture University, Kota) during the period from March, 2017 to September, 2017 to study the performance of the twelve genotypes of gaillardia (*Gaillardia puchella*Foug.) in respect to flower, quality and yield parameter. Among the twelve genotypes of gaillardia, the maximum plant height (81.03 cm) was recorded in the genotype 'Genotype-3'.The minimum days taken to first flower opening (42.60 days), days taken to 50 per cent flowering (64.3 days), the maximum flower diameter (6.29 cm), number of ray florets per flower (214.26), number of whorls of ray florets (5.96), *in-situ* life of flower (12.06 days) and number of flowers per plant (131.53) was recorded in 'Genotype-11'. The maximum flower stalk length and shelf life of flower (15.66 hours) was recorded in 'Genotype-10' (32.64 cm). The maximum duration of flowering (143.66 days) was found in 'Genotype-3' which was at par to the (139.40 days) 'Genotype-11'. The maximum

fresh weight of flower (4.40 g) was recorded in 'Genotype-9'. The maximum length of ray florets (3.03 cm) was recorded in 'Genotype-8'.

EVALUATION OF DIFFERENT GENOTYPES OF GAILLARDIA (*GAILLARDIA PULCHELLA*FOUG.) UNDER JHALAWAR CONDITION

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Abstract

An experiment was carried out at the Instructional Farm, Department of Floriculture and Landscaping, College of Horticulture & Forestry, Jhalrapatan, Jhalawar, (Agriculture University, Kota) during the period from March, 2017 to September, 2017 to study the performance of the twelve genotypes of gaillardia. The maximum plant height (81.03 cm) and leaf width (4.38 cm) were recorded in the genotype 'Genotype-3'. The genotype 'Genotype-2' produced the maximum number of primary branches per plant (18.87) fresh weight (1626.93 g) and dry weight (321.46 g) of plant was recorded in 'Genotype-2' respectively. The highest plant spread (73.70 cm) was recorded in the genotype 'Genotype-6'.The maximum leaf length (11.67 cm) was recorded in 'Genotype-7'.The maximum flower diameter (6.29 cm),days taken to first flower opening (42.60 days),days taken to 50 per cent flowering (64.93 days), number of flowers per plant (131.35), weight of flowers per plant (578.72 g), weight of flower per plot (45.89 kg), the highest flower yield per hectare (395.26 q/ha) were recorded in 'Genotype-11'.

INFLUENCE OF RICE ESTABLISHMENT METHOD AND CROP MANAGEMENT ON MICROBIAL PROPERTIES UNDER RICE-CHICKPEA SYSTEM IN *VERTISOLS*

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Abstract

The field investigation was carried out during 2014-16 at research farm, Indira Gandhi Krishi Viswavidyalaya, Raipur to evaluate the effect of rice establishment methods and crop management practices in chickpea under rice- chickpea cropping system on soil microbial properties. In this study, three rice establishment methods (puddled transplanting rice, unpuddled transplanted rice and direct seeded rice) were laid in main plot and crop management practices (rainfed farmer's practice, rainfed improved practice, farmer's practice with lifesaving irrigation and improved practice with lifesaving irrigation) in sub-plot of split plot design. The improvement in soil microbial properties such as Rhizobium, Phosphorus Solulizing Bacteria Dizotrophs, Dehydrogenage activity and Soil microbial biomass carbon showed significant ($P<0.05$) were recorded under direct seeded rice over puddle transplanted rice. The improvement in these parameters were also recorded under unpuddle transplanted rice over transplanted rice. However, microbial population (Rhizobium, Phosphorus Solublizing Bacteria, Dizotrophs and Dehydrogenage activity) were significantly influenced by water and nutrient management practices.

MICROSATELLITE MARKER ANALYSIS, QTL AND PHYSIO-MORPHOLOGICAL OF BACKCROSS POPULATIONS DERIVED FROM THE CROSSES BETWEEN BASMATI AND AEROBIC RICE VARIETIES (PUSA1121 X MAS26/MAS26) UNDER WATER LIMITED CONDITIONS

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Abstract

Aerobic rice can helps us in tackling this problem as it combines the drought resistant characteristics of upland varieties and

high yielding traits of lowland varieties. In India, development of aerobic rice varieties was initiated using the available upland paddy and high-yielding rice germplasm. Several aerobic rice varieties such as MAS946-1, PMK3, MAS25, MAS26 and MAS946 have already been developed for aerobic cultivation. Improvement for water use efficiency should not be at the cost of grain yield and quality to ensure the farmer's acceptability. Basmati rice area has a problem of drought and water availability. In the present study, experiments were conducted to evaluate segregating Aerobic (MAS26) x lowland Basmati (PUSA1121) rice derived BC_1F_2 and BC_1F_3 populations displayed enormous variation for various physio-morphological (plant height, effective number of tillers/plant, panicle length, 1000-grain weight and grain yield per plant), quality (grain length/breadth ratio) allelic diversity for *BAD2* (aroma) gene and microsatellite markers linked to the traits promoting aerobic adaptation traits under direct-seeded water-limited aerobic conditions, in the field Frequency distribution curves for various physio-morphological were parabolic and in some cases, curves were partially inclined towards the respective aerobic rice parent. Phenotypic correlation coefficient analysis showed significant positive correlation between grain yield per plant and yield-related attributes. A total of SSR database 63-71 polymorphic markers were used to assess the diversity in these populations. The NTSYS-pc tree cluster analysis showed that Basmati and aerobic rice genotypes were quite divergent and segregating populations were interspersed between the two parents. SSR database was used to map QTL for important traits using (WinQTL Cartographer2.5). Analysis revealed a total of 11QTL which individually explained 9.1 – 84% phenotypic variation. Selected plants having higher or comparable grain yield, length/breadth ratio, than the parental genotypes with intact Basmati specific *BAD2A* allele. These genotypes will serve as the novel material for the selection of stable aerobic Basmati rice varieties. It will also be interesting to investigate and confirm the role of QTL identified in this study towards improving the grain yield and quality under aerobic conditions.

SCREENING OF PEARL MILLET GENOTYPES AGAINST LEAF SPOT DISEASE CAUSED BY *DRECHSLERA SETARIAE* UNDER ARTIFICIAL INOCULATED CONDITIONS

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Abstract

Pearl millet (*Pennisetum glaucum* L.) locally known as bajra, sajja, bari, combo, ganti or kambam, is an allogamous crop having protogynous nature. In India it is fourth most important cereal after crops like rice, wheat and sorghum. India is the largest producer of pearl millet, Rajasthan occupies first position in area and production in india. The pearl millet grains are very nutritious and staple diet of approximately 10 per cent of the population in India. Among the various diseases of pearl millet, leaf spot caused by the fungus *Drechslera setariae* has attained the status of the economically important disease. Forty genotypes of pearl millet were evaluated against leaf spot disease under artificial inoculation conditions during *kharif* 2015. Among the forty genotypes, only one (86M84) genotype was found resistant (R), five genotypes (Pusa Composite-383, 9450, 86M74, 9444 Gold, HHB60) were found moderately resistant (MR), fifteen genotypes low resistant (LR), five genotypes mesothetic (M), seven genotypes low susceptible (LS), five genotypes moderately susceptible (MS), two genotypes susceptible (S), and none of genotypes were found under highly susceptible (HS), respectively. These finding will be helpful in breeding program and further developing strategies for the management of leaf spot disease of Pearl millet in India.

ENHANCING THE FIXING OF ATMOSPHERIC NITROGEN IN THE SOIL THROUGH CHICKPEA (*CICER ARITINUM* L.)

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Abstract

Pulses are the predominant source of protein in vegetarian society. Majority of the Indian population is vegetarian and Indian

cuisines are full of dishes made from pulses. Benefits from pulses are numerous from cultivation to consumption. They have a great potential to improve human health as a rich source of protein. Soil health through nitrogen fixation and helps in attaining food and nutritional security. In recent years pulses are consistently coming under the centre stage of research focus because of its importance. The up swinging prices of pulses and the nutritional importance have forced the policy makers to pay attention towards pulses. Year 2016 has been declared by the UNO as the "International year of Pulses". There has been a reduction in the pulse availability per person per day in the last 50 years from 70 grams/capita/day to 34 grams/capita/day (http://www.faostat3.fao.org). Major limitation in production of pulses is that they are grown in marginal hood with lower inputs. Cultivation of pulses is not profitable as compared to other crops such as rice, wheat etc due to lower yields and lower responsiveness to applied fertilizers. This makes cultivation of pulses a complicated task and is cause of its less popularity among farmers. The major challenges impeding the pulse production and productivity are narrow base in the cultivated varieties, genotype and environment interaction, multiple biotic and abiotic stresses, difficulty in screening and precisely identifying the target traits. A major initiative has been taken by the government of India for achieving self-dependency in pulses in the current five year plan by including pulses in National Food Security Mission. (www.nfsm.gov.in). Phenomenal increase in the pulse production has been evident in the last ten years ranging from around 12 million hectares during 2004-2013 to 13.5 million hectares (FOASTAT, 2015). The increase in the pulse production is mainly attributed to the increase in chickpea production in central and southern India. Chickpea contributes more than 35% of areas sown and 48% of production of the total pulses in the country. Chickpea (*Cicer arietinum* L.) with about 28,269 genes and genome size ~738Mb is the one of the most important pulse crop in Asia belonging to the family Fabaceae Sequencing of desi and kabuli has been completed. Chickpea grows in more than 50 countries and 90% of its global area is concentrated in Asia. India leads in world's production of chickpea and largest importer too. The other countries that produce chickpea include Turkey, Australia, Pakistan, Myanmar, Ethiopia, Canada and Iran. Globally, an area of 9.21Mha is under chickpea producing 8.88Mt. Even though India produces 68% of total production of the world, India has to import large quantities of chickpea every year in order to meet the growing domestic demand. Madhya Pradesh is the leading state in India contributing almost 39% of the total chickpea production in India followed by Rajasthan (17%), Maharashtra (16%) and Andhra Pradesh (8%). A major shift in chick, area has taken place in the last two and half decades with major production area shifting to Southern and Central India from North India (Project Coordinator report 2015-16). In past few decades the chickpea area has declined sharply in northern Mates (UP, Bihar, Punjab and Haryana) but has increased significantly in central India mainly Maharashtra and MP and in southern India in AP and Karnataka.

Chickpea from nutritional angle has been acknowledged as best composed legumes and its seeds are highly nutritious containing 52-71% carbohydrate, 18-24% protein, 4-10% fat and several vitamins and minerals. High fibre and low glycemic index reduces rapid rise of blood sugar after consumption and also is good for disorders of digestive tract, lower anti-nutritional factors and higher nutritionally important components make chickpea ideal and complete food. Chickpea seeds have become an important commodity in the diet of poor and vegetarian population of developing countries. Chickpea also fixes nitrogen from air improving soil fertility besides being a dietary component. The allowing by fixing atmospheric nitrtogen and may allow broadening of agricultural system through crop rotation. Chickpea is also called as gram or Bengal gram in common language. It is self-pollinated crop with out-crossing rate less than 1%. Two chickpeas desi (dark coloured seed coat) and kabuli (white coloured seal coat) are known having varied gene pool. Chickpea productivity remained stagnated and low since many years partly because of numerous environmental stresses and insufficient genetic variability in various traits due to the domestication process. Chickpea cultivation is facing water shortages during and stages of crop growth as it is limited to rain-fed areas since the irrigated areas are employed in wheat cultivation. The productivity of chickpea is greatly affected by end season drought due to irregular distribution of rainfall in the crop growth period, higher evapotranspiration, poor water preservation. Drought has become a global phenomenon hampering chickpea production in the major production traits of chickpea in south east Asia and India and yield losses upto 50% have been projected all over the world owing to drought. The chickpea asp is severely affected by water stress in all stages of its growth. The amount of stress brings about a direct response in their physiological processes. Therefore, higher yield and active plant growth activity are central to drought tolerance. Elaborate studies on plant growth stages and characteristics which are affected due to drought stress could be identified by many workers. Those traits that express only when there is a moisture stress have been referred by as drought responsive or inducible traits. While those traits which are continuously expressed in the plant irrespective of there is moisture stress or not they are called constitutive traits. Drought selection indices are those which when selected for have positive effect on yield apart from having greater heritability. Those traits do not reduce the yield under normal conditions. These are easy to measure and show greater efficiency in yield when selected under drought conditions. The yield parameters

viz., days to 50% flowering and maturity, 100 seed weight, plant yield and drought tolerance index (DTI) can be used for selecting

EVALUATION OF VERITIES FOR RESISTANCE AGAINST POTATO APICAL LEAF CURL VIRUS IN RAJASTHAN

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Abstract

Potato Apical Leaf Curl Virus of Potato is an important disease of potato throughout the word. Symptoms appear as curling/crinkling of apical leaves with distinct mosaic symptoms due to primaryinfection and in case of secondary infection, the entire plant show severe leaf curling and stunting symptom. A field experiment was conducted at ARS Kota, during 2 consecutive winter (rabi) season of 2012-13 to 2013-4. In this experiments ten potato varieties (K. Gaurav, K. chipsona-4, K. Garima, K. Pukhraj, K. Bahar, K. Pushkar, K. Satluj, K. Surya, K. Sadabahar and K. Khyati) used in three replication A field experiment was conducted at ARS Kota, during 2 consecutive winter (rabi) season of 2012-13 to 2013-4. Based on 2 years mean data revealed that maximum incidence apical leaf curl virus was in variety Kufri Khayati (72.17%) followed by Kufri Sutlej (29.34%), K. Surya (4.00%) and K. Kufri Goaurav (3.84%) while other varities did not showed any incidence of potato apical leaf curl virus. The maximum total mean yield obtained from variety K. Surya (24.07t/h) while minimum from K. Bahar.

EFFECT OF GRAFTING BETWEEN TOMATO AND BRINJAL

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Abstract

Grafting is a new technology for vegetable production that are first originated in Japan and Korea to control the loss caused by soil-borne, nematodes or to increase the tolerance in the plant. These technique is mainly used for fruit crops but now a days it is recently introduced in vegetables crops mainly in solanaceous and cucurbitaceous family. In Vegetable, grafting is a technique to produce value-added seedlings but requires labor intensive nursery operations. Low temperature and dark condition is required for seedlings for a short period of time to success the graft union. Vegetable grafting has been safely adapted for the production of organic as well as ecofriendly produce and minimizes uptake of undesirable agrochemical residues. This experiment was conducted at the Agricultural Research Field, School of Agriculture, Lovely Professional University (Phagwara, Punjab) in which we were using scion of Tomato (*Solanum lycoperscium*) and rootstock of Brinjal (soalanum Melongena). Grafted and non-grafted plants were grown in the polyhouse in Randomized block design and the result of grafted plants showed more vigorous, abiotic and biotic stress, higher yield, good quality product, early flowering, less disease attack as compare to the non-grafted plants.

EFFECT OF DIFFERENT TYPES OF FERTILIZERS ON GROWTH AND YIELD OF ROUND MELON

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Abstract

Round melon (*Praecitrullus fistulosus*, 2n=24) is a monoecious summer vegetable belonging to Cucurbitaceae family. This experiment was conducted at Agricultural Research Field, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India to study the effect of different types of fertilizer on growth and yield of round melon with Randomised Block Design along with three replications and ten treatments having different fertilizer doses combination. Three treatments having 100% doses are organic fertilizer, inorganic fertilizer, biofertilizer , another three treatments having 50 % + 50% doses of organic fertilizer + inorganic fertilizer , organic fertilizer + biofertilizer, inorganic fertilizer +

biofertilizer , another three treatments having fertilizer doses in three combination of fertilizers 50% + 25% + 25% doses of organic fertilizer + biofertilizer + inorganic fertilizer, inorganic + organic + biofertilizer, biofertilizer + organic + inorganic fertilizers. In organic fertilizer vermicompost + bikhad used, in inorganic fertilizers urea, MOP, DAP used and in biofertiizer azotobactor+ PSB used . This experiments showed that treatment having 50% + 50% dose combination of organic + biofertilizer gives more total number of fruits per vine, fruit diameter, average fruit weight, yield and treatment having dose of 50% + 25% + 25% doses of biofertilizer + inorganic + organic fertilizers showed more ascorbic acid content in round melon.

NATURAL RESOURCE MANAGEMENT FOR HIGHER FARM INCOME

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Abstract

Since last five decades, the strategy for development of Indian agriculture has been to increase the output irrespective of input levels. Although this strategy has been a phenomenal success known as green revolution in achieving food security and bringing India in category of food bowls of the globe from begging bowl. Export of agricultural products has become a large source of income for India. Bur for farmers, farming is becoming less and less profitable occupation due to rising input costs and fragmenting agricultural holdings. According to NSSO, one fifth of rural household who had agriculture as an occupation were below poverty line in 2011-12. Therefore, increase in farm income is being implemented in mission mode in current period. Some of strategies for higher income may be such as:1) reducing cost of cultivation by promoting low cost inputs, reducing farm operations to only some inevitable operations (i.e. reduced or no-tillage). 2) adopting low input farming systems by which we can reduce reliance on external input by maintaining the recycling of on-farm byproducts and their use as on-farm inputs. 3) Enhancing resource use efficiency by adopting conservation agricultural practices like minimal soil disturbance, adopting means of field biodiversity such as crop rotation and intercropping, site specific nutrient management to reduce the level of chemical fertilizers, microirrigation etc. 4) resource conservation technologies like lase land leveling which increases water use efficiency, net land area of the field under cultivation by omitting the need of field bunds and channels, improve crop germination and crop stand. 5) Integrated crop management practices such as integrated nutrient management (INM), integrated weed management (IWM), Integrated pest and disease management etc. for raising a good crop and to avoid risk of decline in soil health, weed flora shift and pest resurgence etc. 6) Organic farming to enter into high value markets.7) Adoption of protected cultivation of vegetable and high value crops like flower and aromatic and medicinal plants.8) Diversification of agriculture to increase food and nutritional security, employment generation, reduce the risk of failure due to single enterprise and sustainable agricultural development. 9) Integrated farming system to minimize the negative impacts of intensive farming at same time ensuring the income for the household. 10) Improvement in seed replacement rate because quality seed is very crucial for higher productivity. By adopting these measures low income levels of farmer which are persistence from last century can be raised to acceptable level and secure future of agriculture in India.

LINSEED IMPROVEMENT IN OIL AND FIBRE QUALITY

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Abstract

Linseed (*Linumusitatissimum*) is an, self-pollinated annual species believed to have originated in either the Middle-East or Indian regions and spread throughout Asia and Europe, prior to its introduction into the New World. Great genetic diversity of this crop present in Indian sub-continent. It is an important crop world-wide, The total world production of linseed reached approximately 2.5 million tonne in 2014, with Canada (34%), Russian Federation (15%) and China (13.6%) became the main producers. India is an important linseed growing country in the world ranking fourth in area (13%) and sixth in production (5.5%), respectively (Refer FAOSTAT, 2016). Currently the fibre type is the third largest textile fibre crop, and the oil-type is fifth oil crop in the world among the major fibres (cotton and jute) or other oil crops (maize, soybean, palm *Brassica*). linseed is important for the seed oil, stem fibre, paper wax, nutraceutical and food processing industries. Flax seeds are being used for

fortification of food products as a health benefit ingredient because they are a rich source of micro-nutrients, dietary fiber; vitamin B_1, and the essential fatty acidsuch as -linolenic acid, also known as ALA or omega-3. Recently, there has been a grow interest in linseed as a functional food due to its probiotic and anticancer properties. However; linseed oil is not much used for cooking but its medicinal value derive interest in linseed. Hence, efforts have been made to lower the linolenic acid content in the oil to make linseed oil 'premium' cooking oil. The present article is intended to appraise the readers about the major developments in linseed improvement in oil and fibre quality. Moving ahead from the conventional approaches,several biotechnological approaches have been attempted like Regeneration of whole plant from the hypocotyl, cotyledons and about induction of somatic embryogenesis in linseed were successful. Protoplast fusion of wild sps.And cultivated sps.Was found successful to liseed variety for oil and fiber quality.Inter-simple sequence repeat and randomly amplified polymorphic DNA (RAPD) primers has been utilized in linseed. Plants derived from the same callus had identical Polymerise Chain Reaction (PCR) patterns at five loci. Thus, they were likely to be derived from the same microspore. Genetic engineering is indispensable when some new trait like production of epoxy fatty acid in linseed is to be conferred to plant. Stable transformation, in progenies of transgenic flax plants using an A. *tumcfaciens* strain, carrying a disarmed Ti-plasmid vector containing a chimeric npt-II gene and a glyophosate resistance gene has been reported. Transformed plantlets with curled leaves, short intenodes and a root system characterized by plagiotropic behavior were produced and no detrimental effect of the T-DNA on important agronomic traits was found. Herbicide resistant genes have also been successfully used in transformation experiments. Resistance to stress has also been conferred to linseed through genetic manipulations. Transgenic linseed with increased pathogen resistance was produced by -1,3 glucansec DNA from potato.

UTILIZATION OF GENETIC MARKERS IN CROP GERMPLASM FOR VARIOUS REVERSE AND FORWARD GENETIC APPROACHES

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Abstract

Genetic markers represent genetic differences among individuals of a species. Genetic markers have evolved from morphological marker through biochemical to DNA marker. The development and use of molecular markers has revolutionized the understanding the organization and diversity of plant genomes. DNA markers are the DNA sequences which show variation in individuals of the same or different species. They have been classified into three broad categories *i.e.* hybridization based (RFLP), PCR based (RAPD, AFLP, SSR) and DNA sequence based (SNP). Germplasm are endowed with abundant genetic diversity and are source of valuable genes which need to be exploited for crop improvement program. Advances in PCR, molecular markers and data analysis has resulted in powerful techniques used for characterization and evaluation of germplasm. Molecular markers have been employed for many studies like characterization, genetic diversity estimates, phylogeny study, synteny study, sorting the duplicates, studying population structure and association mapping. For the above analysis the four markers (RFLP, RAPD, AFLP and SSR) have been compared on various grounds which include level of polymorphism, mode of inheritance, method of assaying, genome coverage, reproducibility, efficiency and cost required. Also some parameters like expected heterozygosity, multiplex ratio, marker index and dendogram based genetic similarity have been compared for all four markers. As no single marker could be an ideal marker yet on comparing we get that SSR marker could be the marker of choice. However the third generation marker like SNP markers having high throughput, can replace the SSR markers.

PERFORMANCE OF MAHI 28 VARIETY OF OKRA IN IPM THROUGH OFTS IN HOSHANGABAD DISTRICT OF MADHYA PRADESH

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Abstract

PowarkhedaHoshangabad is located at 22.75°N and 77.72°E on the banks of Tawa and Narmada rivers of Madhya Pradesh. Okra is one of the major vegetable in district. KrishiVigyan Kendra laid down On Farm Testing Demonstration in the year

2016-17 introducing stacking practicesinokra with biological module of IPM and applying scientific practices in their management practices.The OFT were carried out in village- Sangakhedakala, block Babai of Hoshangabaddistict in supervision of KVK. The productivity and economic returns of Okra in improved technologies were calculated and compared with the corresponding farmer's practices (local check). Improved practices recorded higher yield as compared to farmer's practices. The improved technology recorded higher yield of 688 q/ha 2016-17, respectively than 390 q/ha. In spite of increase in yield of Okra, technology gap, extension gap and technology index existed. The improved technology gave higher gross return (158000 & 140000 Rs./ha), net return 209000 & 189000 Rs./ha) with higher benefit cost ratio (1:4 & 1:3.8) as compared to farmer's practices. The variation in per cent increase in the yield was found due to the poor management practices, lack of knowledge and poor socio economic condition. Under sustainable agricultural practices, with this study it is concluded that the OFTs programmes were effective in changing attitude, skill and knowledge of improved package and practices of okra adoption.

MEDICINAL PROPERTIES OF RICE : ITS FUTURE STRATEGY IN ANTHER CULTURE FOR CHHATTISGARH

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Abstract

Rice is the leading crop produced and consumed on a large scale in the state of Chhattisgarh that is it is a staple food of the inhabitants residing in the domical, and is variably rich in genetic diversity. Rice production is the principal activity and a major source of income for the State. Traditional rice varieties have an enhancing potential in wide range of neutraceutical and functional foods. Traditional healers and local farmers have been using these traditional varieties in ayurveda and in curing of various kinds of ailments, such as cooling the body in ayurvedic treatments, removing weakness of mothers after delivery, curing of joints pain, cure for prolonged cough husk smoke is also used for half side headache in human being. Some local varieties are also used for easy removal of placenta of cow after delivary, better for removal of cattles weakness. Extracts of brown rice are also used as energy drink in individuals, patients and in treatment of chronic gastric problems, jaundice, dysenteric complaints and to increase lactation and nutrition to Childs. Diabetic patients should include brown rice rather than white rice, which contains low levels of glycemic index, provides a person with almost 100% of their daily manganese requirement. *In vitro* androgenesis is an important component of plant biotechnology when the pollen grains are forced to switch from their normal pollen developmental pathway towards an embryogenic route. Haploid and doubled haploid produced through androgenesis have long been recognized as a valuable tool in plant breeding as it can shorten the breeding cycle, fix agronomic characters in homozygous state and enhance the selection efficiency of useful recessive agronomic traits. Recently, doubled haploids have been largely recognized as an important component of crop improvement through genome mapping, quantitative trait locus analysis, and genetic mutation, and as targets for genetic transformation programs. Thus, this review is focused mainly on various facets of doubled haploid in the chief staple food crop rice and sights its recent applications in plant breeding, genetics and genomics. The nutritional value of rice needs to be improved even more so that it benefits mankind. It, being the most dominant cereal crop in most of the world can improve the lives of millions of people who consume it.

PLANT BASED INSECTICIDES : AN EFFICIENT AND RELIABLE TOOL IN INSECT-PEST MANAGEMENT

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Abstract

Plant based insecticides are naturally occurring chemicals extracted from plants. Natural insecticidal products are available as an alternative to synthetic insecticides. There are several insect pests that affect the production and productivity of diverse crops. These insect pests cause severe losses to crop worldwide. To control these insect-pests several synthetic insecticides

have been used so that losses can be minimised. But overdependence on these chemical insecticides in insect pest control has brought about problems like insect resistance to insecticides, resurgence of insects, toxic residues on food, water, air and soil, elimination of natural enemies, disruption of the ecosystem and minor pests assuming major status. On the other hand, use of plant based insecticides offer a good alternative to manage the insect pests in an ecofriendly way. Because, mostly they are naturally occurring, they are highly specific to target insect-pests, no or little adverse effect on beneficial insects, resistance development to them is slow or less common, they have no unknown environmental hazards, have less residual activity and are effective against insecticide resistance species of insects. There are several plants with different active principles like neem, rotenone, chrysanthemum, tobacco, sabadilla, derris, rynia, jatropa, datura, onion, garlic, turmeric, ginger, ocimum, chilli, marigold etc. from which naturally occurring insecticides are extracted. They are having different mode of actions like they act as repellent, anti-feedant, ovipositional deterrent, ovicidal, insect growth regulators sterilant, reduced fitness and longevity. Due to these reasons plant based insecticides are considered as an effective and reliable tool in integrated pest management programme to control insect-pests.

EFFECT OF BIO-FERTILIZERS WITH INORGANIC FERTILIZERS ON GROWTH COMPONENTS AND YIELD TRAITS OF CORIANDER (*CORIANDRUM SATIVUM* L.)

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Abstract

An experiment was carried out to study the "Effect of bio-fertilizers with inorganic fertilizers on growth components and yield traits of coriander (*Coriandrum sativum* L.)in Horticulture Research Farm, I.G.K.V. Raipur (C.G.) during *rabi season* 2007-08. The experiment was planted in Randomized Block Design (RBD) with the three replications. There were fifteen treatments comprising of different bio-fertilizers with and without inorganic fertilizers (NPK). Recommended dose of fertilizers (RDF) applied was given 60:40:40 kg/ha. N_2, P_2O_5 and K_2O respectively.Results showed that the highest plant height, umbel number per plant,weight of 1000 seeds, fresh weight of plant, dry weight of plant, seed yield, cost benefit ratio (1: 4.9) and highest quantity of Nitrogen, Phosphorus and Potassium available in soil at after harvest of crop was noted in combination of T_8 (100% Kand 75% NP alongwithAzotobacter, Azospirillumand PSB) was significantly superior to the rest of the treatments and all characters taken under investigation followed by treatment T_{15} (75% Nand 100% PK alongwithAzotobacter, Azospirillumand PSB). Hence it is concluded that the combined application of Biofertilizers with inorganic fertilizers were found more effective as compared to the application of chemical fertilizers or organic mannurs alone for influencing significant effect on important growth parameters and yield attributing characters of coriander.

INVESTIGATION OF BIO-FERTILIZERS INFLUENCE ON ESSENTIAL OIL CONTENT, PHYSIOLOGICAL AND YIELD TRAITS OF CORIANDER (*CORIANDRUM SATIVUM* L.)

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Abstract

Present investigation regarding the supplementation of chemical fertilizers with biofertilizers for coriander crop was carried out under field condition in Horticulture Research Farm, I.G.K.V. Raipur (C.G.) during *rabi season* 2007-08. The experiment was planted in Randomized Block Design (RBD) with the three replications. There were fifteen treatments comprising of different bio-fertilizers with inorganic fertilizers (NPK).The results indicated that treatment T8 (100%K and 75% NP along with Azotobacter, Azospirillum and PSB) was significantly superior to the rest of the treatments & all characters taken under investigation. Leaf area (highest 116.52 cm^2, 101.94 cm^2 and 60.32 cm^2 at 45, 90 DAS and at harvest respectively), leaf area index (highest 0.19, 0.17 and 0.33 at 45, 90 DAS and at harvest), essential oil content (0.96%), seed yield per plant (14.31%), seed yield per plot (1.2 kg) and seed yield per hectare (23.78 qt.) are the important Physiological and yield contributing characters taken under investigation. Hence it is concluded that the treatment T8(75% NP+100%K with Azotobacter, Azospirillum and PSB) was found economically best for both physiological and yield contributing characters.

ENDOPHYTES—A REVIEW

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Abstract

Endophytes are plant associated microoraganisms that reside in the inner tissues of plant parts. All plants studied till date are inhibited by diverse microbial community which consists of bacteria, fungus and archaea. Mostly endophytes originate from the rhizosphere or phyllosphere but some are transmitted through the seed also. Endophytic bacteria can promote plant growth by two mechanisms either direct or indirect. Direct plant growth promotion is usually caused by phytostimulation and biofertilization. Indirect plant growth promotion occurs when there is some pathogen, pollutants or some other stress condition. The interaction between plants and endophytes depends on different factors like plants genetics, microbial genetics and environmental conditions etc. These diverse endophytes play an important role in ecosystem, plant development, growth and fitness.

A STUDY ON KNOWLEDGE AND UTILIZATION PATTERN OF KISAN CREDIT CARD (KCC) AMONG THE FARMERS IN GARIABAND DISTRICT OF CHHATTISGARH

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Abstract

The present investigation entitled "A study on knowledge and utilization pattern of Kisan Credit Card (KCC) among the farmers in Gariaband district of Chhattisgarh" was carried out during the year 2017. Covering one block of Gariaband district, 6 villages and 120 respondents. The data were collected through personal interview with the help of structured interview schedule and analyzed by using appropriate statistical methods. Agriculture has been the mainstay of our economy. More than 67 per cent of our people depend upon agriculture for their livelihood even though contribution of agriculture to our Gross Domestic Product (GDP) is less than 27 per cent. Agriculture will continue to be central to all the strategies for socio-economic development of the country. Kisan Credit Card is a simple card-cum-passbook. The beneficiaries under the scheme are issued a credit card and a pass book or a credit card cum passbook incorporating the name, address, particulars of land holding, borrowing limit, validity period, etc. which serves both as an identity card as well as facilitate recording of the transactions on an ongoing basis. Farmers may approach the nearest branch of any Bank or Primary Agricultural Co-operative Societies (PACS) for it. The findings of the study revealed that the majority of the respondents belong to middle age group, educated up to primary level, belonged to other backward caste (OBC) and residing in nuclear family system with up to 5 family members with did not have any membership in any organization. Majority of KCC holders belonged to category of small farmer'sand surviving with Rs.25000 to 75000, their annual income from in agriculture + services. Almost all the respondents have acquired the credit from both sources to meet out their expenditure about agriculture. Majority of the KCC holders were regular in repayment of loan in kind and cash mode on yearly basis.The majority of the respondents suggested that Credit should be free from Government for effective utilization of KCC by the farmers.

CLUSTER FRONTLINE DEMONSTRATIONS-KEYOF SUCCESS IN GREEN GRAM (*VIGNA RADIATA*) PROFITABILITY

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Abstract

The cluster frontline demonstrations (CFLDs) on green gram were conducted by Krishi Vigyan Kendra, Malegaon in village Vaygaon of Baglan block during kharif season 2016-17. The results revealed that treatment T1-Improved seed- Utkarsha 10 kg + micronutrient-Zinc sulphate 25 kg + weedicide-Quizalofop ethyl 5 % @ 750 ml + insecticide-Dimethoate 30% EC @ 500 ml + fungicide-Sulphure 80% WP @ 1250 g per hectare recordedhighest average seed yield 8.94q/ha whereas in control

plot it was 6.20q/ha. There was 30.64 % increase in yield observed over farmers practice. The same trend found in case of gross and net monetary return which was Rs.39321.9 & 24007.9 and for control Rs.27262.4 & 12448.5 per hectare respectively. Benefit cost ratio for demonstration and control was 2.59 & 1.85 respectively. From demonstrations it was concluded that the pulses production could be enhanced by encouraging the farmers through Integrated Crop Management practices which were followed in the CFLDs. This intervention not only showed good income but also made seed available to the locality to make the crop more popular in the nearby villages.

GENETIC VARIABILITY, CORRELATION AND PATH ANALYSIS IN FORAGE SORGHUM

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Abstract

The material comprised of total twelve lines and four testers of forage sorghum were evaluated for genetic variability, heritability, genetic advance, character association and path analysis studies in complete randomized block design with three replications during *kharif* season 2018 at S.V.P.U.A. & T., Meerut. Estimates of genetic parameters for all the genotypes of forage sorghum showed significant variability for all the characters under study, indicated wide spectrum of variability among the genotypes. The estimates of genotypic and phenotypic coefficient of variation were found high for plant height, stem girth and green fodder yield. High heritability coupled with high genetic advance noted for plant height, leaf area, stem girth and green fodder yield indicating that these characters are controlled by additive gene action and phenotypic selection for these characters will be effective. These attributes could be improved through pure line selection effectively. Phenotypic correlations were of higher magnitude as compare to their corresponding genotypic correlation in most of the character combination, indicating the existence of strong influence of environmental factor for the various characters. Green fodder yield showed significant stable and positive correlation with plant height, leaf length, number of leaves per plant, leaf area and stem girth at genotypic and phenotypic level. Thus, it can be inferred that selection based on any one of these characters either alone or in combination, will result in identifying high green fodder yielding strains. Path coefficient analysis of genotypic and phenotypic exhibited positive and direct effect of plant height, leaf length, number of leaves per plant and leaf area had greater importance. Hence due consideration should be given to these characters, while planning a breeding strategy for increased green fodder yield.

POMEGRANATE-A POTENTIAL OPTION FOR CROP DIVERSIFICATION IN SALT AFFECTED SOILS OF SOUTHERN RAJASTHAN

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Abstract

In India, with increasing population pressure and competition for good quality lands, intensive agriculture is being pushed more and more into marginal environments. The arable lands are shrinking due to developmental activities and offer little scope for raising crops. There is no option other than bringing marginal and salt affected lands under cultivation and utilizing them judiciously through horticultural practices by growing horticultural crops on highly deteriorated salt affected soils may improve economic conditions of farmers. Keeping this in view, an integrated approach of satellite image interpretation coupled with ground truth verification was adopted in salt affected soils of Bhilwara district in southern Rajasthan to characterize, classify the soils for land use planning. A total of 1,29,501 ha is salt affected which forms 12.43% of total physiographic lands available in the district. Among the salt affected areas 8.8, 42.9, 21.4 % comprised of saline, saline-sodic and sodic, respectively. Based on the characteristics of salt affected soils, the potential suitability of pomegranate (*Punica granatum* L.) these soils are marginally suitable due to limitations of soils depth, salinity and sodicity but after appropriate correction these can be cultivated moderately for pomegranate. The fruit pomegranate (*Punica granatum* L.) belonging to family punicaceae is a delicious and desert table fruit of tropical and subtropical regions of the world. There is tremendous scope of boosting the cultivation of pomegranate in the salinity affected soils under study. Because of hardy nature, high yield and low input requirements, it may emerge as a potential fruit crop for the resource poor harsh conditions. Pomegranate cultivation could be a viable option in areas of present study, where other crops are not able to perform due to abiotic stress and

changing climatic conditions. If efforts are made to bring about 129.5 thousand hectare area under pomegranate cultivation of Bhilwara district of Rajasthan with the existing productivity level of 10 t / ha, then the area can produce 1290 thousand tons of pomegranate, a cost of Rs 6.45 million considering the existing market price of around 50/- per kilogram. Thus, there is further scope for its expansion in adjacent areas of saline soils for cultivation by the farmers in salt stressed areas of the state.

INFLUENCE OF ZINC AND IRON FORTIFICATION ON YIELD AND POST HARVEST STUDIES OF DIFFERENT RICE CULTIVARS (*ORYZA SATIVA* L.)

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Abstract

Among the micronutrients, zinc deficiency is widespread throughout the world particularly in upland rice fields causing low yields and affecting nutritional quality of the produce**.** Iron is also another micronutrient which is lacking in soil as well as in human body. Field studies were carried out during the growing season 2015-16 and 2016-17 at Research Farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) to study "Influence of zinc and iron fortification on yield and Post harvest studies of different rice cultivars (*Oryza Sativa* L.) ". The treatments were laid out in factorial randomized block design (FRBD) with three replications. Two years results shows that among varieties PBNR-03-02 explored highest yield and post harvest studies whereas combine application of $ZnSO_4$ + $FeSO_4$ with RDF treatment recorded maximum yield as well as post harvest characters respectively.

GROWTH TRENDS IN AREA, PRODUCTION AND YIELD OF TURMERIC IN HARYANA VIS-À-VIS INDIA

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Abstract

The analysis of growth is usually used in economic studies to find out the trend of a particular variable over a period of time and used for making policy decisions. The growth in the area, production and yield of turmeric in Haryana vis-à-vis India was estimated using the compound growth function. The necessary secondary data were collected for a period of 27 years from 1990-91 to 2016-17. During 1990-91 to 2016-17, in Haryana growth rates showed a significant positive growth in area, production and yield under turmeric. Likewise, India as a whole country also showed a significant positive growth in area, production and yield under turmeric. Maximum area in India under turmeric was cultivated in 2016-17 i.e. 222 thousand hectares while minimum area under turmeric was cultivated in 1990-91 which was 119 thousand hectares. In Haryana, maximum area was cultivated in 2016-17 i.e. 1.50 thousand hectares. In case of production in India, maximum production of turmeric in 2010-11 i.e. 1237.4 thousand metric tonnes. Maximum yield under turmeric was taken in year 2010-11 i.e. 5.6 metric tonne per hectare. While in Haryana, maximum production of turmeric in 2006-07 i.e. 4.6 thousand metric tonnes and in the same year maximum yield was taken that was 21.9 metric tonne per hectare.

INTEGRATED PEST MANAGEMENT OF THE TOMATO FRUIT BORER *HELICOVERPA ARMIGERA* HUBNER

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Abstract

Tomato (*Solanum lycopersicon* L.) is one of the major and remunerative vegetable crops which have achieved tremendous popularity over the last century. India ranks second in tomato production after China. The total area of various vegetables in

India is 92.05 million hectares with production of 162.18 million tonnes, of which tomato is cultivated in an area of 882,000 hectares with total production of 18735.9 MT and average productivity of 21.2 tonnes per hectare in 2013-14. It is grown worldwide either in the field, green houses or net houses. Tomatoes provide an excellent amount of vitamin C, a very good amount of the mineral manganese and vitamin E. In terms of phytonutrients, it includes flavanones, flavonols and carotenoids like lycopene, zeaxanthin and beta-carotene. The important insect pest of tomato is fruit borer, *Helicoverpa armigera* (Hubner), is the most destructive pest of tomato in India, which is commonly known as gram pod borer, American bollworm and fruit borer. It causes 40-50 percent damage to the tomato crop. The adoption of IPM technology in tomato using African marigold as a trap crop, root dipping of seedlings in Imidacloprid, soil application of neem/pongamia cake, spraying of botanicals like pongamia soap and biopesticide like Ha NPV has been found effective in both insect as well as disease management. The IPM technology has been found economically viable as the yield on IPM farms. The technology can be considered environment-friendly as it uses more of eco-friendly inputs and less of chemicals. The constraints like non-availability of botanicals and bio-pesticides should be addressed on priority basis to make the technology sustainable and more popular.

EFFICIENCY OF POTASH FERTILIZER IN RICE-WHEAT CROPPING SYSTEMS IN SITAPUR (U.P.)

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Abstract

Research trials and farmers' field demonstrations were conducted through Krishi Vigyan Kendra, Katia Sitapur to study the effect of potassium fertilizer on rice and wheat yields and find out the appropriate dose of potassium fertilizer for these crops under rice-rice and rice-wheat cropping pattern. Potassium fertilization significantly increased the production of Rice-wheat cropping system. In the complete fertilized plot, the yearly grain yield of rice was roughly consistent within the range of 9-10 t ha^{-1} while in the -K plots the grain yield production decreased sharply with time from about 10 t ha-1 in 2014 to 6.2 t ha^{-1} in 2016. The initial rice yield decreased due to omission of K was not significant but the yield gap between the balanced treatment and the -K treatment widened sharply and significantly with time. In the reverse treatment i.e., the application of K to the plots not receiving K for the last many years, a dramatic yield increase by 2 t ha^{-1} was observed. The rate of K mining from fertilized plot was 141 kg ha^{-1} yr^{-1} and from K omitted plot was 132 kg ha^{-1} yr^{-1}. Potassium fertilization @ 50 kg K ha^{-1} appeared to be sufficient and economically most viable to produce optimum grain yield of rice in both dry and wet season in clay loam soil at Farmers field and 66 kg K ha^{-1} for T. NDR-359 rice and wheat conducted in sandy loam soil in Sitapur district. Crop residues incorporation @ 4.5 t ha^{-1} substantially increased the rice and wheat yield, which was comparable to that of 33 kg K ha^{-1} and farmers K dose. The effect of applied K was more prominent in light textured soil than in heavy textured soil. On the other hand, wheat crop utilized the applied K more efficiently than rice crops. In research trials K fertilization increased rice grain up to 14% over control plot in clay loam soil while 30% of rice and 53% of 179 wheat grain in sandy loam soil. Application of K fertilizer on soil test based (STB) increased grain yield of rice up to 20% in T. NDR-359 rice by 25% over K control plot. Response of K fertilizer to the grain yield of rice and wheat was found more prominent in farmer's field demonstration than that of research trial in experimental field.

DRYING KINETICS STUDY ON MICROWAVE DRIED TOFU

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Abstract

Tofu is highly perishable at ambient conditions and its shelf-life is very low. The drying kinetics of soypaneer (Tofu) in terms of moisture content, moisture ratio, drying time and rate and effective moisture diffusivity was investigated. A microwave dryer was employed to study the drying behavior of tofu at 0.6, 0.9 and 1.2 kW power levels. Soypaneer drying occurred in falling rate period. The drying data were fitted to five drying models and among these models the page model satisfactorily described the drying behaviour of tofu with highest R^2 values. Effective moisture diffusivity (D_{eff}) of tofu found to increase with increasing microwave power levels and it ranged from 5.1×10^{-8} m^2/s to 9.1×10^{-8} m^2/s. The results of the study are very useful for commercial scale drying of tofu to optimize drying process and to achieve superior quality.

ROLE OF DIATOMACEOUS EARTH IN AGRICULTURE

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Abstract

Diatomaceous earth or natural amorphous silica can have a significant beneficial impact on the physical, chemical and biological processes of soil, water and the growth of crops. Silica is vital for an effective soil-plant system but has been critically deficient in agriculture for decades and this has led to a number of negative consequences. The lack of high grade amorphous silica has a massive effect on circumstances directly relevant to food production such as the amount of fertilizer required for maximum production, crop resistance to abiotic stresses (temperature, water deficiency, wind, salt, heavy metals, hydrocarbons etc) and biotic stresses (insect, disease, fungi etc). Natural freshwater diatomaceous earth is used in agriculture for grain storage as an anticaking agent as well as an insecticide. Some believe it may be used as a natural anthelmintic (dewormer), although studies have not shown it to be effective. Some farmers add it to their livestock and poultry feed to prevent the caking of feed. Freshwater diatomite can be used as a growing medium in hydroponic gardens. It is also used as a growing medium in potted plants, particularly as bonsai soil. Bonsai enthusiasts use it as a soil additive, or pot a bonsai tree in 100% diatomaceous earth. In vegetable gardening it is sometimes used as a soil conditioner,, because like perlite, vermiculite, and expanded clay, it retains water and nutrients, while draining fast and freely, allowing high oxygen circulation within the growing medium.

TEMPERATE HORTICULTURE INSECT PEST MANAGEMENT, IN AN EVER-CHANGING CONTEMPORARY ENVIRONMENT

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Abstract

Pesticide use comes at a significant cost but with vested interests this reality is relayed and portrayed with ambiguity. The increasing trend in the incidence of primary malignant brain tumors in orchard farmers of Kashmir is alarming; as more than 80 percent population of the state is engaged in horticulture and its allied sectors. Biological control is less spectacular than chemical control but more stable and longer lasting. The use of biological control has expanded considerably by means of classical (importation), inductive (augmentation), and inoculative (conservation) measures. With recent advances there is now real opportunity to realize the "Integrated Control" concept that Stern and colleagues (1959) pioneered. Today, more than ever, tools of physiology, toxicology, and biotechnology can help us realize the vision of more holistically harmonizing biological and chemical controls. Scientific opportunity associated with deprecation of pesticides; removal of their ideological kudos and providing a par effective pest control means are reviewed for effective control measures. Bio-rational pest management strategies evolved and adopted during the last 4 years by authors is discussed. Various natural enemies mass reared and utilized against major horticulture pests from the region are also detailed along with various botanical extracts used. Findings published in various papers are clubbed for a holistic approach to the program.

CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURE

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Abstract

Climate change may refer to a change in average weather conditions, or in the time variation of weather within the context of longer-term average conditions. Climate change is caused by factors such as biotic processes, variations in solar radiation

received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have been identified as primary causes of ongoing climate change, often referred to as global warming. Climate change affects agriculture in a number of ways, including through changes in average temperatures, rainfall, and climate extremes (e.g., heat waves); changes in pests and diseases; changes in atmospheric carbon dioxide and ground-level ozone concentrations; changes in the nutritional quality of some foods; and changes in sea level. Climate change will probably increase the risk of food insecurity for some vulnerable groups, such as the poor. Decrease in potential yields is likely to be caused by shortening of the growing period, decrease in water availability and poor vernalization. In the long run, the climatic change could affect agriculture in several ways: a.) Productivity, in terms of quantity and quality of crops, (b) Agricultural practices, through changes of water use (irrigation) and agricultural inputs such as herbicides, insecticides and fertilizers, (c) Environmental effects, in particular in relation of frequency and intensity of soil drainage (leading to nitrogen leaching), soil erosion, reduction of crop diversity (d) Rural space, through the loss and gain of cultivated lands, land speculation, land renunciation, and hydraulic amenities (e) Adaptation, organisms may become more or less competitive, as well as humans may develop urgency to develop more competitive organisms, such as flood resistant or salt resistant varieties of rice.

EFFECT OF FEED SUPPLEMENT ON NUTRIENT UTILIZATION AND MILK PRODUCTION IN CATTLE

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Abstract

The present investigation entitled "Effect of feed supplement on nutrient utilization and milk production in cattle". was carried out in the department of A.H. & Dairying at dairy fram during year 2017-2018 at C.S.A. University of agriculture and technology Kanpur (208002). The major problem of lower milk production at daiey farm. Twevle Sahiwal coes were selected for trial. A balanced is one which supplies all the nutrient nacessary to nourish the animal properly during twenty four hours period four cows in each group T_1 was served as control group whereas T_2 and T_3 groups were provided 50 and 75 gm Dugdh Ganga Mineral supplement, respectivelly. The animals of all the groups were fed according to ICAR feeding standard. Water was provided ad –lib twice daily. The average dry matter consumption per day per animal was recorded 9.17 ± 0.17, 9.18 ± 0.062, and 9.16 ± 0.091, kg in T_1 T_2 and T_3 groups, respectively. The dry matter consumption (gm/day) by the animal all the groups. Singnificance higher ($p<0.005$) DCP and TDN intake was observed in T_3 group as compared to other groups of Sahiwal cows.The dry matter digestibility were observed 60.16 62.06, and 62.76 in T_1, T_2 and T_3 groups, respectively..The digestibility coefficient of crude protein was 60.83 61.68, and 63.13in the observed T_1 T_2 and T_3 respectively.. The digestibility coefficient of either extract in three groups, viz., T_1, T_2 and T_3 were 65.25.66.33 and 67.66 rrespectively. The digestibility coefficient of Crude fiber was 53.66 56.04 and 57.37 in group of T_1 T_2 and T_3, respectively. The digestibility coefficients of Nitrogen free extract were 62.23 64.31 and 66.55 in T_1, T_2 and T_3 group of respectively. The organic matter digestibility were 60.49 61.79 and 63.04 Present in animal of group T_1,T_2 and T_3 respectively. The average weekly milk production lit/day were 41.30 0.192, 44.50 0.118 and 48.49 0.333 in T_1,T_2 and T_3 respectively. The higher milk production were recorded in T3 groups among the other groups. Digestibility coefficient of DM, .CF, NFE, and Organic matter were also higher in group T_3. It was concluded that the feed supplement (Dugdh Ganga) were found beneficiary for proper milk production and nutrient utilization without any ill effect.

STUDY OF TRAINING PROGRAMME ON KNOWLEDGE AND ADOPTION BEHAVIOR OF FARMERS ON PADDY CULTIVATION TECHNOLOGY

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Abstract

A study was conducted to ascertain the level of knowledge and adoption behavior of the farmers with respect to paddy cultivation technology due to training by Krishi Vigyan Kendra Haidergarh, Barabanki, Uttar Pradesh. Farmers were selected from the five villages namely Hetampur from Masoli Block, Sansara and Bijapur from Haidergarh block Devgarhpur and

Tajwapur from Trivediganj block and impact training on scientific paddy cultivation technologies. Twenty five trainees and equal number of non-trainees were randomly selected making the sample size 50 farmers. It was found that trainees had high level of knowledge (100%) whereas in case of non-trainees, 53% high level, 45% medium level and only 4% with low level of knowledge. There was a significant difference between trainees and non-trainees regarding the knowledge about the package of practices of wheat crop. The study also revealed that most of the trainees (85%) had higher level of adoption fallowed by medium level (18%) whereas, most of the non-trainees had medium level of adoption (65%) followed by low level of adoption (34%). This indicates that there had been a significant difference between trainees and non-trainees regarding the extent of adoption of package of practices of paddy crop. Trainees had higher level of adoption of recommended packages of practices as also higher mean score than the non-trainees. Thus, it could be concluded that trainees had more knowledge and extent of adoption of package of practices of paddy crop than non-trainees. The KVK should organize more number of training programme for maximum benefit of the farmers.

SOURCES AND CHANNELS MOSTLY PREFERRED BY SUGARCANE GROWERS

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Abstract

An effective communication or information is pre-requisite for adoption of an innovation or a technology. The Present study was conducted in Gangoh block of Sahranpur district of Uttar Pradesh (India) during 2016-2017. The data were collected personal localite sources like neighbors, friends, progressive farmers and opinion leaders were playing important role in transfer of sugarcane technologies to the fellow farmers with the help of structured interview schedule through 120 farmers selected on the basis of simple random sampling. These sources with high credibility were widely used by majority of the respondents. The most revealing finding of the study is that VLWs or Agriculture Supervisors had lost their credibility among the farmers while the input dealers and agents of commercial seed, fertilizers, plant protection, etc., played a critical role in information network of sugarcane farmers, however their credibility is low. It was important to note that scientists and agriculture officers were perceived a much credible source of information by sugarcane farmers, however these sources were less accessible to the farmers. Further, the increasing literacy rate and easy accessibility of the mass media channels resulted in increased utilization of these media by the farmers. The findings of the investigation indicate that television was & observed the most effective and credible channel of communication to transfer the improved sugarcane technology. The progressive farmer and radio were preferred in order to communicate the technology. R.A.E.O also plays important role in communicating to the improved sugarcane technology. A significant association between utilization of communication channels and caste groups was also observed.

STUDY ON USE OF DIGITAL BANKING AMONG RURAL FARMERS

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Abstract

The Present study was conducted in Saharanpur district of Uttar Pradesh (India) during 2018.The data were collected with the help of structured interview schedule through 100 farmers selected on the basis of simple random sampling. The findings of the investigation indicate that counter banking found more reliable to the respondents in comparison of digital banking. However, digital banking is becoming popular among the younger generation who are frequently using smart phones and internet facilities. People have started using digital/ internet banking to check the balance and transaction history but still they are scared about online funds transfer and payments. They feel that online transfers are not safe and they have also accepted that they have got not any type of training or course to understand its benefits and system.

INDICATORS OF EFFECTIVE MANAGEMENT OF PEOPLE BY GRAM PANCHAYAT ORGANIZATION IN MANIPUR

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Abstract

Panchayati Raj as an institution is nearest to the people and plays a dominant and dynamic role for all round development of the rural people in India. Panchayati Raj in the present form is a constitutional body, democratically elected and decentralized unit of rural self-government. It enables participation of people, particularly weaker sections of the society in the decision making process and local self management. It is a people's institution and generally has a three-tier structure at the district, block and village levels. In Manipur, a two-tier Panchayat Raj System as per Manipur Panchayati Raj Act, 1994, exists - *Gram Panchayat* at village level and *Zilla Parishad* at district level. The present study was conducted to find out the indicators of effective management of project by interviewing 200 Gram Panchayat members randomly selected from 38 Gram Panchayats from Imphal-East and Bishnupur districts with the help of Interview Schedule.To find out the important indicators of effective management of project 34 items have been selected and presented to the respondents in a 4-point continuum *viz*, most important, important, somewhat important and not at all important with weights 4,3,2 and 1,respectively. To identify the indicators Factor Analysis using Principal Component Method has been done. The important indicators of management of project identified were- Resource Capacity Building and Indigenous knowledge; Infrastructure development and service deliverables; Community resourcing by social awareness; Sustaining human and animal health and Social fencing which have special relevance for effective management of Gram Panchayatorganisation in Manipur.

COMPARATIVE STUDY OF SRI AND TRADITIONAL TRANSPLANTING METHOD ON RICE (*ORYZA SATIVA*) PRODUCTIVITY AND PROFITABILITY IN EASTERN PLAIN ZONE OF UTTAR PRADESH

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Abstract

Rice is the major crop in Uttar Pradesh and is grown in about 5.90 m ha which comprises of 13.5% of total rice in India. In order to meet the future food demands for the teeming population of the state, it is vital to give much emphasis on enhancing rice productivity through water use efficiency (WUE) and make rice production system more sustainable and economically profitable. SRI appears to be a viable alternative for rice cultivation that saves expensive inputs, water, improves soil health and ensures environmental sustainability. Keeping view, Krishi Vigyan Kendra Masodha, Faizabad has taken up 20 front line demonstrations continuously for four years during *kharif* 2010-11 to 2013-14 to introduce and popularize system of rice intensification (SRI) over traditional random transplanting (TPR) method of rice cultivation were studied at farmers' fields in Faizabad district of eastern plain zone of Uttar Pradesh. High yielding variety of rice "NDR 359" was used in all three years with an objective to demonstrate the advantage of SRI method of rice cultivation over the conventional method of rice transplanting (TPR). The results obtained that the yield attributes of rice were found higher in SRI as compared to TPR method. The three years pooled data revealed that in case of SRI, the yield attributes like plant height (155.2 cm), effective tillers/hill (45), panicle length (23 cm) and number of grains/panicle (148) were significantly higher as compared to TPR methods. The pooled yield of SRI (74.09 q/ha) was significantly higher as compared to transplanted rice (51.37 q/ha) which was 30.66% lower than that of SRI. The increased in productivity might be due to higher yield attributes in SRI over TPR method of rice cultivation and better yield attributes justifies the lead of SRI over TPR method of rice cultivation. Results further revealed that due to adoption of SRI technology the crop duration for the same variety was reduced by at least 15 days as compared to TPR method of cultivation which might help the farmers to go for second crop after rice in 15 days advance. Although having similar cost of production, SRI realized 57.23% higher net return over TPR method of rice cultivation. The benefit: cost ratio of 2.30 was also much higher than the TPR (1.47). The adoption of SRI technology thus, would improve farmers' profit and eventually contribute towards sustainable livelihood security and healthy environment.

CULTURAL, MORPHOLOGICAL AND PATHOGENIC VARIABILITY IN ISOLATES OF *RHIZOCTONIA SOLANI* CAUSING ROOT ROT OF FENUGREEK

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Abstract

Root rot of fenugreek (*Trigonella foenum-graecum* L.), caused by *Rhizoctonia solani* has become an important constraint to the growers of fenugreek in Rajasthan. Significant morphological, cultural and pathogenic variability were observed among five isolates of *R. solani* collected from Jaipur, Nagaur, Jhunjhunu, Jodhpur and Sikar districts of Rajasthan. . Five isolates of the pathogen, were coded as Rs-1, Rs-2, Rs-3, Rs-4 and Rs-5. Among five isolates, Rs-2 showed faster colony growth rate (>35.00 mm/day) followed RS-3 (33.51mm/day), Rs-4 (29.60 mm/day) and Rs—5 (26.00 mm) and slow growth rate (25.48 mm /day) observed in Rs-1 Isolate. Rs—2 indicated fast growing nature and covered whole Petri plate within 72 h. All the five isolates varied in hyphal width, ranged from 1.97 to 3.47 µm. Isolate Rs-1 caused maximum disease incidence (64.00 %) which was significantly higher over all other isolates, followed by isolates Rs-5 (55.75%) and Rs-3 (51.75%). Lowest disease incidence (40.00 %) was observed with Rs-2 isolate. Among these five isolates, highly pathogenic was Rs-1 isolate (Jaipur Isolate) while Rs-2 isolate (Sikar Isolate) was weak pathogenic.

FOOD PROCESSING, VALUE ADDITION AND POST HARVEST TECHNOLOGY

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Abstract

Food processing is the process of adding value to the agricultural produce by using various techniques like grading, shorting, packaging, etc. which enhances the shelf life of food products. The post harvest sector includes all points in the value chain from production in the field to the food being placed on a plate for consumption. This includes harvesting, handling, storage, processing, packaging, transportation, and marketing. Main concern is the post harvest loss (PHL) which happens at every stage of the supply chain. Eliminating those losses is a way to increase food availability without requiring additional resources or placing additional burdens on the environment. The causes of PHL which some estimates suggested could range from 15 to as high as 40% of production are manifold. Food losses contribute to high food prices by removing part of the supply from the market. There are a wide range of post harvest technologies that can be adopted so that food already produced is not wasted between the farm and table. So that losses throughout the process of pre-harvest, harvest, cooling, temporary storage, transport, handling and market disbursements, novel thermal and non- thermal food processing techniques can be employed to ensure the food and nutritional security which ultimately have profound effect in post- harvest management. In addition, the fortification and value addition to food and by-products can be employed to minimize the waste production. Overall economic setup of country would accelerate by a strong and dynamic food processing sector. Furthermore, food processing sector provides vital linkages and synergies between industry and agriculture and also potential of growth and employment has been identified.

EFFECT OF ENDOGENOUS VARIATION OF GIBBERELLIC ACID ON MOLECULAR, PHYSIOLOGICAL AND YIELD RELATED TRAITS OF WHEAT UNDER HEAT STRESS AT REPRODUCTIVE STAGE

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Abstract

In present study we investigate potential role of gibberellic acid (GA) on wheat under terminal heat stress as adoptaion strategies to counteract its impact on growth and development. Wheat was sown late in pot culture during winters of 2012-14 to impose stress. Genotypes were evaluated based on physiological traits using multivariate analysis for tolerance ability.

Traits like membrane stability index (MSI), SPAD value, Fv/Fm ratio and photosynthesis rate were major contributor in grouping of genotypes and showed positive correlations with grain yield. The genotypes were categorized in to three groups namely tolerant (14), intermediate (17) and sensitive (9). Tolerant genotypes like DBW 14, RAJ 3765, HD 2643, LOK 1 and HALNA performed physiogically better under heat stress as compared to heat sensitive cultivars. Endogenous GA_3 content in leaves was found to be negatively correlated with tolerance ability of genotypes. Path analysis revealed that endogenous GA_3 had direct negative influence on test weight. Temperature tolerant (HD 2643 and DBW 14) and susceptible (HD 2189 and HD 2833) cultivars were used to establish role of GA in providing tolerance. Tolerant genotypes maintained higher growth, yield, antioxidant enzymes activity, MSI, photosynthesis rate etc. and lower lipid peroxidase activity, H_2O_2 content under stress. Paclobutrazol (PBZ) escalated the antioxidant enzymes activity, photosynthesis rate and Fv/Fm ratio and reduced the lipid peroxidation and ion leakage in stress. Effect of PBZ application was more pronounced on tolerant cultivars. GA_3 had non-significant effect on antioxidant enzyme activity, lipid peroxidation and membrane stability while increased the test weight in stressed environment. GA_3 upregulated GA biosynthesis and degradation pathway genes and PBZ down regulated kurene oxidase and GA 2ox gene expression. GA_3 induced increase in cell expansins gene expression was more in late sown plants. The variable level of endogenous GA_3 could not produce significant difference in heat tolerance ability of wheat cultivars. High exogenous GA_3 had positive effect on test weight and cell expansins gene expression. However, exogenous application of PBZ enhanced thermo-tolerance by inducing antioxidant metabolism, photosynthesis and yield related traits. The explored genetic diversity based on physiological traits has the potential to improve wheat breeding programme for heat tolerance.

COCONUT DE-HUSKER : A TECHNOLOGY REVIEW

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Abstract

The term "coconut" can refer to the whole coconut palm, the seed, or the fruit, which botanically is a drupe, not a nut. Coconuts are known for their versatility of uses, ranging from food to cosmetics. By-products of coconut viz., hard shells, fibrous husks and long pinnate leaves can be used as material to make a variety of products for furnishing and decorating, charcoal production, coir making, coco peat in nurseries for rising plants, etc.Coconuts in the husk are very bulky. They are de-husked first before being transported intrucks or carts and to have coconut meat and copra. In India, de-husking of coconut is extensively done by manually. The principal part of the manual de-husker is a sharp-pointed shard of steel positioned vertically with the point up and the broader part firmly placed on the ground. A traditional de-husking method is time consuming, tedious, difficult process and alsodifficult to get skilleddehuskers.To overcome these limitations, to improve the automation and toprovide safety for the operator,mechanical machines/equipment'sare introduced in the countries' coconut growing belts.These mechanical de-huskers are classified as semi-automatic and fully automatic de-husker and also as electrically powered and IC engine powered de-husker. The objective of this paper aims to review new technologies in the coconut de-husking process.

STUDY ON DIVERSITY OF INSECT FAUNA AND THE POPULATION DYNAMICS OF BLACK BUG IN SUGARCANE ECOSYSTEM

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Abstract

The studies on diversity of insect fauna and the population dynamics of black bug, *Cavelerius sweeti* Slater in sugarcane ecosystem were conducted for two seasons during 2014-15 and 2015-16 at Norman E. Borlaug Crop Research Centre of G.B.P.U.A & T. Pantnagar, Uttarakhand, India. The study finds a total of eighteen predominant insect-fauna, among them eleven were insect pests. The order Lepidoptera comprised of five borer pests *viz., Chilo infuscatellus* Snellen, *Scirpophaga*

nivella Fabricius, *Chilo auricilius* Dudgeon, *Chilo sacchariphagus indicus* Kapur, *Emmalocera depressella* Swinhoe and one predator, *Epiricania melanoleuca*. Whereas, five insects were recorded from the order Hemiptera which includes four sucking pests (*Pyrilla perpusilla* Walker, *Cavelerius sweeti* Slater, *Melanaspis glomerata* Green and *Saccharicoccus sacchari*) and one predatory bug, *Eulyes sp.* Meanwhile the study also recorded two Coleopterans (*Holotrichia serrrata* and *Coccinella septempunctata*), two Isoptera (*Odontotermes* sp.) and *Microtermes* sp.), and one each from Orthoptera, Dermaptera, Neuroptera, and Hymenoptera. The incidence of the black bug on sugarcane was observed from 17th to 27th SMW (Standard Meteorological Week) and 16th to 25th SMW during 2014 and 2015 respectively. The population attained its maximum in the 21st standard week in both the seasons. Simple correlation between the weather parameters and black bug population during 2014-15 revealed that there was positive highly significant correlation with T_{max} and positive non-significant correlation with T_{min} whereas, it is negative non-significant with RH_{max} RH_{min} and rainfall respectively. In subsequent year it was positive non-significant correlation with T_{max} and RH_{max} while, it was shown negative non-significant correlation with T_{min}, RH_{min}, and rainfall respectively.

KINETICS OF PHOSPHORUS SUPPLY: A COMPARATIVE STUDY OF LANGMUIR, FREUNDLICH AND SCHOFIELD'S APPROACH IN THREE DIFFERENT SOILS WITH THREE DIFFERENT PHOSPHORUS SOURCES

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Abstract

A Study Entitled "Kinetics of phosphorus supply : a comparative study of Langmuir, Freundlich and Schofield's approach in three different soils with three different phosphorus sources'' was undertaken as a pot culture experiment. The three soils taken were fine textured calcareous clay loam soil of RCA farm, medium texture calcareous clay loam soil of CTAE and saline-sodic sandy clay loam soil of Vallabhnagar. These soils varied in their physicochemical characteristics. Wheat (var. Raj. 3077) was taken as the test crop. To study the hydrolysis pattern of applied ammonium polyphosphate, an incubation study was done keeping the same levels of phosphorus application as in the pot culture and a correlation was also carried out with the hydrolysis of P from APP occurred in the pot experiment following wheat crop commensurating the same time interval. Completely randomized design was followed for inoculations and pot culture experiment with four levels of P (0, 20, 40 and 60 kg P/ha) which were replicated thrice. The stages of studies were two (30 and 45 days) in pot culture experiment and four (7, 14, 30, and 45 days) in the incubation experiment. Application of phosphorus increased dry matter yield, N uptake, P uptake and available P (Olsen's) in all the soils with every source of phosphorus. The three parameter of study of kinetics of P supply revealed that Langmuir adsorption isotherm and equilibrium phosphate potential could be a reliable measure for understanding the supply system phosphorus in a variety of soils. Freundlich adsorption isotherm failed to give any conclusive direction to sustained P supply. The 'r' Values of EPP with different parameters were slightly higher than those of Langmuir's. Thus, either EPP or Langmuir adsorption equation can safely be recommended for P fertilization packages for the area. Out of three sources of P, viz, SSP, DAP and APP, ammonium polyphosphate has shown an outstanding performance in term of various test parameters in all the three soils. Even in problematic saline-sodic soils its performance was better than SSP and DAP. The half life values of APP Obtained from the Incubation Correlated well with the hydrolyzed P in pot culture experiment.

IMPACT OF WATERSHED DEVELOPMENT PROGRAMME IN THE RAINFED AREA IN REWA DISTRICT OF MADHYA PRADESH

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Abstract

To examine the impact of watershed development programme in the rainfed area in Rewa district of Madhya Pradesh. The

specific objectives were to study the cropping intensity, production, cost and returns and input-output ratio on farms of different sizes in Watershed Development Programme (WDP) and Non Watershed Development Programme (NWDP). A multi random sampling technique was adopted. The Majhigavana Mili Watershed Area in Teonthar Block of Rewa district was selected under the watershed area. A sample of 35 cultivators consisting of 20 small (less than 2.00 ha), 10 medium (2.01 to 4.00 ha) and 5 large (4.01 and above ha) farmers each were selected randomly from the list of total cultivators the village of watershed area and non watershed area, respectively. The study pertained to the year 2013-14. The analysis showed that the average cropping intensity was higher in WDP than in NWDP. The average yields per hectare of wheat and gram were, 43.34 and 19.53 quintal respectively in WSA as compared to, 21.54 and 10.75 quintals in NWSA. The average cost of production per quintal of wheat and gram worked out at Rs. 467.61 and Rs. 1435.88, respectively in WSA as compared to Rs. 848.32 and Rs. 2438.73 in NWSA. The average cost of production per quintal of wheat and gram worked out to be in WDP than in NWDP. The average cost benefit ratio was higher for wheat and gram in WDP as compared to NWDP. The farmers in WDP adopted improved technology due to financial assistance provided to them through subsidy and they used higher level of farm inputs which resulted in increased incomes. The analysis indicated that more importance should be given to encourage adoption of recommended package of practices, developing suitable improved varieties of cereals, pulses, oilseeds and potato (less water consuming crops) which would increases not only the income but also enrich the soil fertility. The study revealed that the WDP is one of the most important strategies to bring socio economic change in the rainfed system. Overall there has been a positive impact due to adoption of WDP in raising the level of income, employment and productivity of various crops in watershed area on small, medium and large farms.

INFLUENCE OF ABIOTOC FACTORS ON THE PHEROMONE CATCHES POPULATION OF GRAM POD BORER (*HELICOVERPA ARMIGERA*) IN CHICKPEA IN FARMERS FIELD IN VIDISHA DISTRICT OF MADHYA PRADESH

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Abstract

Study on population of gram pod borer (*Helicoverpa armigera*) moth male catches by pheromone trap were conducted during 2017-18 at farmer's field Ganj Basoda District Vidisha of Madhya Pradesh. It started appearing in 3rd standard meteorological weeks (SMW).The maximum population of moth catches was observed during 10th SWM (5.45 moth/weeks). The activity declined and ended in 13rd SWM with 0.75 moths/week. The population of male moths showed a non significant positive correlation with maximum and minimum temperature as well as relative humidity and rainfall.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF SOYBEAN (*GLYCINE MAX*) IN SOYBEAN-WHEAT CROPPING SYSTEM IN VINDHYAN PLATEAU OF MADHYA PRADESH

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Abstract

Field experiments were conducted at farmers field of different district of Vindhyan Plateau (Vidisha, Raisen, Damoh, Sagar, Bhopal and Sehore) of Madhya Pradesh for consecutive three *kharif* and *rabi* seasons (2013-14, 2014-15 and 2015-16) on clay soil to evaluate the effect of different organic sources (cow dung, vermicompost and poultry manure) in combinations with variable levels of natural sources, *i.e.* rock phosphate, feldspar and gypsum on growth, yield and economics of soybean in soybean-wheat cropping system. The values of different yield attributes and economics associated with 75 per cent RDF through poultry manure + 25 per cent through natural sources + biofertilizers (*Rhizobium* + PSB) were maximum. The seed and stover yield enhancement in this treatment was 20.07 and 20.36 per cent respectively, as compared to RDF through natural

resources. Thus, the combined use of different organic sources played a significant role in increasing seed and stover yields of soybean.

PRADHAN MANTRI MUDRA YOJANA : MICRO UNITS DEVELOPMENT AND REFINANCE AGENCY

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Abstract

Prime Minister, Shri Narendra Modi, today said that supporting the small entrepreneurs of India is the biggest way to help the Indian economy grow and prosper. He was speaking at the launch of the Pradhan Mantri MUDRA (Micro Units Development and Refinance Agency) Yojana in New Delhi. Stressing the contribution of small entrepreneurs in the economy, the Prime Minister expressed confidence that within a year's time, the major banks would also adopt the MUDRA model. The Prime Minister said that in our country, one often experiences that things revolve around mere perceptions, while the details often paint a different picture. Giving the example of the perception that large industries create more employment, he said that a look at the details reveals the reality that only 1 crore 25 lakh people find employment in large industries, whereas small enterprises employ 12 crore people in the country. The Prime Minister said that while there are a number of facilities provided for the large industries in India, there is a need to focus on these 5 crore 75 lakh self-employed people who use funds of Rs 11 lakh crore, with an average per unit debt of merely Rs 17,000 to employ 12 crore Indians. He said that these facts, when brought to light, led to the vision for MUDRA Bank. The Prime Minister spoke about his time as the Chief Minister of Gujarat, when he focused on the environment-friendly cottage industry of kite making, which employs lakhs of poor Muslims. The Prime Minister also congratulated SIDBI on the silver jubilee of its inception, and appreciated the work done by it in supporting India's small scale industry in these 25 years. The Prime Minister said that MUDRA scheme is aimed at "funding the unfunded". He said that the small entrepreneurs of India are used to exploitation at the hands of money lenders so far, but MUDRA will instil a new confidence in them that the country is ready to support them in their efforts that are contributing so heavily to the task of nation building. The Prime Minister said that mere launching of new schemes in not progress. Real success lies in real change on the ground, as was seen in the Jan Dhan Yojana and PAHAL, which had delivered concrete results within limited timeframes, he added. He said that the established financial systems will soon move to the MUDRA-model of functioning, i.e. to support entrepreneurs that give employment to a large number of people using least amount of funds.

EFFICACY OF TRAINING PROGRAMME ON KNOWLEDGE AND ADOPTION BEHAVIOUR OF DAIRY FARMERS ON BALANCE FEED OF LACTATING COW IN DISTRICT BARABNKI UTTAR PRADESH

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Abstract

A study was carried out to assess the impact of training programme on adoption and view of the Farmer Groups on balanced animal feed in Barabanki District of Uttar Pradesh. A total of ten villages from different community development blocks were selected based on 18th livestock census of cattle population (2007). Data were collected on pretested interview schedule. Training programme was provide to 249 different village respondents on balanced animal feed and level of technology adoption was carried out to assess the effectiveness of the programme through pre and post evaluation of respondents. Garrets Ranking Technique was performed inprioritizing the view of farmers on the new feeding technology pattern adopted by Farmer Groups. The overall adoption percentage by the groups was 57.81%. Also the results clearly indicated that there was highly significant difference ($P<0.01$) in the knowledge level of the respondents before and after training. The Garrets Ranking technique revealed that the high score of 72.11had been given to the cross-bred cow which showed a marked increase

in milk production during the experimentation period of 20 days as adoption of new feeding technology and ranked the first position.

VALUE ADDED FLORICULTURE : VISION TO DOUBLE FARMER'S INCOME

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Abstract

Value-addition in floriculture is a procedure of increasing the economic value and consumer appeal of any floricultural commodity. Profit potential is amplified when an indistinctive raw commodity is converted into a unique product. The value-addition for marketing flowers includes adoption of postharvest technology and improved logistics. Export of value-added product *e.g.* oil rather than the raw material such as rose petals, can help generate substantial revenue in international market. Flowers provide an opportunity to convert them into exquisite products directly from fresh flowers like garland, bouquet, flower arrangements and after drying the flowers making different products like potpourri, wreath or after processing like rose water, gulkand, perfumes, essential oil, cosmetics, *etc*. Besides this, a number of pigments like xanthophylls, carotenoids, anthocyanins, *etc*. which has nutraceutical properties and pharmaceutical compounds are also prepared from the flowers. At present dry flower industry is growing very fast with more than 60% share to the floriculture industry in India. Dried flowers are long-lasting, can be used several times and also meet the decorative demand throughout the year. The value addition results in more acceptable quality products for the domestic and export market and hence ensures high premium to the producer. Moreover, value addition technology can help in avoiding wastage during the glut period and farmers involved in the flower cultivation can earn better remuneration.

STATUS OF FARM MACHINERY IN HARYANA VIS-À-VIS INDIA

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Abstract

Modern agriculture is dependent on high yielding varieties, chemicals, increased use of fertilizers, pesticides, irrigation and farm mechanization. Farm machines have played a paramount role not only in agriculture production but also for processing and have grown in to a sizable industry in India. In India, it has been observed that maximum mechanization is undertaken while preparing the seed bed (penetration levels at approximately 40 percent) and irrigation (penetration levels approximately 45 percent) while the total mechanization rate is approximately 40-45 percent. The level of adoption of new technology including farm mechanization by Indian farmers is still low. In developed countries, the farmers have adopted highly advanced, efficient and labour saving agricultural machinery and equipments. Farm mechanization leads to 5.20% of enhancement in cropping intensity, 29-49% increase in gross income of farmers, 20% saving in seeds and 15-20% saving in fertilizers. The farm power availability in India during 2016-17 is 2.02 kw/ha. It has found that there is 6.26% and 9.30% growth per annum in sales of tractors and power tillers in India. The growth in number of tractors in Haryana is around 3% per annum. Haryana contributes 2.7% of milking machines, 11% of mechanized fodder cutter, 2.56% of choppers and 4.4% of disposal equipment to India in livestock sector. The constraints involved in farm mechanization are small size and scattered holdings of the farmers. Majority of small cultivators are poor who are not in a position to purchase the costly machinery like tractors, combine harvesters etc. Studies under AICRP on energy requirement indicate that tractor owning farms do use draft animals for certain jobs. Like- wise farms using animate sources of farm power use tractor on custom service for certain jobs. Mechanization may lead to structural change in agriculture in respect of the occupational distribution in the rural economy. Lack of proper knowledge of farmer to purchase farm machinery, operate and maintain it properly leads to wrong choice, makes it uneconomical and risky too. There is great shortage of diesel in the country as a whole. Thus, to use so extensive oil based farm machinery is not desirable. The lack of repair and replacement facilities in the remote rural areas is another hindrance in efficient small farm mechanization. Due to seasonal nature of the agriculture, the farm machinery remains idle for much of the time. The policy measures of farm mechanization includes: The use of the tractor for custom hiring should be

encouraged through legislative measures. However, to solve the problems of mechanization of smaller holdings, the possibilities can be : (a) Co-operative management of farm machinery (b) Financing of second hand tractors for small farmers (c) Extension services to advice the suitability of various makes, models and horse powers for different size of operational holdings. (d) Devising smaller machinery suitable for small farms which constitute the vast majority of farmers but the machinery has to be effective and less costly.

INDIGENOUS TECHNICAL KNOWLEDGE (ITK) AND THEIR ROLE IN SUSTAINABLE GRASSROOTS INNOVATIONS : AN ILLUSTRATION IN INDIAN CONTEXT

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Abstract

Indigenous Technical Knowledge (ITK) has immense potential for innovation, especially at the grassroots level. India is a country populated by a number of indigenous communities, most of which have their own set of unique traditional knowledge and technology base. Many of these knowledge and technologies are at par with the modern knowledge and technology system and have been provided the indigenous communities with comfort and self-sufficiency. These traditional knowledge and technologies have played a significant role in the overall socio-economic development of the communities. A study on some of the aboriginal knowledge and technologies, with special reference to the concept of Indigenous Technical Knowledge (ITK), prevalent among a number of indigenous communities was carried out and the significance of the same in innovation has been evaluated. The study was conducted within the framework of "sectoral system of innovation". A wide range of diverse sectors including agriculture, animal husbandry, fishing and textile were considered for the purpose of the study as all these sectors are imperative in Indian context. During the course of the study, it has been observed that there is an instant need to document and preserve the Indigenous Technical Knowledge (ITK) of different communities, many of which are at the brink of extinction. There is a lack of proper alliance between the practice of indigenous and modern knowledge. There are serious issues related to intellectual property rights. An appropriate association between the traditional and modern knowledge and technology systems has immense potential to benefit the society.

SCREENING OF VARIOUS BOTANICALS, BIO-AGENT AND CHEMICALS AGAINST *RHIZOCTONIA SOLANI* CAUSING AERIAL BLIGHT OF SOYBEAN

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Abstract

Soybean (*Glycine max* (L.) Merrill) is one of the most important oil seed crop of India. It was wonder of the twentinth century. Soybean ranks first among world oilseed with an annual production of about 105 mt. In oilseed scenario of India, it has occupied fifth place after castor, safflower, groundnut and rapeseed mustard. The application of recent production technologies has pushed the national productivity to 1,068 kg/ha which is only about 47 percent of the world average i.e., 2,148 kg/ha. In India its occupies an area of 22.47 m ha with production of 13.38 million tonnes. Soybean is mainly grown during kharif season in sandy loam to clay loam soil in Chhattisgarh. In Chhattisgarh, the crop is grown over an area of 0.82 m ha with production and productivity of 0.73 mt and 891 kg/ha, respectively which are much lower than national average. Soybean aerial blight caused by *Rhizoctonia solani* is a most important oilseed disease. The disease appears during July-August and is characterized by sudden and complete death of the plants. This disease is very destructive and causes heavy losses to the tune of 35-60 % in warm and humid parts of the countries. Antifungal activity of different medicinal plant leaf extracts, oils and *Trichoderma* spp. were studied under *in vitro* condition. Out of fifteen medicinal plants studied, the leaf extracts of Butch significantly inhibited the mycelial growth of *Rhizoctonia solani* under *in vitro* conditions. Among the medicinal oils, Eucalyptus and Neem oils were found to significantly inhibit the mycelial growth of *Rhizoctonia solani* at 5% concentrations. Among the antagonists, maximum mycelial growth inhibition was caused by *Trichoderma harzianum*

(74.81%) followed by *Trichoderma viride* (67.40%) while *Trichoderma* spp. (mushroom isolates) was least effective against *Rhizoctonia solani*. Under *in vitro* study complete inhibition in mycelial growth of *R. solani* was observed by Benlate and Cursor at all concentration *i.e.,* 250, 500, 1000 ppm.

SURVIVAL OF *RHIZOCTONIA SOLANI*, INCITANT OF AERIAL BLIGHT OF SOYBEAN

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Abstract

Soybean (*Glycine max* (L.) Merill.) a grain legume is widely grown crop due to its high quality protein (40%) and edible oil (20%). Aerial blight caused by *Rhizoctonia solani* is one of the most soil borne diseases of soybean particularly, in the northern zone comprising the states of Haryana, Punjab, Uttar Pradesh and Uttrakhand. The disease appears July-August and is characterized by sudden and complete death of the plants. *Rhizoctonia solani* survives in soil as dormant mycelium, sclerotia and by saprophytic growth on organic matter which served as primary source of inoculums. Little information available on survivability of *Rhizoctonia* in infected plant debris of soybean. There for the experiments were conducted to know the survivability of *Rhizoctonia solani* on infected plant parts of soybean. Plants were separated in to their parts i.e. leaf, stem, pod and seed and cut into small pieces. Sclerotia were also collected from diseased plants. All the infected parts of the plant including sclerotia were kept in three conditions, i.e. (1) Soil irrigated (2) Soil unirrigated (3) Room temperature. For survival studies of the pathogen, each part was taken from pots and paper bags at 30 days interval upto 300 days (10 months). In case of roots soil was separated from the infected roots of soybean plants and roots were kept in room temperature at the laboratory for further studies. Isolation of the pathogen from the infected root was carried out at 30 days interval upto 300 days (10 months) to ascertain the survivability of the pathogen. For isolation of pathogen infected root was equally divided in four parts i.e. lower parts, lower middle, upper middle and upper parts. The result revealed that fungus was survived through sclerotia over a tested period i.e., 300 days in all conditions from date of harvesting. In case of root at room temperature maximum survival of *R. solani* was recorded in upper parts (Collar region) of the root for 300 days and minimum survival of fungus was recorded in lower middle parts for 150 days from the date of harvesting.

SELF HELP GROUP : EFFECTIVE CONCEPT FOR LIVELIHOOD SECURITY OF RURAL POOR

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Abstract

Now a day's Women's contribution is important on domestic as well as economic level for socio-economic development of family. Involvement of women in income and employment generating activities has significant importance as they are the vital part of Indian economy. Hence it is necessary to encourage and make them economically sound and self-reliant by converting their activities in to enterprise. Considering these views the study of Self Help Group was conducted in Kolhapur district. Total 120 respondents of eight enterprises from 12 villages of three tahsils were identified for the study to know the entrepreneurial development taken place in the self employed women through SHG. The collected data were quantified, compiled and analyzed. Data revealed that majority (72.00 per cent) of the respondents stated medium socio-economic changes occurred with regards to increased annual income (68.00 per cent), improvement in social status (63.00 per cent), increase the participation in community development programme and in decision making (56.00 per cent) and increased the knowledge and skill of cultivation technologies (47.00 per cent). The data regarding utilization of increased annual income indicated that maximum share (9.15 per cent) utilized for fulfillment of domestic daily needs, children education (9.54 per cent), Health of family member (6.64 per cent) followed by expenditure of and expenditure on agricultural business enterprises (9.15 per cent).

Majority (65.56 per cent) of the respondents attended the training on dairy enterprises. The profit expenditure ratio of the Self Help Group having Dairy enterprises is Rs. 0.32. Regarding the women empowerment through Self Help Group 83.33 percent women stated Psychological empowerment followed by Cultural empowerment (78.33 per cent), Social empowerment (72.50 per cent), Economic empowerment (81.66 per cent) and Political empowerment (55.33 per cent). The members of Self Help

Group are also trying to increase the livelihood of rural poor farming community by transferring the technologies, improved practices / methods related to agriculture and allied enterprises. Members plays important role in transfer of technology / practices regarding to seed treatment (54.00 per cent), animal care (42.00 per cent), animal feed and fodder (32.00 per cent), proper milking method (39.00 per cent), post harvest technology, Jam, Jelly preparation (35.00 per cent), and pickles preparation (18.00 per cent). Besides these members are also creating awareness among rural families about children care and house management. High interest rate on loan, Unavailability of loan in time, lack of marker for sale, lack of training facility, lack of freedom from family were the major constraints in running the SHG. Availability of in time loan with low interest and provision of timely training was the main suggestions.

ROLE OF KVK IN RURAL DEVELOPMENT : CURRENT SCENARIO

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Abstract

Rural development encompasses the all round development of people in its effective dimensions of economic, social and agricultural scenario. Of course, this development may exclude the neo-rich people, those living in rural areas but deriving income from urban based activities. Rural development could be attained through improving agriculture, forestry, animal husbandry, dairying, sericulture, fisheries, rural engineering, and rural crafts. Empowering rural masses to enable them to practice these occupations to earn more and live better in a more specific term. In India, the extension efforts have largely been taken up by the state departments of agriculture and other disciplines as a state subject. Thus, KVKs are attaining the focal point for front line transfer of technologies for all developmental activities related to agriculture, community and industries in rural India. Farmers' capacity building is often seen within the limited perspective of giving them the knowledge and skills required to practice crop and animal husbandry in a better way. The KVKs which have been mandated to work with farmers, farm workers and rural youth directly as well as through field extension functionaries have the greatest challenge to make their clients more efficient, specialized and to be economically active. The fact that the need for agricultural and rural information and advisory services is to intensify in the foreseeable future exerts more pressure on their performance and hence the expectations run higher, for which KVK is a better option.

INFLUENCE OF FOLIAR APPLICATION OF BORON, ZINC AND GIBBERELLIC ACID ON FRUIT DROP, YIELD AND QUALITY ATTRIBUTES OF AONLA CV. NA-7

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Abstract

The Indian gooseberry or Aonla (*Emblica officinalis* Gaertn), belongs to the family Euphorbiaceae, now-a-days rapidly spreading in the semi-arid regions. It can successfully be grown under marginal wasteland, sodic soil, ravine land, arid and in drought prone areas. Aonla fruit is valued for its high nutritive values, medicinal properties, processing into different value added products and herbal drugs. Due to its importance and different medicinal uses, it is also known as 'Amrit Phal' and 'Wonder drugs'. It is an important ingredient of Triphala, Chavanprash and Amritkalash, *etc.* Fruits are commonly used for making preserve (Murabba), pickle, candy, jelly, sauce, dried chips, etc. Foliar spray of boron plays an important role in ovule development, pollen tube growth and fruit set, whereas, zinc is required for the synthesis of tryptophan, a precursor of auxin and help in reducing fruit drop. zinc is directly or indirectly required for protein synthesis and lack of auxin due to Zinc deficiency results in the failure of cell wall growth thereby causing high osmotic pressure and restricting water uptake**.** Gibberellins have great effect in increasing stalk length and production, including uniform crop emergence, increasing fruit size by cell division and cell elongation, improving fruit quality and storage life, delaying maturity period, controlling cracking of fruits and fruit drop problem, producing seedlessness and increasing sugar content in different fruit crops at different concentration. Numerous effects of gibberellins on different aspect of plant life suggest that hormone can be used commercially for the benefit of human welfare. The present investigation was carried out at horticulture nursery area of

Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during 2017-18. The experiment was laid out in randomized block design with three replications and ten treatments *viz.,* Borax (0.2, 0.4 and 0.6 %), $ZnSO_4$ (0.2, 0.4 and 0.6 %) and GA_3 (25, 50 and 100 ppm) including a control. In view of the results obtained from present investigation, it is reported that plants treated with Borax @ 0.6 % significantly reduced fruit drop (68.08 %) and increases fruit retention (31.92 %), total sugars (12.75 %), moisture (94.09 %) and TSS (15.10 ^{0}Brix) contents. Plants treated with GA_3 @ 100 ppm also produced fruits having maximum length (3.40 cm), width (4.06 cm), weight (30.55 g), volume (28.25 cc), specific gravity (1.08 g/cm^3), pulp weight (29.14 g), stone weight (1.41 g), pulp: stone ratio (20.66 %), ascorbic acid (615.67 mg/100g) and yield (81.86 kg/plant) with minimum amount of titratable acidity (1.55 %).

EFFECT OF DIVERSE COLOUR PLASTIC MULCHES ON NDVI VALUES OF BANANA CROP

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Abstract

Research was conducted to study the effect of six different colour plastic mulches along with no mulch treatment on Normalized Difference Vegetation Index (NDVI) values of banana crop at MPKV, Rahuri, Maharashtra, India. NDVI is a numerical indicator of vegetative condition of crop or land that uses the visible and near-infrared bands of the electromagnetic spectrum.It is determined by using spectroradiometer, which is capable of measuring the spectrum of different light sources reflected from the target 350 nm to 2500 nm. The plastic mulches used for the experiment were yellow, blue, silver, white, red and pervious plastic mulches. All the seven treatments given irrigation with 48% of pan evaporation (Ep). The results indicated that the highest NDVI value (0.8943) observed in plants under pervious plastic mulch, followed by that (0.8918) in silver black plastic mulch at 300 days after transplanting (DAT) due to greater density of vegetation. The minimum NDVI value (0.8104) observed at 300 DAT in plants under no mulch treatment.NDVI values in all treatments increased continuously during peak growth period of banana crop and decreased slightly in the harvesting stage of the crop, which may be due to reason that banana plants remained green and healthy at harvesting stage also.

USE OF INDIRECT SELECTION METHOD IN BREEDING FOR DROUGHT TOLERANCE IN PEANUT (*ARACHIS HYPOGAEA* L.)

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Abstract

An investigation was carried out in 192 progenies derieved from seven hybrids involving eight parents in Peanut *(Arachis hypogaea* L.).The objectives of this investigation were to make the potential use of indirect (Trait based) selection in breeding for drought tolerance conventional breeding programmes by assessment of drought related morpho-physiological traits at one hand viz. water use efficiency (WUE) measured in terms of SPAD reading and harvest index (HI) and quantitative traits on the other. The important outcome of this investigation is that the two selection methods one is indirect (Trait based) selection which was exercised under drought and irrigated conditions and second empirical selection under irrigation condition did not show significant superiority of indirect (Trait based) selection over the empirical for yield under either limited – moisture or normal – moisture condition. However, there was a strong trend for increased kernal yield in trait-based genotypes among the top genotypes, although the yield gains were statistically non - significant when compared with the highest yielding parent ICGS – 76. Even so there were significant yield gains among the top genotypes compared to the other seven parents. Thus the results suggested that the inclusion of some of the constituent traits of the selection index, or their easily measurable surrogate traits would be useful in peanut breeding programs. These data should enable tools to be developed for indirect selection of genotypes suited to drought prone environments. Assessing over all performance of the progenies twenty-two progenies were found to be superior for one trait or the other for resistance / tolerance to drought selection through trait based selection method. However, empirical selection method could not yield a profenly sustaining in drought conditions.

ISOLATION OF ENDOPHYTIC FUNGUS *CURVULARIA SPICIFERA* FROM MEDICINAL PLANT *TINOSPORA CORDIFOLIA* AND INVESTIGATION OF ITS ANTIOXIDANT ACTIVITY

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Abstract

In nature plants face many abiotic stresses and these stresses result in the increase in reactive oxygen in plant tissues hence causing damage to the plant growth. To protect from these abiotic stresses plants have an assembly of beneficial microbes also known as fungal endophytes present inside the tissues of plants which provide oxidative stress protection to the host plant by producing various kind of antioxidant secondary metabolites. An increased expression of antioxidant compounds by the host plant and the endophytic fungi would counteract stress induced reactive oxygen. In the present study, an endophytic fungi *Curvularia spicifera* was isolated from stem of *Tinospora cordifolia* and extract of this isolated fungus showed significant total antioxidant potential. The finding of the study provides further support to the hypothesis that abiotic stress protection in plant is largely a function of oxidative stress protection. The isolated endophytic fungi produce secondary metabolites which can be used for the good of human beings as antioxidant compounds. This study suggests that medicinal plants should be conserved not only for their medicinal properties but also for their associated fungal diversity.

AGRO-FORESTRY FOR SOIL RESTORATION AND CLIMATE CHANGE MITIGATION : A STRATEGY IMPROVING THE SUSTAINABILITY OF NATURAL RESOURCE BASE

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Abstract

Land use system for agricultural production has a dominant role in environment management. Climate change and global warming can therefore be ameliorated by improved land management practices. The phenomenon of enhanced greenhouse effect due to increased emission of carbon dioxide in the atmosphere is basically a function of perturbations in the global carbon cycle, which disturbs the ecological balance leading to climate change and global warming. If we disrupt the carbon cycle, there is depletion of soil and biotic carbon pools, which results in emission of carbon (as CO_2 and CH_4) and N (as N_2O and NO_3) into the atmosphere. The carbon stock of Indian soils can be greatly improved by agro-forestry, besides also by judicious use of organic and inorganic fertilizers in sustainable agricultural system. Agro-forestry systems and mixed farming systems are superior in terms of soil organic carbon improvement as compared to sole cropping. Cultivation of fast growing trees with arable crops under agri-horticultural or agri-silvicultural systems help in improving soil organic carbon content and sequestering carbon, thus mitigating climate change effects. Therefore, popularization of agroecology – compatible, agri-horticultural and agri-silvicultural systems can have immediate impact on reduction in greenhouse gas emissions and slowing down the pace of climate change and global warming. This is also desirable from the viewpoint of improving the sustainability of natural resource base and our food production system.

EXPRESSION OF CYTOPLASMIC DIVERSIFIED HYBRIDS FOR SEED YIELD AND OIL CONTENT UNDER VARIED WATER REGIMES IN SUNFLOWER

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Abstract

Sunflower is sensitive to drought stress and its hybrids have a limited cytoplasmic diversity. The wild cytoplasmic sources of sunflower are not well exploited to their potential for drought tolerance and hybrid development. In this respect, we carried out a Line × Tester based genetic study of 60 hybrids having diversified cytoplasmic background from wild and conventional CMS sources along with commercial hybrid as a check. The hybrids were evaluated under two water regimes viz., normal

irrigated and water stress for seed yield and oil content at the research farm of Punjab Agricultural University, Ludhiana, India. The CMS sources varied significantly regarding seed yield per plant and oil content reflected in performance of hybrids as compare to check under both the environments. Seed yield performance of different hybrids as percent of check ranged from 47.9 to 124.7 under normal irrigation, while, under water stress environment varied from 58.7 to 160.7. Oil content as percent of check ranged from 85.2 to 117.0 under normal irrigation whereas, under water stress environment ranged from 52.2 to 128.6. The highest as percent of check was reported 124.7 for conventional sources *H. petiolaris* hybrids under normal environment whereas, under water stress environment wild source *H. praecox ssp. Runyonii* had 160.7 and 116.2 highest as percent of check for seed yield and oil content respectively. It shows suitability of wild sources to water stress many fold as compared to conventional source. *H. praecox ssp. Runyonii* and *H. argophyllus* may be a potential CMS source for future hybrids development in sunflower. Overall, this study provides useful information about the cytoplasmic and nuclear interactions and their effects on seed yield and oil content in sunflower hybrids and drought stress tolerance when used in the different combinations. Therefore, they can be exploited in the hybrid development program for drought tolerance, high yielding and high oil content hybrids with a diverse cytoplasmic background.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON WHEAT : A REVIEW

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Abstract

Wheat is one of the major staple crops in the country in terms of both production and consumption. In terms of caloric intake, it is the second—most important food in the country behind maize. Research on nutritional aspects relating to wheat cultivation is abundant and is documented comprehensively. Studies being carried out the application of all the needy nutrients through chemical fertilizers have deterious effect on soil health leading to unsustainable yields. Therefore; there is a need to improve nutrient supply system in terms of integrated nutrient management involving the use of chemical fertilizers in conjunction with organic manures coupled with input through biological processes. However, the role of major nutrients on crop physiology and the effect of these nutrients on growth, quality, yield and yield components of cereal crops in general and wheat in particular are unsatisfactory. Above all, the role of balanced fertilizer is the application of essential plant nutrients in light proportion and in optimum quantity for a specific soil crop condition in alleviating the yield, quality and its attributes of wheat production is important. In association with this, research on integrated nutrient management in wheat and its effect on growth, yield, yield components and quality parameters are significance. The literature pertaining to these lines of research in wheat is presented in an elaborative way and is reviewed in this paper.

BIOLOGICAL CONTROL OF *PARTHENIUM HYSTEROPHORUS* THROUGH DIFFERENT APPROACHES

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Abstract

Parthenium hysterophorus L. of family Asteraceae known as congress grass in India, Native to Mexico Central and South America. It was accidently introduced in India along with imported food grains and in many other countries. It disturbs cultivated areas road side vegetation, gardens etc. It causes hazards to human and animal'si.e. causing allergic reaction, dermatitis, asthma etc. *Pathenium hysterophorus* become a major weed, spread rapidly.Many control method including chemical method (use of herbicides) physical and biological methods such as manual uprooting, burning, plant pathogens, insects such as *Zygogramma bicolorate,* micro-organism like *Alternaria alternat, Aspergillus nidulans, Fusarium* sp. and management through competitive plants such as *Cassia tora, Cassia occidentalis, Clitoria ternatea, Xanthium strumarium, Croton* bonplandiam etc. have been recommended. It is concluded that not a single option is suitable for its control. This weed can only be controlled by many biological approaches, biological control is cost effective, environmental safely and can play a significant role in control of weed parthenium.

EFFECT OF CHROMIUM ON SOIL MYCOBIOTA

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Abstract

Effect of the heavy metal chromium as chromium sulphate (Cr) on soil mycobiota was evaluated with an aim to mark out fungal strains which might be able to remove chromium from effluents by adsorption. Soil treated with different concentration (*i.e*. 50 ppm, 100 ppm, 250 ppm and 500 ppm) of solution of chromium metal were screened for fungal isolates over the period of 90 days. Out of 35 isolated fungal species *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Fusarium* sp. and *Penicillium* sp. could survive chromium metal treatment in soil to a reasonable extent and their sizable population were isolated from Cr treated soils throughout the period of three months even from the soil treated with as high as 500 ppm concentration of heavy metal chromium solution.

AGRO-ECOSYSTEM ANALYSIS (AESA) BASED INTEGRATED PEST MANAGEMENT (IPM)

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Abstract

The IPM has been evolving over the decades to address the deleterious impacts of synthetic chemical pesticides on environment ultimately affecting the interests of the farmers. The economic threshold level (ETL) was the basis for several decades but in modern IPM (FAO 2002) emphasis is given to AESA where farmers take decisions based on larger range of field observations. The health of a plant is determined by its environment which includes physical factors (i.e. soil, rain, sunshine hours, wind etc.) and biological factors (i.e. pests, diseases and weeds). All these factors can play a role in the balance which exists between herbivore insects and their natural enemies. Understanding the intricate interactions in an ecosystem can play a critical role in pest management. Decision making in pest management requires a thorough analysis of the agro-ecosystem. Farmer has to learn how to observe the crop, how to analyze the field situation and how to make proper decisions for their crop management. This process is called the AESA. Participants of AESA will have to make a drawing on a large piece of paper (60 x 80 cm), to include all their observations. The advantage of using a drawing is that it requires the participants/farmers to observe closely and intensively. It is a focal point for the analysis and for the discussions that follow, and the drawing can be kept as a record. AESA is an approach, which can be gainfully employed by extension functionaries and farmers to analyze the field situations with regards to pests, defenders, soil conditions, plant health and the influence of climatic factors and their relationship for growing a healthy crop.

VALIDATION OF THE CROPGRO-SOYBEAN MODEL (DSSAT V 4.5) IN THE AKOLA REGION OF VIDARBHA, INDIA

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Abstract

Crop simulation models are valuable research tools in agricultural decision making. In order to increase its general applicability, models need to be evaluated in diverse conditions. CROPGROSoybean model (DSSAT v 4.5) was evaluated for the diverse environment of akola region of Vidarbha, India for the soybean cultivar JS-335, JS-9305 and TAMS 98-21.For this, a field investigation was carried out during *kharif* season of 2014 at the All India Coordinated Research Project on Agro meteorology under Dry land Agriculture Research Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Four sowing times (27 MW-July 07, 28 MW-July 14, 29 MW- July 21 and 30 MW-28 July) to create different set of environmental conditions for weather variability and three varieties (JS-335, JS-9305 and TAMS 98-21) were laid out in Factorial Randomized Block Design with four replications and 12 treatments. The crop data, weather data and physico-chemical

properties of the soil were obtained during 2014 growing season. The genetic coefficients for the soybean varieties JS-335, JS-9305 and TAMS 98-21 were determined with the GLUE coefficient estimator embedded in the DSSAT v 4.5 model using data collected during the experiment. Genetic coefficients were used to simulate the response of various cultivars to weather and management conditions. The observed experimental data were compared with the model simulation results. The evaluation of the model on an overall basis revealed that the model simulation performance in respect of phenological phases was found to be highly reliable. The model predicted the seed yield reliably in JS-335 and TAMS-9821. Straw yield was overestimated to a greater degree in JS-335 and JS-9305 and reliably in TAMS 98-21. This application can be further validated more and also be useful for sensitivity analysis under climate change scenario.

HEALTH BENEFITS OF NON-DAIRY FOODS

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Abstract

The adverse dietary changes include shifts in the structure of the diet towards a higher energy density diet with a greater role for fat and added sugars in foods, greater saturated fat intake, reduced intakes of complex carbohydrates, dietary fibre, fruit and vegetable.Unhealthy diet, physical inactivity as well as life style changes including substance abuse are major global determinants of non-communicable diseases like type II diabetes, coronary heart disease, cancer and higher all-cause mortality rates (WHO 2002). In recent times, there has been growing recognition of the key role of non-dairy foods like millets, tubers like sweet potato, a wide variety of fruits specially berries in disease prevention and treatment. These non-dairy products provide specific health benefits beyond the traditional nutrients as they contain significant levels of biologically active compounds such as antioxidants, dietary fibre, minerals, phytonutrients. Millet fractions possess high antioxidant activityin vitro relative to other cereals. Available epidemiological evidence suggests that sorghum consumption reduces the risk of certain types of cancer in humans compared to other cereals. Studies have indicated that the phytochemicals present in tubers like sweet potato, especially polyphenols, have high free-radical scavenging activity, which helps to reduce the risk of chronic diseases, such as cardiovascular disease, cancer, and neuronal degeneration. Berry has many bioactive substances, including polyphenoland anthocyanins compounds that modulates several apoptotic pathways and matrix metalloproteinases (MMPs) to block cancer progression. Of the various compounds in Mulberry extract, cyanidin 3-glucoside (C3G) (One of the six anthocyanin) is the most abundant, and the active compound studied in berry research. antioxidant and antiinflammatory actions of C3G to improve diabetes and cardiovascular disease.

FUTURE ASPECTS ON SUSTAINABLE AGRICULTURE IN INDIA

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Abstract

Indian agriculture is facing with an array of problems such as water scarcity, reduction in cultivable land/capita, high cost of crop inputs, lack of marketing network and avenues for value addition of farm produce and fluctuating market prices. Current conventional farming can however be improved by adopting appropriate technologies of crop production, post-harvest processing and by improving quality so that agriculture becomes not only sustainable in long term but a profitable business also by linking production with consumerism. The future trends and means of sustainability are discussed. The modern agricultural practices which are heavily dependent on the use of chemical pesticides, inorganic fertilizers and growth regulators has raised the agricultural production manifold but at the cost of resource depletion, environmental deterioration and loss of crop diversity. Therefore it was realized that the modern agriculture is not sustainable in long run, hence the concept of sustainable agriculture emerged which not only emphasizes on the conservation of the natural resources but also

maintains the quality of environment. Often there is misconception that sustainable agriculture and organic agriculture is the same thing. Modern agricultural practices have also enhanced the ozone depletion. Nitrous oxide produced by microbial action on the nitrogenous fertilizers is responsible for the thinning of the stratospheric ozone layer which provide protection against the harmful ultra violet radiation of the sun. Excessive use of pesticides to control pests in modern agriculture practices has led to the problem of pesticide resistance resulting into the rise of pest population. In addition to this, pesticides are also responsible for the environmental pollution which indirectly or directly affects the human health. Management practices in sustainable agriculture. Therefore genetic erosion has emerged as major problem of modern agriculture. Overuse of inorganic fertilizers has led to the problem of soil erosion. Fertilizers destroy the soil structure making the soil susceptible to erosive forces like water and wind. Overuse of nitrogenous fertilizer urea has caused the soil acidity. Excessive nitrogen suppresses biological activity including mycorrhizae (non-pathogenic association of fungi with roots of plants which helps in phosphorus uptake by plants), reduce nodulation in leguminous plants give a competitive advantage to the weed over crop and increase pest incidence.

ECONOMICS OF PROCESSING OF PADDY INTO PUFFED RICE

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Abstract

Expanded / puffed rice (Murmura) is a traditional convenience food widely consumed in India either with jaggery, fersan and shredded vegetables and spices. In India puffed rice milling is an important industry which adds value to paddy. On an average the quantity of paddy processed was 230.27 quintals, the recovery of puffed rice was 55.86 per cent. The total investment in capital assets inclusive of land was 2.58 lakh rupees. At the overall level the total annual cost of processing was Rs. 1.30 lakh, of which the total fixed cost contributed 38.10 per cent, while the total variable cost, shared 61.90 per cent. The per quintal total cost of rice puffing in an average mill was Rs.563.05. The net return received by the average rice flaking mill was Rs.226.65 per quintal. At the overall level, the operating ratio of rice flaking was 0.44, while the fixed ratio was 0.27 and gross ratio was 0.71. All the three ratios, in all the size groups, were less than one indicated that rice flaking was a profitable activity to the processors. On an average, the benefit cost ratio in rice flaking was 1.17 and the profits for the average rice flaking mill would increase at their full capacity utilization.

THE BIOSORPTION OF MALACHITE GREEN THROUGH MYCOMASS

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Abstract

Water pollution caused by the discharge of industrial effluents containing dyes and heavy metals into water bodies or soil has become a critical environmental problem. Many developing countries are facing severe water shortages that are attributable to water pollution caused by rapid industrialization. Dyes are natural or synthetic organic compounds that provide bright, distinct and lasting colour to other substances. These are used in various industries including the paper, textile, leather, rubber, plastic, cosmetics, pharmaceuticals and food industries. Malachite Green is most widely used for colouring purpose amongst all other dyes of its category. Malachite Green is environmentally persistent and acutely toxic to a wide range of aquatic and terrestrial animals. It causes serious public health hazards and also posses potential environmental problems. Removal of pollutants through "biosorption" has attracted much attention in the last two decades owing to a number of advantages, and engaged the scientists from all over the world to identify the potent biomass types for the purpose. Biosorption refers to the passive metal uptake by different forms of biomass, which may be dead or alive. The fungi have proved to be efficient adsorbents for the removal of dyes from wastewater. Fungi belong to groups of organisms with very well known dye sorption capacity. Live and dead forms of fungi can be used in the decolorization process and the main mechanism of these forms is biodegradation and biosorption respectively.

DEHYDRATION TECHNIQUES FOR FLOWERS AND ORNAMENTAL PLANTS

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Abstract

Dry flowers and ornamental plant materials have tremendous potential as substitute for fresh flowers and foliage for decoration as well as for a variety of their esthetic and commercial uses. Fresh flowers though quite attractive, are very expensive and short lived as well as available only during a particular season. On the other hand dried flower products are long lasting and retain their aesthetic value irrespective of the season. Dried and preserved ornamental products offer a wide range of qualities like novelty, longevity, aesthetic properties, flexibility and year round availability. Drying is the best way of enjoying the beauty of the flowers throughout the year. In Indian floriculture trade dry flower industry is most promising as it contributes around 70 per cent share of total floriculture trade. The demand for dry flowers is increasing at an impressive rate of 8-10 per cent annually thus offering a lot of opportunities for the Indian entrepreneurs to enter into the global floriculture trade. Flowers and ornamental plant materials were exposed to various drying techniques like Air drying, water drying, Embedding technique (Sand, Borax, Silica gel), Micro oven drying, Hot air oven drying,molecular sieve drying and cryo drying, Pressing and glecerenizing. The final moisture content in the flowers after drying influences flower shape.The moisture content in the dried flowers also influences longevity and is inversely proportional to longevity of the flower. The dehydrated flowers retain their original shape, size and colours and can be used in value addition which includesdistinctive and artistic greeting cards, landscapes, wallhangings, table mats, Photo frames, paper weights, magnets,decoration of different types and sizes of glass containers, potpourris etc.

EFFECT OF PUNCH SPACING AND SPEED OF OPERATION ON PERFORMANCE OF MULCH LAYING MACHINE

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Abstract

Mulching is advance technology for better crop production, efficient and low cost. Mulch laying operation is generally expected by farmers. The principle units of the machine are the mulch laying and punching unit. The machine performs the operations like bed formation, laying polyethylene mulch, punching holes on laid mulch and covering of soil from both sides on laid polyethylene mulch in a single pass. The performance of the developed machine was evaluated with three punch spacing (25, 50 and 100 cm) and three forward speeds (1.3, 1.5 and 1.7 km/h) to study their effect on effective field capacity, field efficiency and punching efficiency. The combined effect of punch spacing and speed shows significant effect on performance parameters. The effective field capacity and field efficiency was increasing with increased punch spacing and speed of operation but punching efficiency was decreasing with increasing speed of operation. the effective field capacity of the mulch laying machine was calculated. It was obtained in the range of 0.108 to 0.189 ha/h with a mean effective field capacity of 0.148 ha/h. The field efficiency of the manually operated mulch laying machine was recorded in the range of 71.98 to 89.55 per cent when operated with mulches of different thickness. The mean field efficiency was observed as 79.40 per cent. The punching efficiency of the manually operated mulch laying machine was recorded in the range of 75.0 to 93.16 per cent when operated at different operating speed. The mean punching efficiency was observed as 82.46 per cent.

SCIENCE AND TECHNOLOGY IN AGRICULTURE

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Abstract

In addition to water scarcity and increasing land degradation, Indian farmers are vulnerable to impacts of climate change as their livelihood largely depends on monsoon, markets and intermediaries who are integral part of their lives but are unpredictable and play havoc on rural livelihoods. With the agricultural growth rate hovering around 3% annually, farmers

have felt severe economic distress and hence the clarion call by the Prime Minister to Double Farmers' Incomes by 2022. However, this will be a challenge given increasing fragmentation of holdings, extreme weather events, rising input costs and post-harvest losses. It is where challenges are greatest that we require the very best that human innovation can offer. The government has already placed a clear focus on farmers' welfare with policies to enhance water availability(HarKhetkoPani), increased water use efficiency (more crop per drop), better farm practices, improving soil heath, increasing investment in agriculture research, extension and support prices, creating rural infrastructure, ensuring timely delivery of credit and technology, encouraging market reform (e-NAM) and reducing risk in agriculture through the introduction of a new insurance scheme (PMFBY).A draft strategy paper released by the Ministry of Agriculture and Farmer Welfare targeted to raise the average annual income of a farmer household in India to Rs. 2,19,724 by 2022-23, from Rs. 96,703 in 2015-16, with the help of additional public and private investment of Rs. 6.4 lakh crore. Research and technology with the support of pragmatic policies, targeted budget allocations and convergence of schemes based on agro-ecologically focused growth engines will be key to realizing this vision.

EXTENT OF ADAPTABILITY OF MODERN AGRICULTURAL TECHNOLOGIES BY FARMWOMEN IN PALI DISTRICT OF RAJASTHAN

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Abstract

The prosperity and growth of a nation depends on the position and development its females, as they not only constitute nearly half of its population but also positively influence the growth of remaining half of population. It is only women around whom the whole families' growth rotates. The study was undertaken in Pali district of Rajasthan. Out of 10 blocks 2 blocks namely, Sojat and Jaitaran were selected purposely. From these 2 blocks 4 villages 2 from each blocks *e.i.* Chandawal, Suraita, Balara and Bedkallan were selected. The selection was based on the assumption that these were having maximum number of farm women involved in agricultural activities. A total of 160 respondents were taken for present study. The findings of the study were revealed that substantial percentages of respondents were adopting the agricultural technologies in the area of study. The respondents adopting various technologies were land preparation (33.5%), variety of seed used (49.46%), line sowing (39.65%), seed rate (43.11%), seed treatment 18.21%), irrigation management (57.67%), time period of irrigation (53.33%), chemical fertilizers 46.0%), plant protection (44.23%), harvesting of crop (66.12%) and storage (66.23%). This means that the respondents with male heads of family were more adopting the improved technology. Adoption of agricultural technologies followed an increasing trend with increase in land holding status of the respondents. Hence it can be concluded that land holding status of the respondents has direct bearing on the adoption of improved practices. With rapid expansion of India's we closely observed a phenomenon of 'feminization of agriculture' where women play an increasingly important role in agriculture and work spanning, farm cultivating field crops, to livestock rearing, gardening, gathering and finishing. The best way to make use of natural and potential capabilities of rural women is to provide them with opportunities for se4lf development and self employment.

EFFICACY OF PLANT NUTRIENTS ON YIELD AND ECONOMICS OF COWPEA

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Abstract

A field experiment was worked out to decide appropriate combination of chemical fertilizer and vermi compost for better yield, quality and economics of cowpea. Cowpea is a leguminous warm season vegetable crop well adopted in humid tropics and temperate zone. It can tolerate heat and drought condition but frost is detrimental for this crop. Plant requires nutrient at early stage of growth and vermi compost boost up the plant growth due to various nutrient and growth promoting substances in available form. Being a short duration crop its growth and yield are largely influenced by appropriate nutrient management. It was found that cost invested on inorganic source can be reduced by incorporating vermi compost is cost effective than any

other organic compost, manures and FYM. Vermi compost act as a store house of all essential plant nutrients required for proper growth and development and serve as plant growth stimulating factor. The experiment was designed in RBD with 5 treatments and ten replication at farmers' field for two years i.e. 2016-17 and 2017-18 of Arwal district of Bihar, it was observed that combined application of recommended inorganic fertilizer with vermi compost (50% RDF + 50% vermi compost) showed positive responses on plant height, pod formation, length of green pod, number of branches/plant and yield of cowpea as compared to farmers' practice. During the study, it was also observed that 50% flowering delayed in farmers' practices and takes about 65.84 days in comparison to 60.68 days in combined (50% RDF + 50% vermi compost) application. Keen observation of the trial found that the maximum growth of plants and early flowering resulted in maximizing yield (89.80 q/ha) with B:C ratio (4.72).

A NOVEL STUDY ON EFFICACY OF ANIMAL URINE AGAINST *HELICOVERPA ARMIGERA* (HUBNER) IN CHICKPEA AT PANTNAGAR, UTTARAKHAND

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Abstract

A novel and preliminary field study was conducted on the efficacy of animal urine against gram pod borer, *H. armigera* in chickpea at experimental farm NEBCRC, GBPUA&T Pantnagar, Uttarakhand during *rabi* crop seasons of 2016-17 and 2017-18. The experiment was consists of 9 treatments namely 7 animal urine formulations @20%, a chemical insecticide Indoxacarb14.5 SC @75 ml a.i/ha and an Untreated control. Different domestic animal's urine used in the study were *viz.* Desi cow urine, HF cow urine, Jersey cow urine, Ox urine, Buffalo urine, Goat urine and Horse urine. The pooled data for both years clearly showed that all the treatments were found significantly superior over control. The data on mean larval population, pod damage and grain yield was obtained for Indoxacarb (3.34 larvae/10 plants, 11.38% and 15.15 q/ha) showed that the chemical was performed the best among the treatments followed by Desi cow urine (4.50 larvae/10 plants, 13.00%, 12.92q/ha), Horse urine (4.33 larvae/10 plants), 13.97%, 12.55 q/ha) and Goat urine (5.83 larvae/10 plants, 15.65%, 12.25 q/ha) in comparison to untreated control (19.34 larvae/ 10 plants, 38.70%, 5.51q/ha). On the other hand, the mean population of parasitoid cocoons, *Campoletis chlorideae* was recorded the least (0.78/10 plants) in Indoxacarb and significantly more per ten plants (2.42, 2.42 and 2.00) in Desi cow urine, Horse urine and Goat urine treated plots, respectively. Thus, the present novel study clearly revealed that animal urine formulations can safely and effectively be incorporated in integrated pest management schedule against *H. armigera* in chickpea.

A PRELIMINARY LABORATORY STUDIES ON THE BIO-EFFICACY OF ANIMAL URINE AGAINST *HELICOVERPAARMIGERA* (HUBNER) (LEPIDOPTERA: NOCTUIDAE)

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Abstract

The laboratory studies on the effect of animal urine formulations on growth and development of *H. armigera*neonates and their antifeedant activity against 4th instar larvae were conducted at IPM laboratory, Department of Entomology, GBPUA&T Pantnagar, Uttarakhand during April-May 2018. This novel study was consists of seven different domestic animal's urine eachused at 20% concentration.No choice bioassay was usedwith leaf dip method. When treated tomato leaf discs fed to neonate larvae of test insect, Desi cow urine was recorded with least larval survival of 3.33% followed by horse urine (6.67%), goat urine (10.00%), buffalo urine (16.67%) and ox urine (20.00%). Whereas, Jersey cow urine (33.67%) and Holstein cow urine (26.67%) observed with maximum and untreated control (96.67 %) with the highest larval survival. Similarly, they were also found to have growth and development inhibition of test insect *viz.* extended larval, pupal periods, lower larval, pupal and adult weights, and even resulted in deformities in each life stages of test insect. Significantly lower growth indices of *H. armigera* were recordedin different animal urine formulations (0.00 to 0.447) than untreated control (2.631). Preference indices were significantly less in goat urine (0.35), Desi cow urine (0.45) and horse urine (0.50) which showed their strong

antifeedant action. The treatments such as, buffalo urine (0.62), ox urine (0.63) showed moderately antifeedant action whereas, Holstein cow urine (0.79) and Jersey cow urine (0.84) recorded with slightly antifeedant action against 4th instar of *H. armigera*. Therefore, animal urine formulations were found to have higher growth and development inhibition of test insect with relative antifeedant action.

A PRELIMINARY BIOASSAY STUDIES ON THE EFFICACY OF ANIMAL URINE AGAINST *HELICOVERPAARMIGERA* (HUBNER) (LEPIDOPTERA : NOCTUIDAE)

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Abstract

The laboratory studies on the effect of animal urine formulations on growth and development of *H. armigera*neonates and their antifeedant activity against 4th instar larvae were conducted at IPM laboratory, Department of Entomology, GBPUA&T Pantnagar, Uttarakhand during April-May 2018. This novel study was consists of seven different domestic animal's urine eachused at 20% concentration.No choice bioassay was usedwith leaf dip method. When treated tomato leaf discs fed to neonate larvae of test insect, Desi cow urine was recorded with least larval survival of 3.33% followed by horse urine (6.67%), goat urine (10.00%), buffalo urine (16.67%) and ox urine (20.00%). Whereas, Jersey cow urine (33.67%) and Holstein cow urine (26.67%) observed with maximum and untreated control (96.67 %) with the highest larval survival. Similarly, they were also found to have growth and development inhibition of test insect *viz.* extended larval, pupal periods, lower larval, pupal and adult weights, and even resulted in deformities in each life stages of test insect. Significantly lower growth indices of *H. armigera* were recordedin different animal urine formulations (0.00 to 0.447) than untreated control (2.631). Preference indices were significantly less in goat urine (0.35), Desi cow urine (0.45) and horse urine (0.50) which showed their strong antifeedant action. The treatments such as, buffalo urine (0.62), ox urine (0.63) showed moderately antifeedant action whereas, Holstein cow urine (0.79) and Jersey cow urine (0.84) recorded with slightly antifeedant action against 4th instar of *H. armigera*. Therefore, animal urine formulations were found to have higher growth and development inhibition of test insect with relative antifeedant action.

LIVESTOCK BASED SELF HELP GROUPS : A TOOL FOR EMPOWERING FARM WOMEN

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Abstract

Livestock sector plays a key role in sustainable rural development and has acquired the status of important livelihood options in the country. India has World's highest livestock population i.e. 512.05 million along with vast resources of livestock, poultry and fisheries that contributes 25.6% of total Agriculture GDP and 4.11% to overall GDP of the country (19th livestock census). Most of the livestock operations are performed by women that constitute about 69% of workforce engaged in livestock sector in India. Despite their considerable involvement and contribution, women are neglected and under privileged due to many socio-economic and cultural constraints. Women development activities must be given importance to increase the economic growth of the family and for better standard of living. The major strategies for women empowerment include social and economic empowerment along with gender equality. Livestock based Self Help Groups (SHGs) are emerging as a cost effective tool for providing financial strength to the rural women that will not only empower them to take financial decisions but also strengthen collective self help capacities. A self-help group is defined as a "self governed, peer controlled information group of people with similar socio-economic background and having a desire to collectively perform common purpose. Now a day, Government of India is making various efforts in the form of training, financial assistance through various schemes and policies to promote Self Help Groups for women empowerment throughout the country *viz.* more than 33 lakh farm women have been trained in various agricultural and allied sectors under Mahila Kisan Sashaktikaran Pariyojna (MKSP). In India, total numbers of SHGs saving linked with banks are 85.77 lakhs, out of that 73.22 lakhs SHGs – exclusively for Women.

There is strong need to change the cultural taboos and to provide education along with specialized training with respect to Scientific Livestock Farming Practices (SLFP's) to the women for making them self reliance.

AGRICULTURAL EXTENSION AND ADVISORY SERVICES PLAY IMPORTANT ROLE IN REALIZING GENDER EQUALITY AND IMPROVED NUTRITION

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Abstract

Women constitute a significant part in developing countries along with, while women thus play a crucial role in providing their families with food at the same time, they face substantial challenges related to gender qualities, such as unequal access to resources, services and technologies, which significantly undermine food security and nutrition objectives. In addition to socio-economic status, women's have limited power and ability to participate in decision-making processes within their families and societies. There is a growing body of evidence showing that empowering women and promoting gender equality at the household and community. Agricultural Extension and Advisory Services (AEAS) form a production-oriented, technology transfer model to one with a greater emphasis on broader development objectives. A potential role for AEAS has emerged in promoting gender equality and supporting nutrition an idea that received broad support from the discussion of participants. AEAS staff is able to reach farmers and women's groups to closely interact with them. They are in a position to provide information and training on gender and nutrition. As per study revealed that carrying with their activities, AEAS should provide support in all value chain stages, considering aspects such as productivity, profitability and sustainability promote gender equality. Instead of contacting the head of the household, AEAS staff should contact women when sharing information also, they could contact female farmers and male farmers separately with specific information. AEAS should identify the entry point to women's empowerment, and assess their ability to make and implement decisions and provide capacity-building programmes for AEAS and disseminate the existing-learning materials to integrate gender and nutrition developed by AEAS.

INTEGRATED PEST AND DISEASE MANAGEMENT : AN APPROACH FOR SECURING THE FUTURE OF AGRICULTURE

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Abstract

The role of pesticides (chemical substances used to control harmful organisms) has become critically important with modernization of agriculture. Agriculture sector consumes a high amount of pesticides – approximately 85 percent of the estimated 2.9 million tones used each year world-wide. The rate of pesticide usage is increasing world-wide with a rapid rate in developing countries but, still more than 40% of all potential food production and another 20% of the harvested crop is lost to pests & disease. Generally, many farmers use the multiple types and variety of chemical pesticides to prevent the pests and diseases affecting crops just on the basis of the information provided to them by the dealers and sellers of pesticides and they may not be aware of the fact that the use of pesticides adversely affects human health, environment and eco-systems. There are many rules and regulations for the appropriate use of pesticides, but rarely farmers follow them. Keeping the above observations in mind, researchers suggested the use of integrated approaches for pest management. This integrated pest management (IPM), integrated disease management (IDM), can be defined as "the careful consideration of all available pest and disease control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to

agro-ecosystems and encourages natural pest & disease control mechanisms." Moreover, farmers and consultants needed to understand and accept the following basic principles on which IPM & IDM is depend- a. just presence of a pest species does not justify action for control, b. it is about management not eradication, c. single control measure cannot be applied to all pest complexes, d. some level of damage to the crop should be tolerated, e. it uses a diverse array of control options such as mechanical, physical, biological approaches etc. to minimize pest damage, with pesticides used as the last choice. In future, research need to be focused on the applications of new approaches for pest & disease management, initiating the extension programs for making farmer aware about IPM & IDM.

POLYSACCHARIDES : A NATURAL POLYMERS FOR WASTEWATER TREATMENT

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Abstract

Polysaccharides based polymeric materials have been studied by many researches for wastewater treatment. Various treatment methods for wastewater have been designed which use polysaccharide based polymers as natural flocculants. This is due to the functional groups present in the polysaccharides. Their activities are unique viz formation of electrical double layer, neutralizating ionic pollutants present in form of colloidal charge particles and eco-friendly nature. These materials overcome the disadvantage of synthetic polymeric materials and can be used as renewable resources. In this paper we present an overview of polysaccharide based polymetic materials used for wastewater treatment.

EFFECT OF ORGANIC AND INORGANIC SOURCES OF NUTRIENTS ON YIELD MUSTARD CROP

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Abstract

The Field demonstrations were conducted to calculate the contribution of organic and inorganic sources of nutrients on yield, quality and nutrients uptake by mustard variety Pusa Bold at farmers' fields of District Muzaffarnagar during Rabi season, 2015-16 and 2016-17. The experimental results revealed that maximum growth parameters (plant height, branches plant-1 , dry matter accumulation and leaf area index), yield attributes (siliqua length, siliqua plant-1 , seeds siliqua-1 and test weight), yield (grain and stover), nutrient uptake (N,P, K and S) by grain and stover and available soil nutrient (N, P, K and S),were recorded with application of 75% RDF+ FYM 3 t/ha + bio-fertilizer as PSB (phosphorus solubilizing bacteria) higher than the rest of the treatments. The increase of seed yield with application of 75% RDF+ FYM 3 t/ha + Bio-fertilizers was 171.35% over control. Maximum gross return, net return were recorded with the application of 75% RDF+ FYM 3 t ha-1 + Bio-fertilizers. Minimum yield (15.64 q/ha) were recorded from 75 % recommended fertilizer dose and maximum (18.25 q/ha) was with application of all combination organic and inorganic fertilizers in both the years of demonstrations, however B: C ratio was lower than the use of RDF only but in application of FYM improved the physico-chemical properties of soil which may improve the sustainability of production system.

GENETIC ENGINEERING APPLICATIONS IN CROP IMPROVEMENT

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Abstract

Plant genetic engineering refers to the manipulation of genetic materials of plants to effect gene expression. Thus, today we are able to isolate and modify specific pieces of DNA from any source and introduce it into plants Genetic engineering of crop plants is one of, or perhaps, the most influential technologies in agriculture for plant improvement of the 21st century. The food and fiber requirements of approximately 10 billion people need to be met with existing resources that are currently

limited. Biotechnology, and specifically genetic engineering, can greatly expand those limits. The potential of agricultural biotechnology and its ability to complement and enhance traditional plant breeding are just beginning to be understood. While there are technical limitations in terms of size of DNA to be introduced, location of integration, plant species amenable to transformation, and detection of phenotype/genotype alterations, by and large these limitations can be expected to be overcome within the next several years. The process of genetic engineering of plants involves three major steps: gene manipulation, transformation, and regeneration. The potential of agricultural biotechnology and its ability to complement and enhance traditional plant breeding are just beginning to be understood.

EFFECT OF ZINC AND FYM ON YIELD OF WHEAT (*TRITICUM AESTIVUM*) IN SOIL ORDER OF INCEPTISOLS IN UTTAR PRADESH

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Abstract

Wheat crop has been food for mankind since the beginning of agriculture. It was the major crop instrumental in ushering " Green Revolution " in India. Field experiment was laid down at Pot Culture House of the Department of Soil Science & Agricultural Chemistry , C.S. Azad University of Agriculture & Technology, Kanpur during Rabi season of 2016-2017. Treatment combinations are nine with four replications as control , RDF , RDF + FYM , RDF + $ZnSO_4$, RDF + FYM + $ZnSO_4$, RDF (125%) + FYM , RDF (125%) + $ZnSO_4$, RDF (125%) + FYM + $ZnSO_4$ and RDF (150%) + FYM + $ZnSO_4$ having RBD design . Wheat variety taken was PBW – 343. The wheat grain yield maximum 55.80 q ha^{-1} was recorded in RDF (125%) + FYM + $ZnSO_4$ followed by RDF (150%) + FYM + $ZnSO_4$ 53.00 q ha^{-1}, RDF (125%) + $ZnSO_4$ 52.3 q ha^{-1}. Minimum average grain yield was recorded in control 33.27 q ha^{-1} , respectively. Maximum straw yield of wheat recorded 67.49 q ha^{-1} under RDF (125%) + FYM + $ZnSO_4$ followed by 66.25 q ha^{-1} under RDF (150%) + FYM + $ZnSO_4$. Yield of straw yield under control was 42.78 q ha^{-1}, respectively. It is suggested that the farmers of Central Plain Zone of Uttar Pradesh should adopt a dose of 125% RDF + FYM + $ZnSO_4$ for better crop yield of wheat crop.

CLIMATE CHANGE IMPACTS ON GLOBAL FOOD SECURITY

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Abstract

Climate change could potentially interrupt progress toward a world without hunger. Its affects livelihoods of poor and rich alike by impacting basic human needs, including food, clothing and shelter requirements. The four components of food security food availability, food access, food utilization and food production system stability are the heart of the mandate of the Foor and Agriculture Organization of the United Nations (FAO). All four components are affected by climate (FAO, 2008) but food availability is most intimately associated with climate and its changes, from crops to animal products, marine and aquaculture products and wood and non-wood products from forests. The changes in climate variability have a direct implication on food-production system stability. Increased frequency and intensity of extreme events such as drought and flood would be a great threat to stability, whether the impact is domestic or through the global food market. The frequency and magnitude of food emergencies might increase, resulting from complex interrelations between political conflicts and migration in a context of increased competition for limited resources. Food safety may also be compromised with degraded hygiene in preparing food under limited fresh water availability or food-storage ability due to warmer climate. Malnutrition may also increase, due to shrinking food biodiversity and excessive dependence on a few staple foods. Even when production is sufficient, if a system of food allocation, whether it is through market or not, is negatively affected, food access is impaired and food security is compromised. Urbanization is rapidly taking place in many countries of the world, creating a category of urban poor who do not themselves farm and are very vulnerable to climate change.

INTEGRATED MANAGEMENT OF FUSARIUM WILT OF PIGEON PEA

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Abstract

Pigeon pea is affected by a large number of pathogens and cause significant yield by each of them and the most significant ones were the Fusarium wilt of pigeon pea (*Fusarium udum*), Sterility Mosaic Phytophthora blight (*Phytophthora drechsleri variety cajani*), Alternaria blight (*Alternaria alternata*) and Root rot (*Rhizoctonia bataticola*) these are the major diseases of pigeon pea that cause severe loss to this particular crop. The Fusarium wilt is an important disease of pigeon pea.It is caused by a soil borne pathogen known as *Fusarium udum.* The symptoms of the disease is very easy to identify where the whole plant starts wilting at the initial stage and it becomes completely dry after some time. The pathogens survive in the soil and survive for a longer period of time. So IPM practices are very important or essential to manage this particular pathogen. The practices include cultural use of resistant varieties as well as biological, as chemicals has not proved effective against his particular pathogen. So cultural practices include three or four years of crop rotation with non host crops or we can also use a mixed cropping system by taking Jowar and Arhar as a cropping model for management of this particular Fusarium wilt disease which must also collect and burn the plant trashes that are left after harvesting. Resistant varieties are reported from different places and we must go for utilization of these resistant plants which give good control over this particular pathogen. Biological control has a good effect on the pathogen and that is why they should be delivered as seed treatment with *Trichoderma viride* with the rate of 4 gram/kg at a cfu at 10^6cfu per gram. So this is a good way of managing the pathogen in soil as it reduces the inoculum in the soil for the next season.

ANALYSIS OF VARIANCE AND ESTIMATION OF GENETICVARIABILITY PARAMETERS FOR QUALITY TRAITS IN BREADWHEAT (*TRITICUM AESTIVUM*L. EM. THELL) GENOTYPES

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Abstract

Wheat is an important cereal crop of the world covering an area of 220.41 million hectares globally. As surplus production of wheat have already been achieved, the major thrust of modern plant breeding is to bring about improvement in quality of wheat genotypes. In order to achieve this objective of quality improvement, an investigation was conducted comprising of half diallel mating between ten wheat genotypes viz. QLD 39, KAUZ/ALTAR84/3/MILAN/KAUZ/4/HUITES, UP 2762, KFA/2*KACHU, Raj 4419, PBW 729, WH 1187, HD 2967, DBW 50 and NIAW 1594to produce 45 F1's, which were evaluated along with ten parental lines in randomized block design with 3 replications. Estimates of genetic variability parameters as phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), environmental coefficient of variation (ECV), range, genetic advance, genetic advance % mean and heritability were calculated for various quality traits viz. protein content (%), hectolitre weight (kg/hl),sedimentation value (ml) and phenol colour reaction. Analysis of variance showed significant differences amongst genotypes for all the traits studied except for hectolitre weight. Sedimentation value with a PCV of 18.35%, GCV of 17.673% and phenol colour reaction with PCV of 16.367%, GCV of 13.657% showed moderate estimates of both PCV and GCV while ECV for all the traits studied was low i.e., below 10%. High heritability estimates were observed for sedimentation value (92.756%) while phenol colour reaction (69.621%) exhibited moderate estimates of heritability. High heritability coupled with high genetic advance % mean for sedimentation value (heritability-92.756% and genetic advance % mean- 35.06%) indicated that the quality trait was controlled by additive genes. This indicates that wheat quality improvement by selection was possible for sedimentation value and phenol colour reaction as variation exist amongst genotypes for these traits.

IMPACT OF KVK TRAINING PROGRAMME ON SOCIO- ECONOMIC STATUS AND KNOWLEDGE OF TRAINEES IN DEORIA DISTRICT

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Abstract

The present study was undertaken among 250 respondents consisting 125 on campus trainees and 125 off Campus trainees spread among eight selected villages under Salempur Block of Deoria district. Variables namely respondents socio- economic status and their levels of knowledge about training programme of the selected Krishi Vigyan Kendra were measured by utilizing pre structured interview schedule study find that the majority of on campus trainees (58.40) had high socio-economic status (24.80%) and only 16.80 percent had low level of socio-economic status whereas in case of off campus trainees 65.60 percent had medium socio-economic status followed by 19.20 percent low level and only 15.20 percent had high level of socio-economic status. The study revealed considerable difference between on and off Campus trainees regarding their socio-economic status. Majority of the on campus trainees had high level of knowledge followed by medium and low level of knowledge. Whereas in case of off Campus trainees 65.60 percent respondents had medium level of knowledge followed by 19.20 percent had low level of knowledge. This indicates that there has been a significant difference between on and off Campus trainees in respect to their knowledge of KVK training programme.

APPLICATION OF SOCIAL MARKETING IN EXTENSION : A FRAMEWORK DEVELOPMENT

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Abstract

Social marketing refers to the application of marketing to the solution of social and health problems. Kotler and Zaltman defined it as the design, implementation, and control of programs calculated to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication, distribution, and marketing research. Social marketing is a comprehensive strategy that can guide programming and its strong focus on an audience's needs makes it highly relevant to Extension. Campaigns from several countries which incorporated varying elements of social marketing have used a structured framework that included: audience segmentation; research-based analysis of an audience's perceptions toward the behavior; the articulation of specific, measurable behavioral goals; and the use of social marketing tools and other principles (e.g., social norms, messaging, commitment, incentives/disincentives, prompts and reminders, and a participatory approach). Across the globe, the extension professionals have seen great potential in applying social marketing to Extension programming. Also, Extension professionals are already employing many elements of social marketing. Hence, a blending of the Conceptual Programming model with the social marketing process is discussed as a means of structuring Extension program planning when using social marketing in order to extract the benefits of social marketing into extension.

COMPARATIVE STUDY OF IOT TOOLS USED FOR CROP MONITORING IN SMART AGRICULTURE

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Abstract

Agriculture plays a very important role in the development of Indian economy. Farmers if aware about their surroundings can contribute widely in the agricultural development. Many improvements and enhancement have been inculcated from past to help the farmers so that optimum utilisation of resources, maintaining the fertility of soil, temperature, humidity, efficient usage of power and irrigation methods, etc can be achieved. This may not only beneficial to the famers but also to the larger section of the rural poor who are directly, indirectly involved in agricultural activities as consumers. This will provide a excellent crop productive environment which facilitates the over all rural development. Beside them, this sector is also facing

the crises of lack of man power and lack of water, which adversely affects the production of crops. Use of IoT devices is one of the solution one could find in this type of environment. This paper highlights the comparative study of all the available IoT tools to monitor production of crops.As IoT has already entered the agricultural domain, itshowcased efficient ways to increase and maintain thecrop production, balanced prices of agricultural tools, herbicides, fertilizers etc. The use of IoT devices for agriculture especially for developing and monitoring crop production hasled to the collaborated environment necessary for the development of the economy as a whole.

DEVELOPMENT AND QULAITY EVALUATION OF LOW GLYCEMIC COMPOSITE FLOUR FOR "MISSI ROTI"

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Abstract

The present study was an attempt for the development and quality evaluation of low glycaemic composite flour for missi roti. Findings of the survey revealed that missi roti was consumed by all the diabetics but the type of grain selected and proportion used varied. Composite flour was developed for most commonly produced and consumed cereals/millets i.e. wheat (WT), bajra (BJ), maize (MZ) and foxtail millet (FT) with Bengal gram (BG) in the proportion of 3:2 and with Bengal gram and barley (BY) 3:1:1 after several trials of different proportions in preparing niissi roti and its acceptability (scores > 6) by panel of judges using nine point hedonic scale. A recipe of 'miss/ roti' was standardized for its carbohydrate content (40g/serve), serving size, cooking time, cooked weight and water required for preparing the dough. Developed composite flour provide 70-83 per cent of energy from carbohydrate and were the good sources of fibre (2.10 - 6.10 g%). Protein quality of the composite flour were better than the plain flour (8.9 to 18.3 and 1.80 to 7.63 NDP cal% respectively). Developed flour was stored in 1 kg capacity flour bags at room temperature for a period of three months. Shelf life parameters revealed that free fatty acids and peroxides increased steadily with storage, but did not exceed the safe limits. Acceptability of roti from MZ, BJ, FT and their blends decreased significantly ($P < 0.05$) with storage period whereas it remained same for WT and its blends. Nutritional status of the diabetic and no diabetic subjects revealed that majority (43%) of them were in the category of overweight and obesity, waist hip ratio confirmed the abdominal obesity (> 0.85) in the females. Glucose tolerance test was conducted with 40g glucose and test recipe i.e. missi roti with chutney on diabetic and no diabetic subjects at 0, 1/2, 1, 11/2 and 2 hour after feeding to determine the glycaemic index (GI) of composite flour. G1 was lower for composite flour than the plain flour. Blends of FT with Bengal gram and wheat with Bengal gram and barley are the best as their GI was lowest. The acceptability of WT + BG + BY composite was for longer duration upto 3 months and its GI was also lowest therefore, for commercial purpose this blend is recommended. Further it is suggested that diabetics may select composite flour as per their preference for the stap cereal/millet in place of plain flour.

GENETIC DIVERSITY ANALYSIS IN LENTIL (*LENS CULINARIS* MEDIKUS)

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Abstract

Lentil is one of the most important pulse crop of India, grown in winter season It has versatile uses as food, feed, fuel and fodder. The Field experiment under present investigation was conducted during *rabi* season 2017 & 18 at Agricultural Research Form of B.R.D.P.G. College, Deoria (U.P.) The experiment was conducted to evaluate 10 varieties / strains of lentil including four check under irrigated, normal soil condition in Augmented Block Design. The entire experimental field was divided into 10 blocks of equal size and each block had 11 plots. Out of 11 plots in a block, 7 plots was used for accommodating the test genotype. Which were not replicated while remaining 4 checks. The highest number of genotypes appeared in cluster III , which contained 13 entries followed by cluster IX having 12 genotypes, Cluster IX having 12 genotypes, Cluster IV with 10 genotypes and Cluster V, VIII with 9 genotypes in each. Minimum numbers of genotypes were presented in cluster II having 2 genotypes.The highest intra-cluster values were found for cluster IX (17.60) followed by cluster VII (10.33) while the lowest value was recorded in case of cluster VI (4.69). The maximum inter- cluster distance was found between cluster V and VIII (36.77). Between remaining cluster distance showed moderate to low inter-Cluster distance.

EFFECTS OF GROWTH REGULATORS ON *IN VITRO* ROOT REGENERATION IN POTATO VARIETY KUFRI CHIPSONA-1 AND KUFRI MOHAN

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Abstract

Potato (*Solanum tuberosum* L.) is one of the most important cultivated food and cash crop grown in more than 100 countries in the world. China, India, USA, Ukrain, Germany and Poland put together constitute more than 62% of total global production. The consumption of potato was 36.4 kg/capita/year in the year 2011. It is a high quality vegetable cum food crop and used in preparing more than 100 type recipes. The protein content of potato has a high biological value than cereals and considered to be better than milk. Hence, potato is supplementing meat and milk products by lowering energy intake and also by reducing food cost. Potato is the fourth most important crop by volume of production it is high yielding having a high nutritive value and gives high returns to source of potato. The centre of origin is South America (Peru) in sixteenth century Spanish explorers introduced it in Europe and later it become an important food crop of the world and belongs to family Solanaceae with chromosome number 2n=4x=24.The present study was conducted to evaluate the effects of IAA and GA_3 on *in vitro* root regeneration in two potato varieties Kufri Chipsona-1 and Kufri Mohan. Maximum (4.49) number of roots/shoot within a number of days (14.08), the longest (7.82 cm) root was observed with 1.0 mg/L IAA + 1.0 mg/L GA_3 after 28 DAI in Kufri Chipsona-1. The main effects of GA_3 in both varieties were observed with 1.0 mg/L GA_3. The combined effects of IAA and GA_3 were reported to be highest with 1.0 mg/L IAA + 1.0 mg/L GA_3. Present study concluded that the presence of IAA in combination with GA_3 in culture media was the most effective for high frequency root induction in both varieties of potato. Therefore, the present study recommends the use of IAA in combination with GA_3 in culture media to achieve enhanced root induction and proliferation from shoots regenerated through *in vitro* induced callus in potato.

GENETIC VARIABILITY ANALYSIS FOR YIELD RELATED TRAITS IN RICE (*ORYZA SATIVA L)* GERMPLASM

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Abstract

Rice (*Oryza sativa* L.) is one of the key food stuffs of the humankind, it is also known as "universal grain" and tack food crop for world's poorest and compactly occupied regions in various Asian countries. India is the second largest producer after China, has an area of over 43.9 m ha with production of 111.5 m t and productivity of 2539 kg/ha. In crop improvement programme, to raise the productivity breeder needs to maintain a pool of diverse desirable donor parents. The nature and enormity of genetic divergence and character association were estimated in identified 218 rice germplasm accessions (landraces) received from National Bureau of Plant Genetic Resources (NBPGR), New Delhi. A total of 11 quantitative traits were measured at suitable stage of rice germplasm. The investigational materials of 7000 rice germplasm accessions were received from NBPGR, New Delhi during *kharif* 2017-18. Present investigation was based on 218 promising identified high yielding core germplasm and evaluated in augmented design with six checks viz., Pusa Basmati-1, Jaya, NDR 97, Annada, Swarna and IR 64 during *kharif* 2017-18 at Research-cum-Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh. Each plot consisted of three rows of 3 m length with the spacing of 15 x 20 cm of plant to plant and row to row standard packages of practices were followed over the season for normal growth of crop.

Rice germplasm accessions were grouped into 10 clusters. The utmost inter-cluster distance varied from 9.523 to 1.993. The highest inter-cluster distance was observed between clusters V and I (8.251) suggesting maximum variability among them. Cluster IX (2.89) showed highest mean value for 100-seed weight. Cluster X had highest mean value for panicle length (28.61), L/B ratio of (3.61) and 100 grain weight (2.55g). The better genotype can be selected for most of the characters on the basis of mean performance in the clusters. The cluster V showed highest grain yield/plant and effective tillers/plant (23 tillers/plant). This indicated that these clusters could be utilized in the hybridization programme for obtaining desirable transgressive segregents. The correlation coefficient of grain yield had positive and significant ($P<0.1$) correlation with leaf width

(r=0.4071), plant height (r=0.2330), panicle length (r=0.3476), days to maturity (r=0.986), and 100 grain weight (0.5106) had positive and significant (P<0.1) correlation with Panicle length (r=0.2013), length breadth ratio (r=0.2011), days to maturity and plant height, while leaf width had positive (P=0.05) correlation with plant height. The hybridization regarding genotypes belonged to these clusters and correlation was expected to give desirable segregents in rice breeding programmes. On the basis of yield and considering all desirable traits, germplasm accessions were identified *viz*., IC252072, IC518849, IC455521, IC300035, IC218046, IC114311, IC517006, IC217865, IC377969 ,IC518632 IC455469, IC462202X, IC379316, IC458448, IC390324, IC386367 and IC387646. These can be used to identify phenotypically divergent sources for traits of interest in breeding programmes as well as directly released as a variety based on the most of agronomic traits.

SOCIO-ECONOMIC DETERMINANTS OF THE AWARENESS AND ADOPTION OF CITRUS PRODUCTION PRACTICES IN CHHINDWARA DISTRICT OF MADHYA PRADESH

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Abstract

Citrus is the leading fruit of India and famous worldwide especially Nagpur Mandarin cultivar because of its pleasant taste and remarkable quality. The yield of citrus per hectare in India is almost half of potential due to non-adoption of recommended horticultural practices by citrus growers. Adopting a decision regarding the improvement of practices is usually influenced by various factors including farmers' socio-economic attributes. In order to determine the relationship between socio-economic aspects and the awareness and adoption of recommended citrus production practices the present study was carried out in Chhindwara district Blocks Sausar and Pandurna. The Study was based upon cross sectional survey research design due to availability of sampling frame, probability (random sampling) was applied for sample selection. Through random sampling, 120 citrus growers were selected as sample. Structured questionnaire administered through interview was used as a research instrument. Analysis of the data collected from the targeted citrus growers revealed a highly significant influence of education on awareness and adoption. Moreover, significant association was found between citrus cultivation area and awareness and adoption of improved practices. Age also showed significant association with awareness and adoption. Moreover, dominancy of middle aged farmers and illiteracy in the study area strongly point the need of provision of formal and non-formal education and training program for farmers. Young generation needs to be focused and reorientation of youth clubs may help in better way to gain the utmost outcome.

CHARACTERISTICSOF MULTPUPRPOSE TREE SPECIES

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Abstract

The concept of multipurpose tree species include those tree which have application for social agroforestry objective and agroforestry land management system. It is capable to production a range of products and has an active supporting role to strengthen sustainability. *Silvicultural criteria:* The species should adapt to site and should be able to produceoptimum harvest on a sustained basis. The leaf litter should decompose quickly thus adding organic matter to the soil. The species should preferably be capable of enriching soil through nitrogen fixation. The morphological character of the species should suit the objects of plantation and the cultivation practices. The species should have the capacity to enrich the micro site and ameliorate the climate. Specific species may be needed to reclaim refractory site. The species should generally fast growing and harvestable at short rotation. Tree should have good coppicing capacity. It should be easily attached by insect, pest and disease. *Social criteria* **:** The species should be able to fulfill the needs of the local people. The tree have acceptable characteristic to suit local customs and traditions. Tree product should be easily marketable. The species should be capable of providing favourable economic returns. The tree should have a ability to provide raw materials needed by local industry or stimulating tree product based industry. Associated aesthetic characters and provision of recreational opportunity may be required some time.

EFFECT OF DIFFERENT PRE-HAND MILKING TREATMENTS OF NEEM LEAF EXTRACT ON BACTERIOLOGICAL QUALITY OF RAW MILK

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Abstract

An experiment was conducted to determine the effect of different pre-hand milking treatments of Neem leaf extract as udder wash on bacteriological quality of raw milk on 12 healthy cross-bred cows at SHIATS, dairy farm, Allahabad with treatments as T_1(control), T_2, T_3 andT_4 (preparedby boiling 100, 150 and 200 g green Neem leaves in 1 litre water for 5 minutes, respectively). Collected milk samples were analyzed to determine Standard plate count (SPC), Lactic acid bacterial count (LABC), Lipolytic bacterial count (LBC), Proteolytic bacterial count (PBC) and coliforms in milk. Statistical analysis of different bacterial parameters in pre-hand milking treatments of neem leaf extract revealed siginificant difference in SPC, LABC, LBC, and PBC but shown non-significant diffirence in coliform count of milk. Results of the experiment indicated that the bacteriological quality of raw milk adjudged on the basis of SPC and physiological groups of of bacteria was best in T_4 followed by T_3, T_2 and control shown superiority of T_4 over rest of the pre-hand milking treatments of washing udder with Neem leaf extract.

TO STUDY MORPHOLOGICAL AND QUALITY CHARACTERS IN *AVENA SATIVA* L.

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Abstract

Oat (*Avena sativa* L.) is an important winter cereal crop in the world used as food, feed and fodder. It belong to the family Poaceae & ranks sixth in the world cereal production following wheat, maize, rice, barley and sorghum. Data on twenty four agro-morphological and quality characters was recorded in ninety-two genotypes of Oat (*Avena sativa* L.) at Forage Research Area of the Department of Genetics & Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana, India) during *rabi* 2015-16 to determine genetic variability, heritability and genetic advance. Assessment of the genetic variability can be achieved using morphological measurements and phenotypic characterization. Introduction, hybridization and mutation are methods for creating variability in the population. Introduction does not create variability. Variability refers to the presence of differences among the individuals of a plant population. Variability results due to the differences either in the genetic constitution of the individuals of a population or in the environment in which they are grown. The knowledge of the nature and magnitude of variation present in the base material is of immense significance for effective selection of superior genotypes from breeding the material. Hence, it is essential that base population should possess a large amount of heritable variation. The superior genotypes identified for green fodder yield were JO1, JHO99-1, DULO, UPO212, HFO864, HFO879, HFO58, HFO878, HFO924 and HFO912 on the basis of high mean value.

EFFECT OF SUPPLEMENTARY FEEDING OF CHELATED MINERAL MIXTURE ON MILK PRODUCTION AND ANOESTROUS PROBLEM IN BUFFALO UNDER VILLAGE CONDITIONS OF PANCHMAHAL DISTRICT OF CENTRAL GUJARAT

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Abstract

The present study was conducted on the milch buffaloes under the banner of KVK- Panchmahal under semi arid ecosystem of middle Gujarat. Eighteen lactating Mahasana buffaloes was divided in to two groups of 9 buffaloes in each group i.e. T_1 (control) and T_2 (chelated mineral mixture supplementation @ 50g/ day) during 2017-18. All animals were managed under farmers own traditional system of feeding and management. The animals were selected nearly at the same lactation stage, body weight, milk yield and parity. The feeding of selected animals in control group (T1) were consisted of 5-6kg dry fodder *viz.,*

Maize, Sorghum and Per millet stover with some quantity of local dry grasses and 25kg green fodder *i.e.* hybrid Napier and Lucerne with 2.5kg /day/animal concentrate mixture. In the treatment group (T_2) in addition to the above, a regular supply of chelated mineral mixture as supplementations was offered during the whole period of study, without interruption. The drinking water was offered *adlib.* The data recording of experiment trial was carried out for 150 days. The results of the present study revealed that the initial milk yield was similar in the both groups but average milk yield recorded during the study was period 5.87±0.23 6.93±0.42 lit./day in T_1 and T_2 groups, respectively The results indicated that the buffaloes supplemented with mineral mixture produced 18.05 per cent more milk as compared to control without any adverse affect on the body weight and health of the animals. The increase in milk yield was significantly higher ($P<0.05$) in supplemented group. The average service period was recorded 127±12.42 and 83.63 ±12.53 days in T_1 and T_2 groups, respectively. The results revealed that the 88.89 % buffalo conceived in T_2 group as compared to control (55.56 %). The services per conception was also observed significantly ($P<0.05$) higher in non- supplemented group than the supplemented ones. The results of study revealed that the net profit per buffalo was recorded 145.80 and 184.7 Rs. per day in T_1 and T_2 groups, respectively. The supplementation of chelated mineral mixture during experimental period indicates that benefit cost ratio 1:3.00 was recorded, which appears to be very lucrative over traditional system of feeding. Based on observations, it can be concluded that the supplementary feeding of chelated mineral mixture economically improved the milk production and reproductive performance of buffalo under hot semi-arid ecosystem.

BIOEFFICACY OF INSECTICIDES AGAINST *AMRASCABI GUTULLABI GUTULLA*ISHIDA ON OKRA

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Abstract

An experiment was conducted during *kharif* 2016 at Vegetable Research Centre, GBPUA&T Pantnagarto evaluate the field efficacy of six insecticides viz. buprofezin 25% SC, carbofuran 3% CG, chlorantraniliprole 18.5% SC, cypermethrin 25% SCthiamethoxam 25% WG and quinalphos 25% EC against leafhopper (*Amrascabigutullabigutulla*Ishida)prevailing in okra agroecosystem. Among all the treatments thiamethoxam 25%WG @ 25 g a.i./ha was found to be most effective against leafhopper (71.67% and 72.59% reduction over control after first and second spray, respectively) followed by buprofezin 25% SC @ 200 g a.i./ ha (67.27% and 69.37% reduction over control after first and second spray, respectively)and quinalphos 25%EC @ 200 g a.i./ha while carbofuran 3% CG @ 1000 g a.i./ha was least effective in reducing the pest population.Highest yield was recorded in chlorantraniliprole 18.5% SC @ 25 g a.i./ha treated plot (10.81 T/ha) followed by thiamethoxam 25%WG @ 25 g a.i./ha (9.63 T/ha).

THE NANOPHYSICS AGE AND ITS NEW POINTS OF VIEW

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Abstract

The nanophysics is somewhere between the size sizes of quantum mechanics and perceptible material science. The right meaning of nanophysics is the material science of structures and relics with measurements in the nanometer run or of wonders happening in nanoseconds. Present day physical techniques whose basic are produced in material science research centers have turned out to be fundamentally imperative in nanoscience. Nanomaterials and Nanomedicine Various uses of nanoscale science to the field of prescription have brought about the continuous improvement of the subfield of nanomedicine. Nanomedicine is a moderately new field that is quickly advancing. Plan of medications on the nanoscale bestows numerous physical and natural focal points. Such favorable circumstances can thusly convert into enhanced restorative adequacy and lessened poisonous quality. Also, there is currently wide agreement among restorative scientists and professionals that alongside customized drug and regenerative solution, nanomedicine is probably going to reform our meanings of what comprises human sickness and its treatment. Nanomaterials are characterized as the creation of issue with something like one measurement going somewhere in the range of 1 and 100 nanometers. Because of the simple little size and the subsequent high

surface/volume proportion, nanomaterials have physical-substance properties that contrast from those of plainly visible materials. Nowdays nanomaterials are frequently connected in numerous mechanical fields including gadgets, optics, material and numerous others till to biomedicine. The utilization of nanoparticles (NPs) in solution has extended as of late, particularly in symptomatic. All things considered nanoparticles could be planned as differentiation specialists, directed treatments in disease or nanocarriers ready to tie, particularly transport biomolecules and amass to the site to treat.

STUDIES ON PREPARATION AND PRESERVATION OF ENRICHED HONEY-MALTA (*CITRUS SINENSIS* L. OSBECK) READY-TO-SERVE (RTS) BEVERAGE

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Abstract

The present investigation was conducted atVCSG UUHF, Bharsar, Pauri Garhwal during 2015-2016,to develop functionally enriched Honey-Malta (*Citrus sinensis* L. Osbeck) RTS and determine the effect of different preservation methods on selected physicochemical parameters ofHoney-Malta RTS.The experiment was laid in completely randomized design with 3 treatments and 4 replication of each treatment and randomized block design was used for sensory analysis. Honey-Malta RTS was prepared and evaluated for physical, bio-chemical and antioxidant parameters. All physicochemical parameters were positively affected by different preservation methods pasteurization (65 ?C for 30 minutes), preservative (sodium benzoate 120 ppm) and pasteurization with half preservative (65?C for 30 minutes with sodium benzoate 60 ppm). With advancement of storage period decrease in TSS, total sugars, reducing sugars, pH, ascorbic acid and total phenols was observed but slight increase in titrable acidity was noted. It was concluded from the study that pasteurization with half preservative (65?C for 30 minutes with sodium benzoate 60 ppm) was recommended as best method of preservation for honey-malta RTS among all the three preservation methods with best sensory and nutritional value.

EFFECT OF SOME NEWER INSECTICIDES ON PARASITIZATION OF IRRADIATED AND UNIRRADIATED EGGS OF *CORCYRA CEPHALONICA* BY *TRICHOGRAMMACHILONIS*

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Abstract

The present investigation was undertaken to study parasitization capacity of *Trichogrammachilonis*on previously treated UV irradiated and unirradiated eggs of *Corcyra cephalonica*under laboratory condition in the Bio-control laboratory, Section of entomology, College of Agriculture, Nagpur (Maharashtra) during 2016. The results of different insecticides on parasitisation potential of *T.chilonis*revealed that insecticides *viz.* chlorantaniliprole, diafenthiuron and thiomethoxam were found harmless and could be used safely before release of *T.chilonis* in the field. Whereas,clothianidin, flonicamid and azadirachtin were found slightly harmful towards parasitisation capacity of *T.chilonis*. Amongst all the insecticides, Cartap hydrochloride and spiromesifen recorded highset reduction in parasitisation and should not be used in field prior to release of the parasitoid.

CLIMATE CHANGE AND AGRICULTURE

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Abstract

Climate change may refer to a change in average weather conditions, or in the time variation of weather within the context of longer-term average conditions. The occurrence of climate change is evident from increase in global average temperature,

changes in rainfall pattern and extreme climatic events. The results of many studies show that the surface temperature is predicted to increase by 1.4 to 5.8°C from 1990 to 2100. Climate change and agriculture are interrelated processes, both of which take place on a global scale. Climate change affects agriculture in several ways, including through changes in average temperatures, rainfall, and climate extremes (e.g., heatwaves); changes in pests and diseases; changes in atmospheric carbon dioxide and ground-level ozone concentrations; changes in the nutritional quality of some foods; and changes in sea level. Climate change will probably increase the risk of food insecurity for some vulnerable groups, such as the poor. Animal agriculture is also responsible for greenhouse gas production of CO_2 and a large percentage of the world's methane, and future land infertility, and the displacement of local species. Agriculture, forestry and land-use change contributed around 20 to25% to global annual emissions in 2010.The agricultural sector is also responsible for production of green house gases which is a reason for global warming.A study by Cline (2008) assumes that no efforts are made to reduce anthropogenic greenhouse gas emissions, leading to global warming of 3.3°C above the preindustrial level and concluded that global agricultural productivity could be negatively affected by climate change, with the worst effects in developing countries.Rising temperature leading to rapid development of insects and insect voltinism, with the logical assumption that increases in surface temperature would permit multivoltine species to increase the number of generations per year. Each year one or the other part in the world is affected by drought, floods, cyclones, frost and other climatic events. These altogether have widespread negative effects on soil health and quality, food production, water availability and environmental sustainability. To achieve food security and agricultural development goals by 2030, adapting to climate change and lowering emissions will be necessary because as CGIAR manifested around 41% of GHG come from agriculture.

MANAGING INSECT PESTS AND DISEASES OF CITRUS: ON FARM ANALYSIS FROM SATPURA PLATUN OF MADHYA PRADESH

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Abstract

Population pressure is increasing demanding more food for sustainable future but competition for key resources is high due to prevalence of insect pests and diseases. Numerous losses have been recorded due to diseases infestation in India particularly in case of citrus. On farm technicalities are increasing while farmers' technical knowledge is stagnant making insect pests and diseases pathogens resistant. Citrus is leading fruit and its better productivity is vital for the farmers and national economy but per acre production is lower that potential. Insect pests and diseases role is counted as significant in lowering the production. Therefore presents study was undertaken to explore growers concerns. 120 respondents were selected from Chhindwara District of Madhya Pradesh blocks Sausar & Pandurna using probability sampling technique under survey based research design. Findings indicated that growers were more familiar to insects/pests attack than diseases infestation. The adoption of cultural and mechanical control was found more prominent method to manage diseases impacts. Lack of technical knowledge, Finance shortage, and high cost of inputs were the major adoption militating factors among growers. Micro credit schemes should be started by the public sector to alleviate the finance problem and trainings should be impacted by the pathology and entomology experts along with extension agents to adopt alternate way to manage the viral diseases.

MICROPROPAGATION : A NOVEL APPROACH IN INCREASING THE YIELD AND QUALITY OF POTATOES

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Abstract

Potato is the highly consumed vegetable in the world as it provides food and nutritional security in the world. Vegetative tuber (potato seed) is used as the conventional planting material for potato. About 40-70 percent of cost is associated with seed tubers in potato seed production. Thus, micropropagation could enhance global food production and availability in a sustainable way. Micropropagation is a boon for those regions where potato cultivation is difficult under traditional methods.

Micropropagation is a tissue culture (in vitro) method used for rapid and true to type multiplication of plants on artificial nutrient media under controlled and aseptic environment. Through this approach, microtubers, plantlets and minitubers are high quality starting materials that can be produced year round in in vitro conditions (microtubers, plantlets) or ex vivo conditions (minitubers) at a high density. It is labour-intensive as compared to TPS technology. The production of virus-free potato plantlets, homogeneity and genetically pure plants helps to enhance the quality and yield of crop. Micropropagation is the most commercially exploited area of tissue culture through which economic standards of farmers can be improved in a more efficient way.

PHYSICO-CHEMICAL CONCEPT AND FUNCTIONS OF DAIRY SPREAD

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Abstract

Dairy spread is to emergence of new categories of dairy products after global decline in the consumption of butter and margarine. It is also known as fat spread or yellow fat spread. Spread is an emulsion of water-in oil. Dairy spread generally contain butter fat whereas non-dairy spread contains vegetable fat. Low fat spread contains only dairy ingredients and has less fat than butter and margarine. Low fat spread containing about 39 to 41% fat is termed as half butter while those in which reduced calorie is at least 33% is termed as reduced calorie spread. Fat spread classify into three groups on the basis of level of fat and origin of fat used for their manufacture like dairy spread containing fat of milk origin, blended spread of fat containing minimum 10% milk fat and non-dairy spread. Dairy spread contains,butter and margarine spread not more than 80 ± 0.03% fat, Reduced fat spread 68 ± 0.38% fat, Low fat spread 38 ± 0.45% fat and 0.25- 6.5 % protein, very low fat spread 20 ± 0.25% fat and 8.5 ± 0.21% protein. It contains emulsifier salts.The function of fat spread is to energy sources, flavour carrier, source of essential fatty acid (Linoleic and linolenic), vitamin transports, lubrication of bread when eating, taste contribution during eating and also provide product structure.

GENETIC STUDIES OF DOWNY MILDEW RESISTANCE IN INDIAN SLICING CUCUMBER (*CUCUMIS SATIVUS* L.)

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Abstract

Cucumber (*Cucumis sativus* L.) is one of the most important cucurbitaceous vegetable crops grown extensively in tropical and sub-tropical parts of the world. However, cucumber production is limited by most devastating disease is downy mildew disease. An experiment was designed to identify the resistance source for downy mildew disease and to study the inheritance of downy mildew resistance along with yield traits. Biochemical and molecular analysis was also under taken to develop DNA marker for resistant gene. The experiments were conducted at the experimental farm of Division of Vegetable Crops, ICAR-IIHR, Hessaraghatta, Bengaluru, Karnataka, during 2015-2018. In screening experiment forty-one cucumber genotypes were screened under natural condition and also under artificial epiphytic condition using detached leaf assay method. Screening of genotypes under field conditions, sporulation of pathogen, progress of disease, detached leaf assay and non-linear statistical analysis implied that none of genotypes were found to be immune to downy mildew but genotypes IIHR -438 and African Horned cucumber were found resistant to downy mildew disease. Ten genotypes recorded susceptibility and rest of the genotypes recorded highly susceptibility with PDI of > 60. The six generation populations of two cross combinations were planted in Randomized Block Design with three replications. Result indicates that resistance in both crosses was controlled by two pairs of dominant and recessive interacting genes (inhibitory recessive epistasis). In generation mean analysis the epistatic interaction was greater importance than main effects in Swarna Agethi x IIHR-438 cross whereas, dominance x dominance epistasis effect was higher and duplicate epistasis was prevailing in IIHR-431x IIHR-433 cross. The estimates of gene effects of yield traits through analysis of six generations revealed that, the magnitude and direction of the

gene effects varied in crosses. In Swarna Agethi x IIHR-433 cross showed preponderance of both additive and dominance effects for number of fruits per plant and epistatic interactions were observed for yield per plant. However, scaling test was non-significant for fruit length, girth and weight. In IIHR-431 x IIHR-433 cross fruit length, average fruit weight and yield per plant showing duplicate type of interaction it hamper the selection at early generation. Epistatic interactions were observed for node to first flower, number of fruits per plant, fruit girth.A total of 143SSR primers were employed to identify polymorphic primers using 225 F2 populations of Swarna Agethi x IIHR-438 through BSA, SSR 3-5 and SSR 4-13 are co-segregated with disease reaction in BSA. The dm genes are tagged with SSR 3-5 and SSR 4-13 markers loci with distance of 16.6 cm in linkage group 3 and 18.1 cm in linkage group 4, respectively. Thus, backcross breeding along with marker-assisted selection (MAS) can be employed for early selection of downy mildew resistance gene in cucumber and its introgression to develop a resistant variety and/or hybrid.

GENE EFFECTS FOR FRUIT YIELD AND ITS COMPONENT TRAITS IN SLICINGCUCUMBER (*CUCUMIS SATIVUS* L.) USING GENERATION MEANS

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Abstract

Generation mean analysis in cucumber (*Cucumis sativus* L.) was carried out during 2017–18 to study gene effects for fruit yield and its components in interacting and non-interacting crosses using 3-parameter and 6-parameter models, respectively. The four promising parents were crossed to generate six generation populations. The estimates of gene effects obtained through analysis of six generations revealed that, Swarna Agethi x IIHR-433 cross showed preponderance of both additive and dominance effects for number of fruits per plant and epistatic interactions were observed for yield per plant. However, scaling test was non-significant for fruit length girth and weight. In IIHR-431 x IIHR-433 showed cross fruit length, average fruit weight and yield per plant showing duplicate type of interaction it hamper the selection at early generation. Epistatic interactions were observed for node to first flower, number of fruits per plant and fruit girth. The magnitude and direction of the gene effects varied in the crosses. Thus, characters such as earliness and fruit length which are governed by entirely additive components could be improved through individual selection, while node to first flower and number of fruits per plant showed predominant dominance gene effects and interaction effects, biparental mating followed by recurrent selection would exploit both additive and non-additive type of gene effects efficiently.

STCR DOSE OF SOLUBLE FERTILIZERS ENHANCES THE NUTRIENT UPTAKE, YIELD AND SOIL PROPERTIES IN HYBRID MAIZE

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Abstract

A field experiment was conducted during *Kharif*2014 at Zonal Agricultural Research Station, University of Agricultural Sciences, Bengaluru to study the influence of different approaches and different forms of fertilizers on nutrient uptake, yield and soil properties in hybrid maize.The experiment was laid out in randomized block design comprisingof ten treatments replicated thrice. The results revealed that Significantly higher total uptake of major nutrientsby maize crop was recorded in 100 per cent soil test crop response (STCR) dose applied through soluble fertilizer (SF) with three splits and three sprays. Similarly, higher grain(98.22 q ha^{-1}) and stover (130.96 q ha^{-1}) yield was recorded in 100 per centSTCR dose applied through SF at three splits and three sprays of 19: 19: 19 @ 1% concentrationcompared to recommended dose of fertilizer (RDF) through conventional fertilizer (CF). Similar results were recorded higher in post-harvest nutrient status of soil major nutrients. The present study evidently concluded that soluble fertilizer application based on STCR targeted yield approach with three splits at basal, 30 and 50 DAS along with three sprays of 19:19:19 at 20, 40 and 60 DAS was helpful for getting higher nutrient uptake and higher post-harvest nutrient status of soil by maize crop, This increased higher nutrient uptake and higher post-harvest nutrient status of soil might be due to its easy solubility and uniform distribution of nutrients in root zone

leading to availability of sufficient available nutrients for uptake by the crop through soluble fertilizers. Split application of soluble fertilizers for three times along with three sprays of 19:19:19 at three stages helps in better translocation and uptake of these nutrients without fixation or any leaching losses.

CLIMATE SMART AGRICULTURAL TECHNOLOGIES : A WAY FORWARD FOR FOOD SECURITY

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Abstract

In this era of climate change the major challenge in front of global community is to feed the growing population of human. The food demand of a global population expected to reach 9.1 billion in 2050 and over 10 billion by end of this century, which will require a major change in food production system. Climate smart agriculture (CSA) is an approach for transforming and reorienting the agricultural production system to ensure food security under the new realities of climate change.Climate change poses challenges to agriculture, particularly in developing countries throughwidespread changes in rainfall and temperature patterns which threaten agricultural production and increase the vulnerability of people dependent on agriculture for their livelihoods. Threats can be reduced by increasing the adaptive capacity of farmers as well as increasing resilience and resource use efficiency in agricultural production systems through adoption of climate smart agriculture technologies like direct seeded rice, ICT services to access weather and agro advisories, zero tillage, laser land levelling, residue management/mulching, crop diversification, nutrient expert decision support tool, precision nutrient management, Green Seeker etc. The CSA approach follows the triple objectives adapting to climate change, reducing greenhouse gas emissions and of sustainably increasing productivity and incomes. It seeks promote synergies by taking these objectives into consideration to inform decisions from the local to the global scales and over short and long time horizons, to derive locally-acceptable solutions and to reduce trade-offs.

IMPACT OF TRAINING PROGRAMME CONDUCTED BY KVK-AHMEDABAD IN TERMS OF GAINING IN KNOWLEDGE BY FARMERS ABOUT SMALL SCALE PROCESSING AND VALUE ADDITION

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Abstract

The study was conducted for determination of gain in knowledge among the trainee farmer of the KrishiVigyan Kendra, AAU, Ahmedabad. Before and after type of research design was employed for evaluation of knowledge gain by using knowledge test battery consist of items related to small scale processing and value addition. The knowledge tests were administered to four batches constituting total of 120 trainees, before and after the training. The results revealed that overall knowledge mean score before and after training progamme was 34.53% and 69.84% respectively which indicate that knowledge gain was 35.31%.Hence training on small scale processing and value addition had great impact in changing knowledge of the farmer as t-test is found to be significant at 0.01 levels. Thus training played the crucial role for enhancing knowledge of the farmers.

APPLICATION OF CRUDE OILS ON GROWTH, YIELD AND QUALITY OF BER (*ZIZIPHUS MAURITIANA* LAMK) CV. APPLE BER

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Abstract

Ber (*Ziziphus mauritiana* Lamk) is commonly known as Indian jujube or Chinese date belonging to the family Rhamnaceae and is called as king of arid fruits. Apple Ber is a Thailand cultivar of ber which has been very much appreciated in India for its

taste. This fruit is sweet, crisp, juicy and as delicious as apple. The weight of each fruit is around 150 g - 200 g. It appears like green apple that is why named as Apple Plum or Apple Ber. This cultivar has recently gained tremendous importance among all the other cultivars of ber. These plants start bearing at 6-8 months after planting, as compared to conventional ber cultivars, which take 3 - 4 years for bearing. Of late, a lot of organic substances have been found effective in the maintenance of soil and plant health thus giving positive results for growth, yield and quality of different crops. Traditionally the organic edible oil is used as a fertilizer for farming to get high quality yields with low cost per crop. Vegetable oils are a group of fats that are derived from some seeds, nuts, cereal grains and fruits. Vegetable oils are mainly triacylglycerols (92–98%), polar lipids (phospholipids and galactolipids), monoacylglycerols, diacylglycerols and minor amounts of free fatty acids and polyisoprenoids. Crude oils are a complex of hydrocarbons, together with organic compounds of sulphur, nitrogen and oxygen. Crude oils are also used for controlling major fungal diseases and number of minor diseases. Recently farmers are also adopting the practice of application of crude edible oils from ground nut, rice bran, cotton, oil palm, neem and pongamia *etc*. to get good growth and higher yield with better quality in some of the other fruit crops.

ROOT ANATOMICAL STUDY ON INTERACTIONS BETWEEN*FUSARIUM OXYSPORUM* F. SP. *CICERI* AND CHICKPEA

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Abstract

A field experiment was conducted at All India Pulses Improvement Project, MPKV, Rahuri for the year 2014-2016. The Fusarium wilt resistant lines *viz*., WR 315 and susceptible line *viz.,* JG 62 were taken for the study of vascular anatomical features . The fifteen days old seedlings grown in wilt sick soil as well as in sterilized soil were used for observation. Transverse section (TS) of tap roots of resistant and susceptible lines were observed under electron microscope for vascular elements. Marked difference between resistant and susceptible lines were observed with reference to anatomical structures. In the microscopic observation, transverse section of tap root has shown correlation between resistant traits and vascular anatomy. After 48 hrs of inoculation, 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 was observed as a disorganized mass of few protoxylem and sparsely distributed enlarged metaxylem (Plate 9 F). After 86 hrs of inoculation, the vascular region was seen as a cross-shaped structure with four xylem arcs alternating with phloem tissue. In the infected 'WR-315' plants, staining with PAS reagent marked the presence of many densely stained polysaccharide deposits comprising of gums and resins (Plate 9G). Similarly, the occurrence and intensity of these polysaccharide deposits was apparently less in the infected 'JG-62' plants. The study of root anatomical parameters reveals that with the help of root anatomy able to differentiate the Fusarium wilt resistant and susceptible lines of chickpea.

EFFECTIVENESS OF TRAINING PROGRAMME CONDUCTED BY KVK-AHMEDABAD ABOUT CARE AND MAINTENANCE OF FARM MACHINERY

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Abstract

The present study on knowledge level of trainee farmers about care and maintenance of farm machinery conducted on 120 trainee farmers of Bhal region who were randomly selected from different four batches of training conducted by Krishi Vigyan Kendra, Anand Agricultural University, Arnej. The findings of the study revealed that majority of the trainee farmers had very low to low level of knowledge about care and maintenance of farm machinery before training. The training program had a tremendous impact in terms of knowledge gain on scientific practices of care and maintenance of farm machinery. The difference between the scores at pre and post training yields the change in knowledge level. Data was analyzed using

frequency, percentage and t test. Study showed that overall mean knowledge score at pre and post exposure stages were 28.53% and 63.61% with difference of knowledge gain showing 35.08%. Difference observed between the knowledge mean scores of farmers in pre and post exposure stages was found to be statistically significant as t-test is found to be significant at 0.01 levels. The majority of the respondents agreed that the information given by the trainers was more informative and helped in changing their knowledge and skill. All the respondents gained knowledge through the training

EVALUATION OF VARIETIES AGAINST POTATO DISEASES IN SOUTH EASTERN RAJASTHAN

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Abstract

Potato is an important food and cash crop globally and is an important crop in the Indian agriculture capable of providing nutritious food to ever increasing population of the country. Potato crop in suffers from various diseases. Multiplex of diseases is common in potato under field due to congenial climate conditions. The development of one pathogen is inflamed by the presence of other pathogens. A field experiment was carried out at Agricultural Research Station, Kota to study and screen out the varieties with respect to diseases in randomized block design with four replications. The soil was clay loam. The minimum and maximum temperature during the study was 3.5^{0}C and 37.5^{0}C, respectively. While relative humidity was 15% and 90%, respectively. Five varieties viz., K.Sinduri, K.Garima, K.Khayati, K.Pukhraj and K. Bahar revealed against early blight, stem necrosis, mild mosaic and leaf roll. Out of five varieties studied, the minimum disease incidence was observed in K. Sinduri i.e. 4% early blight, 6% mild mosaic and 4% leaf roll, respectively. K.Sinduri and K.Garima were observed free from disease of stem necrosis. The maximum disease incidence was recorded in K.Bahar i.e. 38% early blight, 24% stem necrosis, 36% mild mosaic and 22 % leaf roll, respectively. However, K. Khayati showed 18% early blight, 15 % stem necrosis, 18% mild mosaic and 10% leaf roll while K.Pukhraj found 28 % early blight, 12 % leaf roll, 10% stem necrosis and mild mosaic incidence, respectively.

EVALUATION OF QUALITY TRIATS IN NEWLY DEVELOPED CROSS COMBINATIONS OF TOMATO (*SOLANUM LYCOPERSICUM*)

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Abstract

Tomato (*Solanum lycopersicum* L.) acquired the status of world's most popular vegetable because of its wider adaptability to varied agroclimatic conditions and high nutritive value. It is considered as protective food because of having rich source of minerals, vitamins and organic acids. On an average it contains 900 IU of vitamin A and 23 mg of vitamin C per 100g of fruit pulp. Tomatoes are consumed either fresh or in processed form. Soft, juicy and fully ripened tomatoes are usually preferred for processing. Large quantities of tomato are used to produce soup, juice, ketchup, sauce, puree, paste and powder. Tomatoes for processing in general should have following features *i.e.,* fruits are uniform in size and shape to allow mechanical harvesting, uniform and intense red colour, lack of fruit cracking, small pedicel scar and flexible skin to permit easy peeling, TSS in the range of 4-6 and pH less than 4.4. If pH values more than 4.5 unacceptable to processing because it affect heating time. Tomatoes are important source of lycopene, ascorbic acid and carotene valued for their colour, flavour and antioxidant properties. Lycopene reported to possess anticancerous properties and it is powerful natural antioxidant used in pharmaceuticals. A study was conducted at College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad with the aim to develop more heterotic hybrids for quality traits in tomato *viz.,* TSS, pH, vitamin C and Lycopene. We developed two cross combinations (EC 654289 x Arka Meghali and EC 620494 x Arka Meghali) with high lycopene content and vitamin C. For TSS, better crosses were EC 654289 x Arka Meghali(7.33), EC 620639 x Pusa Ruby(6.23) and EC 620639 x Arka Vikas (6.23). pH is desirable in lower contents so, we identified two hybrids (LA 3667 x Pusa Ruby and LA 3667 x Arka Vikas) in this direction. These hybrids may be further utilized for multilocational trails for further crop improvement.

TECHNOLOGY DISSEMINATION APPROACH THROUGH CLUSTER DEMONSTRATION FOR MUSTARD GROWERS

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Abstract

Mustard possesses a good position in oil seed crops along with high yield potential in both rain fed and irrigation condition. it contains 37-49 percent in oil content. Mustard is the major growing oil seed crop during Rabi crops in the district with low productivity i.e. 1420 kg /ha. The major reason behind low yield of mustard is wide gap between improved practices(IP) & farmers practice(FP).In order to identify the gap and performance of the FLDs conducted by krishi vigyan Kendra, Morena present study was undertaken .the major factors which were responsible for the lower yield of mustard was higher seed rate without treatment, delayed sowing time defective method of sowing ,imbalance use of chemical fertilizer, no or less plant protection measures, no weed management and use of old varieties the yield under IP ranged from 1920 to 2350 kg/ha .

EFFECT OF SEED SIZE AND WEIGHT ON SEED VIGOUR PARAMETERS OF WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

The presented investigation was carried out during 2017-18 in the department of Seed Science and Technology at Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.). The experiment was laid out in completely randomized block design with three replication. The prescribed procedure for seed quality assessment was follow during this experimentation. In the present study four varieties of wheat viz. K-607 (V_1), K-1006(V_2), K-307 (V_3), and K-9107 (V_4), were selected. The raw seeds ofabove varieties were graded with four different sieves having oblongaperture size of 2.50 mm (S_1), 2.30 mm (S_2), 2.20 mm (S_3), and 2.10 mm(S_4). Each grade was assessed for its seed quality parameter in the seed science laboratory. The observation on seed recovery percentage, 1000 seed weight(g), 1000 seed volume (u), 1000 seed density(g/u), first count test, standard germination percentage, seedling length (cm) and seedling dry weight (g)was recorded on the laboratory. Result reveled that in the present investigation variety showed significant effect withrespect to all the parameter studied. The sieve aperture size determines the recovery percentage and quality of seed lot during processing .The different sieve size had showedsignificant effects with respects to all the characters studied. Thus fromthe above study, it may be concluded that oblong sieve size of 2.30 mmcan be used for processing of standard sieve size for wheat variety K-607, K-1006, K-307 and K-9107 without much loss in seed quality and betterrecovery of seeds, but in our studies we can suggested to use sieve size 2.20mm which showed optimum standard quality parameters.

EVALUATION OF QUALITY ATTRIBUTES OF INSTANT RICE AND DHAL MIX

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Abstract

With the increased urbanization and more women's involving into corporate world there is need to develop a food which can be made within minutes and also full-fill the nutritional objectives. So keeping in mind a study was conducted for the development of instant rice and dhal mix and its nutritional value was calculated. Dehydrated dhal and rice was prepared by drying the cooked dhal and rice in dehydrator at temperature such as 50, 60, 70^{0}C and later these two are mixed to from standardize ratios. The physico-chemical characteristics (moisture content, fat content, protein content, carbohydrate and ash content) and sensory characteristics (colour taste, flavour, texture, appearance and overall acceptability) were evaluated for instant rice and dhal mix samples. Dehydrated rice and dhal has it's nutritional value in different ranges due to different

temperature processing, for dehydrated rice protein, carbohydrate, fat, ash and moisture content has their value in range of 5-7%, 80.0-85%, 0.46-0.49%, 0.40-0.50%, 4.5-9.0%, respectively and dehydrated dhal has value of 22-25%, 55-57%, 1.5-1.9%, 0.44-0.80%, 8-10% protein, carbohydrate, fat, ash, and moisture content respectively. When the product was standardized into different ratios, samples were formed and sensory evaluation was performed. Sample (rice to dhal ratio 7:3 at 50^0C) got highest score (8.4) and sample (rice to dhal ratio 1:1 at 70^0C) got lowest score on hedonic scale as 6.3 on the basis of sensory (the one getting the highest score) sample which was ready to be rehydrated, nutritional value was calculated which was found to be 4.08%, 22.85%, 1.19%, 0.45%, 52% for protein, carbohydrate, fat, ash and moisture content respectively. In sensory evaluation, highest score for colour, taste, flavour, texture, appearance and overall acceptability were obtained as 8.3, 7.8, 8.5, 8.5, 8.3, 8.4 respectively.

SUSTAINABLE DEVELOPMENT OF CLEAN RENEWABLE ENERGY IN INDIA

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Abstract

Renewable energy plays an important role in meeting national targets for sustainable development, responding to climate change and environmental issues, and ensuring national energy security. India is considered to have potentials for developing renewable energy. In order to meet the demand for electricity for socio-economic development and to take advantage of natural resources and technological advances in renewable energy, the Government of India has issued the Strategy development of national renewable energy and mechanisms, policies and incentives to support it. In the process of implementing the strategy, regular assessment of internal and external environmental factors is essential to make appropriate adjustments. This is also the research going in India, by analyzing strengths, weaknesses, opportunities, and threats, for renewable energy development in India based on collected data, opinions of experts, investors, renewable project owners, and a case study. World energy consumption is based on 80% upon fossil fuels which are the polluting sources that accelerate global warming. Besides, climate change revealed that current energy and environment equilibrium is unsustainable. Energy policies should now integrate climate change policies in order to save the environment that the people live in. This challenge is very crucial one in front of the not only a single country, but also all countries in the world. Thus, unsustainable patterns of energy production and consumption in any country threaten not only human health and quality of life but also affect ecosystems and contribute to climate change. There arises a question that who is going - 2 - to save or sustain our planet for the future generations? Who is going to pay for the proper maintenance of the planet? Can sustainable energy developments be an engine for sustainable future?

NANO FERTILIZERS : NEED OF FUTURE AGRICULTURE

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Abstract

Nanotechnology is one of the most important tools in modern agriculturewhich involves the use of nanosized particles with unique properties to boost crop and livestock productivity.Nano particles are spherical metal particles typically less than 100nm in size. These nanoparticles are having high surface area (30-50 m2/g), more catalytic surface, and rapid chemicalreaction, rapidly dispersible and adsorb abundant water. So nano fertilizers may increase the efficiency of nutrient uptake, enhance yield and nutrient content in the edible parts and also minimize its fixation in the soil. Preparation ofnano particles by the suspension directly in deionized water and dispersed by ultrasonic vibration (100W, 40 KHz) for 30 min. Different concentrations (0, 100, 200, 400, 800, 1000, 1500, 2000 ppm) of solutions were prepared. The pH of all the prepared suspensions should be 6.8-7.0.

Preparation of nano biosensors to detect moisture content and nutrient status in the soil and also applicable for site specific water and nutrient management, Nano-fertilizers for efficient nutrient management, Nano-herbicides for selective weed control in crop field, Nano-nutrient particles to increase seed vigor, Nano-pesticides for efficient pest management, herbicide

carrier material specially for herbicide such as paraquat. Nano herbicides are effective in weed management. Nano fertilizers are synthesized or modified form of traditional fertilizers.Rock phosphate may use as nano form to increase availability of phosphorus to the plant because direct application of rock phosphate nano particles on the crop may prevent fixation in the soil similarly there is no silicic acid, iron and calcium for fixation of the phosphorus hence it increase phosphorus availability to the crop plants.The nano-fertilizers have higher surface area it is mainly due to very less size of particles which provide more site to facilitate different metabolic process in the plant system result production of more photosynthesis. Particles size of nano-fertilizers is less than 100 nm which facilitates more penetration in the foliar applied on plant. Zeolite based nano-fertilizers are capable to release nutrient slowly to the crop plant which increase availability of nutrient to the crop though out the growth period which prevent loss of nutrient from denitrification, volatilization, leaching and fixation in the soil especially NO_3-N and NH_4-N which are more eco-friendly and reduce environment pollution. They are nontoxic and less harmful to environment and human.Nano fertilizers can easily penetrate into the seed and increase availability of nutrient to the growing seedling which result healthy and more shoot length and root length but if concentration is more than the optimum it may show inhibitory effects on the germination and seedling growth of the plant. Nano fertilizers for different crop and site specific management of nano fertilizers in precision agriculture these are several issues need to standardize to achieve better result from nano-fertilizers in crop production. These nano fertilizers are available as Nanozinc, NanoPoatah, NanoNPK, Nanophos, Nanobor etc. These products being produced and marketed by so many private companies and also made available on line by Amazon and flipcartin India.

STUDY OF VARIABILITY IN *A. ALTERNATA* ISOLATES *OF WITHANIA SOMNIFERA* (L.)

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Abstract

Ashwagandha [*Withaniasomnifera* (L.) Dunal] Winter cherry is an important tropical medicinal plant of India. Ashwagandha leaf blight caused by *Alternaria alternata* significantly reduces the plant population resulting with low root yield. An experiment was conducted at Plant Pathology lab College of Agriculture, JNKVV, Jabalpurduring 2009-10 for studying the variability within three isolates of *A. alternata* of Ashwagandha. Among eight media tested for Mycelial growth of *A. alternata* Potato Dextrose Agar medium was found best followed by host decoction agar media, Richards agar,Carrot agar and found lowest Martins agar. as well as Mean no of spores found significantly higher in PDA which was found best followed by host decoction agar media.

A STUDY OF PHYSICO-CHEMICAL PARAMETERS OF SHANKAR GHAT, WAINGANGA RIVER (BALAGHAT DISTRICT, MADHYA PRADESH)

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Abstract

Present paper deals with the study of Physico-chemical parameters of Shankar Ghat at Wainganga river Balaghat. Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. The precipitation which is the main source of water gets contaminated as soon as it reaches on the earth's surface. During its flow anthropogenic activities in the surrounding area add further impurities in it. The present study was aimed to analyze the physico-chemical parameters of shankar ghat at Wainganga river the reservoir carried out from the month of January 2017 to December 2017. The sampling stations were divided by a measurable distance and samples were collected every month. The parameters such as temperature, pH, conductivity, Dissolved oxygen, free carbon dioxide and turbidity were analysed. The paper highlights the condition of the reservoir in various seasons with respect to parameters mentioned above.

IMPACT OF NO-TILLAGE AND CONVENTIONAL TILLAGE SYSTEMS ON SOIL MICROBIAL COMMUNITIES

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Abstract

Soil management practices influence soil physical and chemical characteristics and bring about changes in the soil microbial community structure and function. In this study, the effects of long-term conventional and no-tillage practices on physicochemical properties were determined in a continuous pearl millet-wheat and moong bean-wheat cropping systems. The long-term no-tillage treatment resulted in higher soil carbon and nitrogen contents, viable microbial biomass, and phosphatase activities at the 0–15?cm depth than the conventional tillage treatment. Soil organic carbon (SOC) significantly increased from 0.54 to 0.67% and from 0.24 to 0.48%, respectively, in pearl millet- wheat and moong bean- wheat surface soil samples while in sub-surface soils, SOC was increased from 0.36 to 0.12% and from 0.52 to 0.60%, respectively at two sampling sites. The highest available N, P, K, and total N were recorded in surface soil samples under zero tillage in comparison to conventional system. However, C:N ratio was observed to be slightly affected by the two management practices. Results of the study concluded that pH, EC and bulk density of soils were significantly lower under zero-tillage practices as compared to conventional tillage and zero tillage with SOC was found to be suitable for soil health under the pearl millet- wheat and moongbean-wheat cropping system.

EFFECT OF PRUNING INTENSITY, CROP LOAD AND FERTIGATION ON PLANT GROWTH ATTRIBUTES IN POMEGRANATE CV. BHAGWA

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Abstract

The field experiment was conducted at Horticulture farm, Rajasthan Agricultural Research Institute, Durgapura (Jaipur-Rajasthan) during 2015-16 and 2016-17. The experiment, comprised of 18 treatment combination replicated four times, was laid out in split plot design with three fertigation treatments *i.e* F_1 (100 % RDF), F_2 (75 % RDF) and F_3(50 % RDF)) under main plots and, two levels of pruning intensities *i.e.* P_1(25 % pruning of one year old shoots) and P_2 (50 % pruning of one year old shoots) and three levels of crop loads *i.e.* C_1 (20 fruits per plant), C_2 (30 fruits per plant) and C_3(40 fruits per plant) were added in sub plots. The maximum plant height (0.77 m), stem girth (0.75 cm) and plant spread i.e 0.96 and 0.94 m in East-West and North-South direction, respectively, was recorded in F_1 treatment followed by F_2 treatment. The minimum plant height (0.59 m), stem girth (0.57 cm) and plant spread *i.e* 0.68 and 0.67 m East-West and North-South direction respectively, was recorded in treatment F_3. Pruning and crop load treatments were found to influence most of the growth attributes significantly. The trees which were subjected to heavy pruning (P2) had significantly highest plant height (0.72 m), stem girth (0.70 cm) and canopy spread *i.e*. 0.89 and 0.87 m in EW and NS directions, respectively. The different crop load treatments had not showed significant difference on plant height and canopy spread.

VITAMIN A BIOFORTIFICATION OF COWS' MILK BY GOLDEN SWEET POTATO

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Abstract

Cow's milk is yellow in colour due to the presence of Beta Carotene (precursor of Vitamin A) and is valued over buffalo milk. Dairy cows hardly receive any source of Beta Carotene in their feed and thus their milk is no longer a source of Vitamin A. In eastern U. P. more than 40% children suffer due to lack of Vitamin A. Some modern dairies do import lot of Vitamin A fortified feed supplement. Thus looking for feed supplement for Vitamin A is doubly important for Vitamin A, reducing import

of feed supplement and in increasing Vitamin A content in milk. Stem and leaves of Golden Sweet Potato (GSP) are rich in Beta Carotene. GSP stem and leaf contain respectively 1776 and 1833 microgram of Beta Carotene per 100 grams of fresh material, equivalent to 2447 and 2664 microgram of Vitamin A. Upon feeding GSP stems and leaves, the Beta Carotene content of the milk increased from the first day itself. By the 5th day it increased to 0.69µg± 0.01 from the initial value of 0.47µg± 0.01. Therefore, the stem and leaves of GSP can profitably be used for substituting imported supplement, and increasing Vitamin A content of the cows' milk.

EFFICACY OF HEXACONAZOLE 5% + FLUBENDAMIDE 3.5% ON MAJOR DISEASE AND INSECTS OF PADDY

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Abstract

Rice (Oryza sativa L.) is the staple food in the world, as well as in Chhattisgarh. Several insects & disease served as pest for rice crop, but stem borers, leaf folder, sheath blight & leaf blast are regarded as the most important rice insects and disease of paddy in bilaspur districts. In the recent years, it becomes serious constraint upon rice production of rice growing areas and is believed as the most important nuisance of rainfed and low land rice. Sheath blight, Blast, Stem borer, leaf folder, BPH etc cause severe damage and yield loss to the rice crop in different stages of the crop growth and thus the occurrence of pests and diseases together in rice, demand the necessity of chemical which can be effective for insect and diseases both. Looking to above situation an assessment trail was conducted during Kharif 2017 at village Nawgaon block Bilha district Bilaspur Chhattisgarh to assess the combining efficacy of ready mixed formulation of Hexaconazole 5% + Flubendamide 3.5%.Among different treatments assessed during Kharif 2017, Hexaconazole 5% + Flubendamide 3.5% WG @2g/lt showed less sheath blight incidence & severity (19.63 & 10.42%), Blast (PDI 5.54%) and less pest incidence leaf folder (0.90%), Stem borer (0.35 DH & 0.68% WE), subdue the incidence of BPH, compared to untreated control. All the treatments recorded significantly higher yields, B: C ratio compared to farmer's practice.

SOIL HEALTH MANAGEMENT FOR SUSTAINABLE CROP PRODUCTION

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Abstract

Soil health, also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. This definition speaks to the importance of managing soils so they are sustainable for future generations. To do this, we need to remember that soil contains living organisms that when provided the basic necessities of life - food, shelter, and water - perform functions required to produce food and fiber. Agricultural sustainability has become a major concern in developing countries, including India. Population burst (>1 billion), over-exploitation of natural resources, and excessive use of chemicals such as fertilizer, pesticide etc over many decades have resulted in steadily declining in agricultural productivity. A healthy soil would ensure proper retention and release of water and nutrients, promote and sustain root growth, maintain soil biotic habitat, respond to management and resist degradation. Soil health is an assessment of how well soil performs all of its functions now and how those functions are being preserved for future use. Soil health cannot be determined by measuring only crop yield, water quality, or any other single outcome. Soil health cannot be measured directly, so we evaluate indicators. Soil quality indicators are a composite set of measurable physical, chemical, and biological attributes which relate to functional soil processes and can be used to evaluate soil quality status. Issues of agricultural sustainability are related to soil quality, soil quality assessment and the direction of change of soil quality with time is a primary indicator of sustainable agriculture. It is therefore imperative to identify the soil characteristics responsible for changes in Soil quality, which may eventually be considered as determinants of soil quality for assessing agricultural sustainability. Soil indicators are often divided into Physical, Chemical and Biological categories depending on how they affect soil function. However, these categories are not always clearly defined since a soil property or indicator can affect

multiple soil functions or categories. Physical indicators of the soil refer to the arrangement of solid particles and pores. Physical indicators provide information about soil hydrologic characteristics, such as water entry and retention that influences availability to plants. Some indicators are related to nutrient availability by their influence on rooting volume and aeration status. Other measures tell us about erosional status. Physical indicators such as texture, infiltration rate, bulk density, soil compaction, aggregate stability, and soil crusting can help determine how well water and roots are able to move through the soil and how stable the soil resource is to the effects of climate. Top soil thickness, soil color, subsoil exposure, sediment Pans, and soil structure are visual examples of physical indicators. Chemical indicators include measurements of pH, salinity, organic matter, phosphorus concentrations, cation-exchange capacity, nutrient cycling, and concentrations of elements that may be potential contaminants (heavy metals, radioactive compounds, etc.) or those that are needed for plant growth and development. The soil's chemical condition affects soil-plant relations, water quality, buffering capacities, availability of nutrients and water to plants and other organisms, mobility of contaminants, and some physical conditions, such as the tendency for crust to form. Biological indicators include measurements of microand macro-organisms, their activity, or byproducts. Earthworm, nematode, or termite populations have been suggested for use in some parts of the country. Respiration rate can be used to detect microbial activity, specifically microbial decomposition of organic matter in the soil. Ergosterol, a fungal byproduct, has been used to measure the activity of organisms that play an important role in the formation and stability of soil aggregates. Measurements of weed seed numbers, or pathogen populations can also serve as biological indicators of soil quality. Soil organic matter accumulation can improve SQ by decreasing bulk density (BD), surface sealing and crust formation, and by increasing aggregate stability (Somasundaram et al., 2013), cation exchange capacity, nutrient cycling and biological activity (Karlen and Andrews, 2004). The balanced rate of fertilizers in combination with organic manure sequester soil organic carbon in soil and also improved the soil physical environment in intensive cropping system. The minimum tillage practice with residues showed maximum accumulation of organic carbon, which in turn improved the soil quality indicators like porosity, aggregate stability, water holding capacity of soil and microbial biomass carbon compared to conventional methods.. The bulk density of the soil decreased with the application of different organic manures and also with the better soil management practices. For maintaing yield as well as soil quality in the alfisols, the application of inorganic fertilizers along with crop residue are recommended.

GENETIC IMPROVEMENT OFNATURAL ENEMIES IN ORDER TO ENHANCE THEIR EFFICACY AGAINST TARGET INSECT PESTS

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Abstract

Food security entails ensuring adequate food supply to people, especially those who are deprived of basic nutrition. India ranks 74 out of 113 major countries in terms of food security index. In terms of monetary value, the Indian agriculture currently suffers an annual loss of about Rs 8,63,884 million due to insect pests. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields. Runoff can carry pesticides into aquatic environments while wind can carry them to other fields, grazing areas, human settlements and undeveloped areas, potentially affecting other species. Biological control is the use of living organisms to maintain pest populations below damaging levels. Natural enemies of arthropods fall into three major categories: predators, parasitoids, and pathogens. It has gained impetus in recent times, as conventional insecticides did not achieve the desired level of control of pest insects due to the evolution of resistance in them, and in addition, showed deleterious effects like environment pollution, pest resurgence, and reduction in their natural enemies in the agroecosystem. In order to reduce environmental contamination from chemical pesticides renewed emphasis has been placed on the development of effective bio-control agent for management of insect and mite pests. Genetic engineering can provide increased understanding of the biology and pathogenicity of the organism. Genetic engineering, also called genetic modification, is the direct human manipulation of an organism's genome using modern DNA technology. It involves the introduction of foreign DNA or synthetic genes into the organism of interest. Improvement of biological control agents has been discussed but fears of laboratory deterioration and inadvertent selection of the laboratory-selected biological control agent restricted interest in this potential tool. Various technologies and methods have been adapted in order to genetically improve the performances of

natural enemies (predators, parasitoids and pathogens). Artificial selection of various strains under different conditions, hybridization (heterosis) of different strains and rDNA technologies has been adopted towards these directions. Genetic improvement projects with natural enemies of insects have been conducted for- Improved climatic tolerances,Improved host finding ability,Changes in host preference, Improved synchronization with the host, Insecticide resistance, Non-diapause, Induction of thelytokous reproduction, etc. As in crop breeding, three potential genetic manipulation tactics are being utilised for achieving the above goals- a. Artificial selection, b. Hybridization or, use of Heterosis, c. Use of Biotechnology (recombinant DNA (rDNA) techniques).Though, the use of predator and parasitoids has no hazardous environmental impact but their efficacy under various conditions limits their usages. The improvement of their potency can boost their uses over the chemical mode of pest control. The genetically improved natural enemies (predators, parasitoids and pathogens) might be the next level biological weapons against the pest populations in agricultural systems.

FIVE YEARS STUDY OF BURNING TREES BASED AGROFORESTRY SYSTEMS IN TERAI REGION OF U.P.

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Abstract

The present study compares the performance of three agroforestry systems viz. Melia based agroforestry system (MBAF), Poplar based agroforestry system (PBAF) and Eucalyptus based agroforestry system (EBAF), among each other and with open conditions growing similar intercrops under similar conditions in the Tarai region of Distt.Pilibhit ,U.P. Intercrops grown in the farmers field were sugarcane during first year , ratoon sugarcane during second year, wheat crop during second winter season, oat as fodder crop during third winter season and dhaincha as green manure during fourth summer season.At 56 months of age , melia trees recorded more dbh and crown diameter than eucalyptus and poplar,though their height was significantly lesser than other two species.There was more reduction in intercrop yields under the canopy of melia(40.51%),than that of poplar(25.65%) and eucalyptus(21.05%).At five years of age,PBAF produced higher net returns of Rs.358330/ha,compared to Rs. 322462/ha from EBAF , Rs. 214621/ha from MBAF and Rs. 277567/ha from growing the same crops under open conditions.Returns from EBAF could have been less if the generally followed practice of dense planting over 1250 trees/ha was followed compared to just 500 considered in this study to keep the uniformity in the tree density and intercrops.

FIELD EFFICACY OF FUNGAL BIO-AGENTS AND THEIR COMBINATION WITH THE CHEMICAL INSECTICIDES AGAINST SOYBEAN DEFOLIATORS

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Abstract

An experiment was conducted at Junagadh Agricultural University, Junagadh during *Kharif,* 2017 to study on the efficacy of insecticides for the management of *Helicoverpa armigera* (Hubner) Hardwick and *Spodoptera litura* (Fabricius) infesting groundnut. Insecticides used in experiment were chlorantraniliprole 0.006 %, indoxacarb 0.008 %, quinalphos 0.05 %, *B. bassiana* 0.007 %, *B. bassiana* 0.0035 % + chlorantraniliprole 0.003 %, *B. bassiana* 0.0035 % + indoxacarb 0.004 %, *M. anisopliae* 0.0035 % + chlorantraniliprole 0.003 %, *M. anisopliae* 0.0035 % + indoxacarb 0.004 %. Two sprays of respective insecticides were applied at 15 days interval. Considering the effectiveness, yield and economics of insecticides indoxacarb 0.008 per cent and quinalphos 0.05 per cent were found the most effective and economical treatments for the control of soybean defoliators. Treatments of chlorantraniliprole 0.006 % and *B. bassiana* 0.0035 % + chlorantraniliprole 0.003 % were found comparatively less economical against defoliators in soybean ecosystem. Chlorantraniliprole 0.006 % (30353 Rs/ha)

recorded maximum net return but the cost benefit ratio chlorantraniliprole 0.006 % (1:6.32) was found low as compare to indoxacarb 0.008 % (1:13.47) and quinalphos 0.05 % (1:13.01) due to high cost of chlorantraniliprole 0.006 % insecticides.

INSECT PEST COMPLEX OF LINSEED AND MANAGEMENT OF *DASYNEURA LINI* BARNES

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Abstract

The investigations on insect pests of linseed and management of *D. lini* were conducted at Experimental Farm, Bihar Agricultural University, Sabour during *Rabi* season of 2016-17. A total of nine insect pests (*D. lini, Thrips palmi* Karny*, Frankliniella schultzei* (Trybom)*, Agrotis ipsilon* Hufnage*, Helicoverpa armigera* Hübner*, Spilosoma obliqua* Walker*, Monolepta signata* Olovier, unidentified aphids and wire worm) and four natural enemies (*Coccinella septumpunctata* L., *Menochilus sexmaculatus* (Fabricius)*, Oxyopes* sp. and *Paederus* sp. were found to be associated with linseed. The highest population of *A. ipsilon* (1.00 larva/m^2) and thrips (26.60 nymphs & adults/plant) were observed during 52nd and 9th SMWs, respectively. However, the highest population of aphids (2.40 aphids/plant), *Helicoverpa* (1.00 larvae/m^2), *Oxyopes* (1.00 spider/plant) and coccinellids (1.0 coccinellid/plant) were observed during 8th SMW. Similarly, the maximum fresh bud fly infestation (6.12%) was also recorded during the 8th SMW. Minimum temperature had positive correlation (P=0.01) with the population of *A. ipsilon, H. armigera* and cumulative bud fly infestation, whereas maximum temperature showed positive correlation (P=0.01) with cumulative bud fly infestation. Minimum relative humidity and population of *A. ipsilon* were found to be positively correlated (P=0.01), whereas maximum relative humidity had negative correlation (P=0.01) with *H. armigera* and cumulative bud fly infestation. Out of 101 genotypes screened for resistance against the infestation of *D. lini,* 12 genotypes were categorized as resistant, 65 as moderately resistants, 17 as moderately susceptible, 05 as susceptible and 02 as highly susceptible. The field trial on different dates of sowing revealed that the infestation of *D. lini* increased and yield decreased in all five tested varieties in progressive manner with delay in date of sowing. The lowest mean bud fly infestation (13.39%) and highest mean yield (1385.30 kg ha^{-1}) was obtained with the crop sown on 08.11.2016, whereas the highest mean bud fly infestation (37.46%) and lowest mean yield (177.75 kg ha^{-1}) was obtained with crop sown on 08.01.2017. The application of insecticides showed significant reduction in bud fly infestation and increased yield over untreated check. The minimum bud fly infestation (8.25%) was recorded with the application of fenvalerate 20 EC being at par with imidacloprid 17.8 SL (8.57%) followed by spinosad 45 SC (9.87%) at 15 days after second spray. Among the insecticides/bio-pesticides, the maximum infestation (16.26%) was recorded with neem leaf extract followed by fipronil 5 SC (12.31%) and dimethoate 30 EC (10.87%). The maximum incremental yield (5.21 q ha^{-1}) was obtained with fenvalerate followed by imidacloprid (4.54 q ha^{-1}) and spinosad (3.29 q ha^{-1}). However, the minimum incremental yield (0.39 q ha^{-1}) was obtained with neem leaf extract followed by fipronil (2.05 q ha^{-1}) and dimethoate (3.06 q ha^{-1}). The maximum benefit-cost ratio (15.12:1) was obtained with fenvalerate followed by imidacloprid (11.47:1) and dimethoate (5.92:1). However, minimum benefit-cost ratio (0.30:1) was obtained with neem leaf extract followed by fipronil (1.42:1) and spinosad (1.86:1).

IN-VITRO CONSERVATION OF PLANT BIODIVERSITY

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Abstract

Plant biodiversity is the totality of plant species, genes and ecosystem of a region. Plant biodiversityconservation is a global concern. It has been established that one third of the global plant species are threatened in different level according to the "International Union of conservation of Nature." The Threat to rapid loss and extinction of genetic diversity due to disturbance of ecosystem, destruction of habitats, climate change, pollution, human population pressure, ever increasing agricultural pressure and practices etc. are responsible factors. Long term conservation of plant biodiversity by in situ methods have several problems and limitations. Therefore certain *invitro* techniques such as plant cell culture, plant tissue culture, micropropagation, anther culture, ovule culture, embryo culture, endosperm culture, cryopreservation are useful and applicable techniques for*ex- situ* conservation. Plant biodiversity will not only help in increasing agricultural productivity but also in developing disease resistant varieties. Advances in plant bio technology provided new options for collection, multiplicationand short to long term conservation of plant biodiversity, using in vitro techniques.

ROLE AND IMPORTANCE OF SOIL HEALTH CARD TO SOIL HEALTH

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Abstract

Soil health card is represent of nutrient of status of the soil and it includes 12 parameters namely- N,P,K , S , Zn, Fe, Cu, Mn, B, pH, EC and OC. SHC is indicate fertilizer recommendations and soil amendments needed for the farmer's holding. The soil health card evaluates the quality of soil, nutrients content and other biological properties. Soil health card is a tool to help the farmer to monitor and improve soil health. Regular use will allow them to record long-term trends in soil health and to assess the effects of judicious use of fertilizers, bio-fertilizers, organic fertilizers, soil health, crop choice, cost reduction, farm profitability and sustainability. Its purpose is to use indicators that assess each soil's ability to support crop production within its capabilities and site limitations. Soil health card to farmer, which will carry crop-wise recommendations of fertilizers required for land holding and help to farmer to improve productivity through judicious use of inputs.

ASSESSMENT OF COMBINED USE OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON CROP PRODUCTION AND SOIL FERTILITY

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Abstract

Soil fertility is a main problem to sustain agricultural production and productivity of India. Use of inorganic fertilizers has been seen both positive and negative response on plant growth, and the soil texture, structure and soil fertility. Organic manures improve physical, chemical and biological properties of soil but nutrient content is very low which a required large amount for plant growth is. However, inorganic fertilizer is usually immediately response on plants growth. Continuous use of inorganic fertilizers alone causes reduction of soil organic matter, soil acidity or alkalinity problems and environmental pollution. Integrated nutrient management system is an alternative example for the sustainable soil fertility management by combined apply of organic manures with inorganic fertilizers resulting improve soil fertility, crop productivity and protect environment to pollution. The objective of this study is to assess the effect of combined use of organic manures and Inorganic Fertilizers on crop production and Soil Fertility. The result found that appropriate application of organic manures with inorganic fertilizers increases the productivity without negative effect on yield and improves soil fertility compare to use of organic or inorganic fertilizers separately.

EFFECT OF PANCHAGAVYA ON YIELD AND ECONOMICS OF ORGANIC BLACKGRAM [*VIGNA MUNGO* (L.) HEPPER]

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Abstract

A field experiment was conducted at Agronomy Farm, Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* season. The experiment was laid out in factorial randomized block design with three replications and assigning 21 treatment combinations consisting of control and six doses of panchagavya (panchagavya 2%, panchagavya 4%, panchagavya 6%, panchagavya 8%, panchagavya 10% and indigenous panchagavya 2%) as growth promoter and three stages of application of panchagavya (branching, flowering and branching + flowering). The blackgram variety PU-31 was sown at 30 cm row to row spacing by using recommended seed rate of 16 kg ha^{-1}. The significantly higher seed yield (801 kg ha^{-1}) and net return (67042 ha^{-1}) of blackgram was obtained with the application of panchagavya 4% over control and other applications of panchagavya.

The significantly higher seed yield (751 kg ha^{-1}) and net return (60977 ha^{-1}) of blackgram was obtained with the application of panchagavya at branching + flowering stages over the application of panchagavya at branching alone and flowering stage alone.

MARKER ASSISTED BACKCROSS BREEDING FOR DROUGHT RESISTANCE IN RICE

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Abstract

Drought stress is the major constraint to rice (*Oryzasativa*L.) production and yield stability in rainfed ecosystems. Identifying genomic regions (QTLs) contributing to drought resistance will help to develop rice cultivars suitable for rainfed regions through marker-assisted breeding.Marker assisted backcross breeding (MABB) has provided new opportunities to introgress regions governing stress tolerance through careful QTL identification and fine mapping studies. Selection for well-developed root system with deep and thick roots would improve drought tolerance in rice and these traits can be successfully transferred to popular varieties by MABB. Hence a marker assisted backcross breeding was conducted to introgress root trait QTLs from a *japonica* cultivar, CT9993 which is deep rooted and drought tolerant, in to popular varieties of Tamil Nadu. These QTLs for basal root thickness, grain yield and root pulling force on chromosome 4 and penetrated root thickness on chromosome 9 of CT9993 were introgressed in to the popular varieties by crossing and the progenies were selected for foreground analysis using the flanking markers of the QTLs.

ANALYTIC STUDY OF M.SC. (HORTICULTURE) THESIS UNDER THE DEPARTMENT OF PLANTATION, SPICES, MEDICINAL AND AROMATIC CROPS AT KNK COLLEGE OF HORTICULTURE, MANDSAUR (M.P.)

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Abstract

The study was carried out under the department of Plantation, Spices, Medicinal and Aromatic Crops at KNK College of Horticulture, Mandsaur (M.P.) for the period of 10 Years (From 2008 to 2017) and data was analyzed year- wise, Varieties - wise, supervisor- wise, and gender- wise. The data for all the parameters was collected from accession register. For the analysis of each parameters excel program was used. The study revealed that out of 205 M.Sc. theses from total four departments, awarded from the college, contribution of PSMA was 42 thesis with 20.48 per cent. The highest number of thesis submitted and awarded in the year 2013(7) followed by 2015(6), 2016(5) and 2017(5). The thesis awarded to male students (28) was just double comparing to the female students (14). Maximum 05 male students were awarded thesis during 2013 and minimum 01in 2009. Maximum total 07 (5+2) male and female students were awarded thesis during the year, 2013. Dr.I.S. Naruka guided 31 research scholars for thesis followed by Dr.P.P. Singh (06 thesis) and Dr. Om Singh (05 thesis). Garlic (*Allium sativum* L.) was undertaken for maximum experimentation and higher percentage (43.7) for the award of thesis followed by Coriander and Fenugreek (12.5%) and Ajwain and Dill (7.14%).

IMPACT OF NEEM-COATED UREA IN CULTIVATION OF MAJOR KHARIF AND RABI CROP IN MADHYA PRADESH

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Abstract

The study comprises 200 paddy and 200 soybean growers of Balaghat & Seoni and Khargone & Dhar districts respectively. The positive impact of NCU (Neem coated Urea) was observed on yield and probability of crops. The yield of paddy and soybean obtained by NCU respondents was found to be higher than NU (Normal Urea) respondents. The use of NCU reduced

the expenditure of applying nitrogen in both the crops and found economically feasible as consumption NCU is found more profitable as compared to NU. The total cost of cultivation of paddy (Rs 10619/acre) was found to be more as compared to soybean (Rs. 9776/acre). The expenditure on ploughing & sowing (14.19%), harvesting & threshing (13.16%), fertilizers-other than Urea/NCU (12.82%), family labour (11.7%) and hired labour (11.44%) were found to be major component of cost of cultivation of paddy, while the expenditure on seed (22.49%), hired labour (20.41%), family labour (13.65%), fertilizer-other than urea) (12.34%), harvesting & threshing (8.51%), plant protection chemicals (6.82%) and ploughing & sowing (6.15%) their found to be major component of cost of cultivation of soybean during the year 2015. An average farmer also received more net return in cultivation of paddy (Rs. 10015/acre) as compared to soybean (Rs. 7909/acre). On in investment of Re 1.00 he was also found to be got more return in paddy (Rs 2.06) as compared to soybean (Rs. 1.83) respectively. Although, no remarkable difference were found to be observed in cost incurred and profit received by an average farmer in cultivation of paddy and soybean in the area under study.

ESTIMATION OF TOTAL FACTOR PRODUCTIVITY GROWTH OF MAIZE PRODUCTION IN CENTRAL INDIA

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Abstract

Maize popularly known as "corn" is one of the most versatile emerging cash crop having wider adaptability under varied climatic condition. It is called of cereals globally .In India, maize is the third important food cash crops after wheat and rice. Present investigation shows that output index was highest during 2002-2011 (3.047). TFP growth was positive during all the period of time and highest growth rate during 2002-2011(3.195). But still fertilizer is the principal source of growth for maize crop. This indicates that in future more fertilizer responsive varieties will determine the positive growth of maize. It accounts for 9 per cent of total food grain production in the country. By cultivating maize, farmers can protect the worsening quality of soil as well as other factor, which affect the productivity.

PEST AND PREDATOR SCENARIOS IN PEANUT

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Abstract

Peanut is one of the major oilseed crops of India. Peanut is often damaged by more than 100 insect pests which are broadly classified into defoliators, sucking pests, root feeders and storage insect pests. Among sucking pest thrips and leafhoppers are the major ones, coccinellids and spider often predate on these sucking pests. Hence we tried to study the natural enemies and pest scenarios in Peanut.Incidence of insect pests was studied by sowing peanut variety GJG 22 every month under unprotected condition in plots of 5X5 Square meter at Entomology research plots of Directorate of Groundnut Research (ICAR-DGR) farm. Sucking pests were estimated using sweep net catches. Thrips and leafhoppers were found throughout the season. Highest thrips population was recorded 20 per five sweeps during 48th Standard week and leaf hopper population 0f 30 per five sweeps was recorded during 42nd standard week. Natural enemies like coccinellidsand spiders were recorded during last year. Highest number of coccinellids (6) was recorded during 30th and 48th Standard week and spiders (7) were recorded during 38th Standard week.Coccinellids showed clearly that when there incidence was more the sucking pest population was low. Lotka-volterra model clearly states that pest and natural enemies' incidence are negatively correlated.

ECONOMIC ANALYSIS OF INPUTS USE PATTERN IN WHEAT CROP IN DRY ZONE OF HARYANA

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Abstract

This study pertained to the dry zone of Haryana state. The study is based on the data collected under the comprehensive scheme to study the cost of cultivation of wheat crop. Under this scheme from each of the 30 centers the data from ten farmers representing 5 size holdings that were up to 1 ha, 1 to 2 ha, 2 to 4 ha, 4 to 6 ha and above 6 ha were collected by the Agriculture Inspectors in different zones. The inputs included in this study are seed, irrigation, fertilizer, insecticide, pesticide and herbicide. Each size of holding represents a sample of 60 farmers. This study is related to agricultural year 2013-14. Data related to actual use of inputs in the wheat crop on each size of holding and in dry zone has been tabulated and presented in absolute as well as percentage form in simple and cross tables. The quantity and value of different inputs used per ha in all five size of holding in dry zone are presented. The state average for all the inputs used also calculated. The actual input use has been compared with the recommended dose to find out gap. To estimate the response of the input in the wheat crops grown on the farms, the Cobb-Douglas production function is used. The marginal value productivities of all the inputs (at their mean levels) are estimated by taking partial derivative of the production of the concerned crop and multiplying with the price of its output.

EFFECT OF TIME OF MACRO AND MICRO NUTRIENTS FOLIAR SPRAY ON PHYSICO-CHEMICAL ATTRIBUTES OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. HISAR SAFEDA

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Abstract

The present investigation was carried out at experimental orchard, Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2017-18. The treatments comprised of eight different macro and micro nutrients foliar sprays T_1: RDF + Foliar spray of NPK (19:19:19) at 2% and micronutrients Fe (1300ppm), Mn (1600ppm), Zn (1600ppm), Cu (1000ppm), B (1000ppm) at vegetative stage (April and October); T2: RDF + Foliar spray of NPK (12:32:16) at 2% and micronutrients Fe (500ppm), Mn (800ppm), Zn (800ppm), Cu (1000ppm), B (2000ppm) at flowering stage (May and November); T3: RDF + Foliar spray of NPK (16:8:34) at 2% and micronutrients Fe (1200ppm), Mn (1600ppm), Zn (1600ppm), Cu (1000ppm), B (1000ppm) at fruiting stage (July and February) T4: T1 + T2; T5: T2 + T3; T6: T1 + T3; T7: T1 + T2 + T3; T8: Control (RDF). The physico-chemical parameters in terms of per cent fruit set, per cent fruit retention, fruit size, average fruit weight, number of fruits per tree, yield, TSS, acidity and ascorbic acid content were significantly enhanced by T_7 foliar treatment which was found statistically at par with T_5 and T_6 treatments. However, the guava trees given RDF only resulted in lowest values of different physico-chemical attributes. The winter season guava fruits had higher percentage of fruit set and fruit retention also, they have better quality in terms of TSS, acidity and ascorbic acid content in comparison to rainy season fruits. Moreover, the yield, average fruit weight and number of fruits per tree significantly increased in winter season.

INFLUENCE OF BIO-FERTILIZER'S ON QUALITY AND YIELD OF *KHARIF* ONION (*ALLIUM CEPA* L.)

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Abstract

Onion (*Allium cepa* L.) commonly known as 'PYAJ' a member of Amaryllidaceae family is one of the major biennial herb vegetable-cum- condiment, spice plants cultivated in India. The bulbous are of immense medicinal and culinary importance world over. It is an exhaustive crop and requires high soil fertility and applied nutrients for successful growth and yield. The present investigation on *Kharif* onion involving planting method's, organic and bio-fertilizers was carried out at the farmer's field near College of Agriculture, Gwalior (M.P) during the *Kharif* seasons of 2013-14 and 2014-15, with Thirty Six treatment combinations laid in split-split-plot design replicated three times. The main plot treatments consisted three different planting methods viz., flat, furrow and ridge. The sub plot treatments were six organic nutrient sources *viz.,* FYM 12.5 t/ha, FYM 25.0 t/ha, VC 2.1 t/ha, VC 4.2 t/ha, PM 2.1 t/ha and PM 4.2 t/ha. The sub-sub plot treatments were two bio-fertilizers viz., PSB 5 kg/ha and Azospirillum 5 kg/ha. The 45 days old seedlings of onion variety Agrifound Dark Red were transplanted in keeping

30 cm × 15 cm planting geometry. Among the different combinations of organic and bio-fertilizers tried, application of Seedlings inoculated with PSB @ 5 kg/ha gave the highest diameter of bulb (4.435 cm), scales per bulb (5.27) and weight per bulb (65.74 g) and lowest bolting percentage (4.71%) over those inoculated with Azospirillum. The maximum bulb yield of 136.36 q/ha was recorded with PSB inoculated seedlings while seedlings inoculated with Azospirillum gave minimum bulb yield (133.33 q/ha). It is Quality parameter TSS differed significantly due to bio-fertilizers while protein content remained unchanged due to bio-fertilizers. Seedlings inoculation with PSB resulted in significantly highest TSS (12.47%) as compared to seedlings inoculation with Azospirillum (12.31%).

ROLE OF WEATHER PARAMETERS ON POPULATION DYNAMICS OF FRUIT FLY COMPLEX UNDER SOUTH GUJARAT MANGO ECOSYSTEM

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Abstract

The field experiment was conducted during 2016-17 at Agriculture Experimental Station, NAU, Paria, Gujarat (20°26'N, 72°58'E, 10 m at altitude) to study the role of weather parameters on population dynamics of fruit fly complex (*Bactrocera dorsalis*, *B. correcta* and *B. zonata*) on mango, *Mangifera indica* L. Fruit fly complex population was monitored on the basis of total male fruit fly collection during standard meteorological week wise with the help of methyl eugenol impregnated Nauroji-Stonehouse parapheromone trap. Traps were placed at 2-3 meters above the ground level. Fruit flies were recorded throughout the investigation period, wherein maximum catches were observed during April-July which coincided with fruiting and harvesting stages of the crop. The results showed that male population of fruit flies varied from 1.4 to 336.4/trap. Maximum fruit flies population was caught in 25th standard meteorological week (336.4 fruit flies males/trap) followed by 23rd SMW and 24th SMW which associated with ripening stage of mango fruits. The correlation studies showed that male fruit flies (collection/trap/week) catches positively significant with minimum temperature, wind speed ($P<0.01$), evening relative humidity and rainfall ($P<0.05$). Whereas, other weather parameters were showed non-significantly with fruit fly catches. The entire abiotic factor contributed 75.10 per cent variation in fluctuation of fruit flies population.

STUDY OF PATH COEFFICIENT FOR FODDER YIELD IN MUTANT FORAGE SORGHUM (*SORGHUM BICOLOR* L.)

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Abstract

Sorghum is an important crop widely grown for grain and fodder yield with a greater emphasis on fodder particularly in semi arid tracts. Forage sorghum has become very popular among the farmers due to its wide adaption, rapid growth, higher green and dry fodder, ratoonability and tolerance to drought stress. Because, sorghum fodder plays an important role in the health and nutrition of the large population of livestock in the country. Country facing insufficient production of milk mainly due to non-availability of nutritive fodder in adequate quantity for livestock. Hence the milk production in country can be increased by providing nutritive fodder having good quality. To overcome such situation, genetically stable genotypes having high fodder yield potential are urgently needed. Path coefficient analysis is an important technique for partitioning the correlation coefficient in to direct and indirect effect of independent variables on dependent variable. The present field experiment on forage sorghum [*Sorghum bicolor* (L.) Moench] was conducted during summer-2010 at Instructional Farm of Rajasthan College of Agriculture, MPUAT, Udaipur (Rajasthan). The experimental material comprised of 15 mutants obtained through mutation breeding (M_5 generation) by the use of gamma-rays *viz*., SSG 222, SSG 224, SSG 225, SSG 226, SSG 227, SSG 231,

SSG 232, SSG 233, SSG 234, SSG 236, SSG 241, SSG 244, SSG 253, SSG 256 and SSG 263 along with its parent SSG 59-3, popular variety of multicut forage sorghum.

Analysis of variance revealed significant differences among the genotypes for 41 characters out of 71 characters studied at different cuts. In present study, difference between genotypes for green fodder yield per plant per day was not significant at first and second cut therefore path coefficient was computed at third cut only taking nine independent characters. The residual effect (R=0.3375) indicated that about 66 per cent variability of green fodder yield per plant per day could be explained by the characters under consideration. Out of the nine, seven characters i.e. early vigour, plant height, leaf length, stem girth, number of tillers, regeneration and root volume were positively correlated with green fodder yield per plant per day. Out of those, only three traits *viz*., root volume (1.42), stem girth (0.91) and leaf length (0.74) had positive and high direct effects on green fodder yield per plant per day at third cut, indicating importance of these characters and can be strategically used for future to improve the green fodder yield of sorghum.

GENETIC DIVERSITY ANALYSIS AMONG MAINTAINER LINES OF PEARL MILLET [*PENNISETUM GLAUCUM* (L.) R. BR.] BASED ON GRAIN YIELD AND YIELD COMPONENT CHARACTERS

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Abstract

A field experiment was conducted to study genetic diversity among forty eight pearl millet genotypes at Chaudhary Charan Singh Haryana Agricultural University, Hisar using Principal Component Analysis (PCA) and Principal Factor Analysis (PFA). The first five principal components (PCs) having eigen values more than one accounted for 81.02% of the total variability attributable to grain yield. Most important traits in PF1 were 1000 grain weight, green fodder yield/plant, dry fodder yield/plant and grain yield/plant and captured 25.12% of the total variation. PF2 was represented by days to 50% flowering, panicle length, number of productive tillers/plant and plant height and contributed 19.9% of the total variation. PF3 represented panicle length with 13.8% and PF5 represented panicle diameter with 10.1% of the total variation. All genotypes were plotted for PF1 as X-axis and PF2 as Y-axis. Graphical display of genotypes indicated that genotypes HMS 7B, HMS 45B, HMS 49B, HMS 61B, ICMB 97111 were superior for grain yield, number of productive tillers/plant and panicle length.

BIOEFFICACY AND PHYTOTOXICITY OF FLUXAPYROXAD 250 G/L + PYRACLOSTROBIN 250 G/L 500 SC (MERIVON 500 SC) AGAINST POWDERY MILDEW DISEASE OF CUCUMBER

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Abstract

Cucumber (*Cucumis sativus* L.), a popular fresh market vegetable prepared as salads, is cultivated throughout India. The total area under cucumber cultivation in India is reported around 0.071 lakh ha and its production is 0.12 million tonnes with an average productivity of 16.92 tonnes (Anon, 2015-16). The major constraint to cucumber production in India is powdery mildew and caused by *Erysiphe cichoracearum* and *Sphaerotheca fuliginea*, respectively. A powdery mildew infection acts as a sink for plant photosynthates causing reductions in plant growth, premature foliage loss, and consequently a reduction in yield. The yield loss is proportional to the severity of the disease and the length of time that plants have been infected (Mossler and Nesheim 2005). For instance, in cucumber there is a negative linear relationship between disease severity and yield (Dik and Albajes, 1999). Powdery mildew and downy mildew together causes up to 50-70 per cent a loss (Sitterly, 1972 and Awad, 2000). If these diseasesare not controlled in a timely manner, symptoms can be severe enough to cause extensive premature defoliation of older leaves and wipe out the crop. A field experiment was conducted to evaluate the efficacy of Merivon 500 SC (Fluxapyroxad250 g/L + Pyraclostrobin 250 g/L 500 SC) against powdery mildew of cucumber during 2015, at

Konanathale village of Ranebennur taluk. It was found that Fluapyoxad250 g/L + Pyraclostrobin 250 g/L 500 SC@0.005 per cent and 0.006 per cent is highly effective in reducing the powdery mildew disease in cucumber. Further the phytotoxicity was not observed in the chemical Fluxapyroxad250 g/L + Pyraclostrobin 250 g/L 500 SC to the treated plots of cucumber even at high doses (0.1%) and also exhibiting an appreciable increase in cucumber yield.

FUTURE ASPECTS FOR DEFENSE MECHANISM AGAINST CROP PESTS AND DISEASES

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Abstract

The development of plants with resistance to the most damaging pests and diseases is increasingly important in the face of growing pressure to reduce synthetic chemical inputs, including pesticides, fungicides, and herbicides used for crop protection. This reduction is partly underwritten by legislative directives, consumer demands and indeed an overall reduction in available chemical controls for most crops especially those out with the main arable species. Additionally, losses due to pest and disease attacks represent a major financial cost in crop production and throughout the subsequent supply chain, even before the costs of control measures are considered. The move toward more sustainable production systems, based on integrated pest and disease management approaches, is gaining momentum, and the development of more resistant cultivars is a major factor contributing to the success of these systems. In addition, there is a recognized need for frameworks which combine natural enemies with resistant cultivars and other management practices to reduce reliance on crop protection chemicals and maintain viable and sustainable future crop production. The development of resistant cultivars is crucial to the future of sustainable crop production practices, and there is a substantial need for the continued introgression of specific resistance genes or physical and structural traits, from existing or extended genetic resources. Recent advances in knowledge can aid this process, even in many minor crop species, where increased understanding of trait heritability and technological advances in genomics and bioinformatics are enabling the identification of genes controlling resistance, providing a framework for improved selection efficiency. Moreover, the advent of new technologies can provide significant benefits, as exemplified by the opportunities afforded by CRISPR-based tools in understanding plant-pathogen interactions. Integrated Pest and Disease Management (IPDM) approaches to pest and disease control require the development of resistant varieties and also monitoring and management strategies that can be applied effectively within crops. Plant defenses can be exploited to enhance resistance to pest attack and also to confer tolerance of pest infestations. Plant physical defenses can offer particularly durable resistance to pests and pathogens; ecological studies; plant structural traits such as trichomes, spines, and cuticles can provide a physical barrier to arthropod pest attachment, feeding and oviposition, while plant vigor and altered phenology can increase tolerance of pest damage and reduce the incidence of pest attacks.The harmful effects of fungal disease outbreaks in cereal crops could be limited by using mixed genotype plantings; cultivar mixtures often show higher tolerance of, or resistance to, disease. The impact of this approach on other microbial species in the crop environment is also considered. The development of environmentally friendly control mechanisms for pests is a further aspect of future crop production systems, and there are various less damaging ingredients under consideration. These can include the use of plant mutualists or manipulation of soil conditions, for example by application of chemical constituents such as silicon.

EFFECT OF TILLAGE, NUTRITION SOURCES AND WEED CONTROL ON GROWTH, YIELD ATTRIBUTES AND YIELD OF CHICKPEA

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Abstract

A field experiment was conducted during two consecutive seasons of Rabi 2013-14 and 2014-15 at instructional farm of Rajasthan Agricultural Research Institute Durgpura, Jaipur. The eight treatment combinations two each of tillage (Conventional and Reduced tillage) nutritional sources (chemical alone and integrated nutrient management) and weed control (chemical and hand weeding (were tried in Factorial Randomized Block Design with three replications.Result revealed

that conventional tillage significantly improved growth (primary branches, secondary branches/plant and plant height), yield attributes (No. of pods/plant, seed/pod and 100-seed weight) and seed yield of chickpea during both the years. The mean increases in seed yield, net return due to conventional tillage was 28.89 per cent and Rs. 8258/ha compared to reduced tillage. However, the nutritional sources did not attain statistical significance in terms of growth, yield attributes and yield of chickpea. The mean increase in seed yield due to INM was 7.86 per cent over chemical fertilizers alone. Further, among the weed control practices, two hands weeding though improved the growth and yield attributes but could not attain statistical significance except the number of pods/plant and significantly improved seed yield of chickpea. The mean increases in seed yield under two hands weeding were 20.32 percent respectively over chemical weeding.

ACTINOMYCETES : KEY FACTORS FOR SOIL HEALTH MANAGEMENT AND CROP PRODUCTIVITY

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Abstract

The extensive use of agrochemicals has led to deterioration of soil quality due to organic matter losses, alteration in soil pH levels, killing of beneficial microorganisms and residual effects which results in reduction of agricultural productivity. This is one of the most challenging consequences of conventional agricultural practices. Therefore, there is an immense need to replace these agrochemicals with biological agents which represent a better alternative for plant growth promotion and soil health management in ecofriendly manner. Actinomycetes are aerobic, spore forming bacteria with substrate and aerial mycelia and responsible for nutrient recycling by hydrolyzing several polymeric substances such as cellulose, starch, chitin, *etc.*, killing of harmful microorganisms in rhizosphere due to release of various hydrolytic enzymes, restriction of pathogens via siderophore production and competition. Beside these characteristics, actinomycetes are also responsible for production of large amount of secondary metabolites like indole acetic acids (IAA), ammonia, HCN, 1-aminocyclopropane-1-caroxylate (ACC) deaminase *etc.* which directly or indirectly help to improve plant growth and crop productivity. Hence, actinomycetes represent a key component of agricultural ecosystems to manage soil health and crop productivity.

DIGITAL MARKETING : A TOOL TO OVERCOME RURAL ENTREPRENEURSHIP PROBLEMS

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Abstract

India, the fastest growing economy of the world still has more than 65percent of population living in rural areas with heavy dependence in agriculture. They are facing many problems in rural entrepreneurship such as lack of education, economic problem, infrastructural problem, lack of access to markets, lack of basic amenities, insufficient technical and conceptual ability and so on and this has made it difficult for the entrepreneurs to establish markets in rural areas. Digital marketing holds the potential to overcome most of the problems faced by the entrepreneurs. This paper will review the role that digital marketing has been playing to remove all the obstacles faced by SMEs.

SPATIAL DISTRIBUTION PATTERN OF BEAN BUG *CHAULIOPS FALLAX* SWEET AND SCHAEFFER (HEMIPTERA : MALCIDAE) IN PULSES UNDER MID HILLS OF HIMACHAL PRADESH

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Abstract

The bean bug *Chauliops fallax* feeds exclusively on all leguminous crops in most regions of the world. The population density and spatial distribution of bean bug has been investigated on three different host plant *i.e.* soybean, cowpea and black gram (mash) under mid hill conditions of Himachal Pradesh during 2016. The fields of 600m^2 and 300m^2 area were selected as a sampling unit for sampling in soybean, cowpea and black gram. Him Palam Hara Soya -1, C-475 and Pant U19 genotypes of soybean, cowpea and mash were selected for the estimation of density and distribution of the bean bug. Different methods *viz.,* Morisita's index, Index of dispersion and Lewis index were used to calculate the density and distribution of the population of the pest. The mean population of bugs per plant was recorded on soybean (7.25) followed by cowpea (3.01) and black gram (1.21). Studies on knowing the distribution pattern of bean bug population under field conditions revealed that in soybean the distribution of bug was contagious (2.99) while in cowpea (2.44) and black gram (1.87) regular and contagious distribution pattern was found. The Z value of Morisita's index in case of soybean was 9.98 followed by 5.87 and 3.50 in case of cowpea and black gram. Similar trend was found in case of Index of dispersion and Lewis index. Optimum sample sizes for estimates of the pest density in all the three host plants are presented.

PRODUCTION CONSTRAINTS AND WAYS TO IMPROVE YIELD IN WHEAT

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Abstract

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops of the world (674 mt production) and it is grown across different agro climatic conditions. Being a staple food crop it occupies one-sixth of the world total arable land area (216 m ha). Diversified climatic condition prevailing in the country are conducive for cultivation of all three type of wheat [bread (95%), durum (4%) and dicoccum (1%)]. India is the second largest producer of wheat after China. In India, it is grown on an area of 29.9 m ha with an annual production of 95 m t with a productivity of 3172 kg ha^{-1}. Late sowing because of excessive soil moisture after rice harvest, shorter wheat growing season because of short span of winter leading to incidence of high temperature during flowering and grain maturity, low mechanization, imbalanced nutrient use, poor land leveling, use of low productivity varieties, disease incidence at epidemic level, deficiency of zinc and nitrogen, aggressive growth of weeds and post harvest losses have been identified as the major production constraints. Some of the strategies to improve the yield are selection of improved varieties (*viz.* DWR-195, UAS-415, HD-2189 for Karnataka), seed treatment with cow urine, early sowing, method of planting, adoption of moisture conservation techniques, integrated nutrient management and irrigation management etc. Climate and soil seems to be the major production constraints of wheat in India. In this topic review we are conclude that In case of planting system 3 wheat rows per bed gave higher yield, row spacing of 22.5 cm gave higher grain yield, Application of 100 per cent RDF along with vermi compost (1 t ha^{-1}) + phosphate solubilizing bacteria (PSB) recorded higher grain yield and biological yield followed by 75 per cent RDF + vermi compost + PSB and Integrated use of organic and chemical fertilizers is beneficial in improving crop yield.

EFFECT OF FOLIAR SPRAYS OF UREA, POTASSIUM SULPHATE AND ZINC SULPHATE ON YIELD AND ECONOMICS OF GUAVA CV. TAIWAN PINK

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Abstract

The present experiment was laid out in randomised block design to know the effect of pre harvest foliar sprays of urea (T1-2%, T2-3% and T3-4%), potassium sulphate (T4-1%, T5-2% and T6-3%) zinc sulphate (T7-0.2%, T8-0.4% and T9-0.6%) and water (T10-control) on economics of guava cv. Taiwan Pink. The experiment was carried out at Farmer's field at Manchili village near Athili with the support of Department of Post Harvest Technology at College of Horticulture, Dr.Y.S.R. Horticultural University, Venkataramannagudem, West Godavari District of Andhra Pradesh during 2016-2017. The treatments were replicated thrice and were imposed at two stages viz., first spray after the emergence of first flush after

pruning and second spray at 15 days after first spray. The highest number of flowers per shoot (7.20), number of fruits per shoot (3.82), fruit yield per tree (16.20 kg/tree) and fruit yield per ha (7.94 tons/ha), gross returns (? 317600), net returns (? 2334005), benefit cost ratio (3.80) was recorded in T_3 (plants sprayed with urea @ 3.0 %) followed by T_4 (plants sprayed with urea @ 4.0 %).

ROLE OF POLYAMINES AS AN EARLY MARKER FOR ASSESSING ROOTING ABILITY IN FRUIT CROPS

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Abstract

Polyamines (PAs) widely present in living organisms are now regarded as a new class of growth substances. This includes spermidine (Spd - a triamine), spermine (Spm - a tetramine) and their obligate precursor putrescine (Put - a diamine), plays a vital role in regulation of plant development and physiological processes, which affecting cell division. Explants treated with auxin there was increase in polyamines concentration, especially before root emergence. The relationship between auxin-induced root formation, polyamine concentration, polyamine synthesis inhibitors and ethylene is yet unclear. Although in most of the species, exogenous treatment with PAs does not affect rooting, but PAs increased rooting in olive and hazelnut. Studies showed that exogenous treatment with H_2O_2, a product of PA's catabolism such as PUT, increases rooting percentage and promote earlier rooting. It was suggested that the role of PAs in rooting by the H_2O_2 was to increase the peroxidase activity and they could be used as an early marker for rooting ability.

MODELING AND ARCHITECTURAL ANALYSIS AS BASES FOR FRUIT CROPS MANAGEMENT

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Abstract

Canopy architectural models have considered mainly empirical laws to stimulate 3D development of structure. By simulating a group of plants, the models can integrate plant and environmental processes from organ to canopy level. They provide a framework to understand the growth of individual plants affected by the microenvironments of temperature and humidity by accounting for these variables at different locations in the canopy. The aim of architectural (or morphologenetic) modelling is to produce models that accurately reflect botanical structure and development in both space and time. Large quantities of data are required for architectural modelling and incorporation of plant growth and development in them. Uses of plant architectural models are similar to those of crop models, but at a greater level of resolution as they operate at individual plant level. Architectural models will be used to investigate aspects of plant production and management that involve details of the vertical and horizontal characteristics of the canopy. A major benefit will be in increased understanding of processes at this level, leading to better parameterisation of crop models.

FOREST AREA CONSERVATION AND ENVIORNMENT AWARENESS

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Abstract

Forest as a important renewable natural resource, playing a major role in country's ecological stability and economic

development. Current national forest policy 1988 in India aims at maintaining a minimum of 33% of country's geographical area under forest and tree cover and now 24.16% forest area in India. Conservation is the proper management of natural resources to prevent its exploitation, destruction or degradation. India is blessed with natural resources but these resources from our research study on the usage of natural resources are depleting every day. As we know nature provides all the basic needs which are necessary to us but we are over exploiting or over using these resources. Forest conservation is the practice of planting and maintaining forest areas for the benefits sustainability of future generations. The conservation of forest also stands aims at a quick shift in the composition of trees and species, age, management objectives, ownership, growing stock and other distribution. Forest are vital for human life because they provide a diverse range of resource. Trees are store carbon and act as carbon sink, produce oxygen which is vital for existence of life on the earth. Trees are truly called as earth life, lung help in regulating hydrological cycle, purify water, air and environment, provide life habitat, reduced global warming, absorb harmful gases, noise and sun rays, reduce pollutions, soil erosion, conserve soil mitigation natural hazards such as floods, landslides and other natural hazards. But in these days forest cover is depleting rapidly due to many reason such as an expansion of agriculture, timber plantation, other land uses like pulp and paper plantation, urbanization, construction of roads, industries, constitutes the biggest and severe threat to the forest causing serious environmental damage. Thus there is need of public awareness. Conservation of natural resources has acquired great attention at present. It is high time that man must realize of the grave consequences of his action which are damaging the environment beyond repair. If we continue exploit the nature, there will be no more natural resources available in the future. So, there is an urgent need to conserve the nature for future. Society participation in the conservation of natural resources is vital importance. If individual does his or her duty to perfection, the whole world can become less pollution free and we can conserve our natural resources. It is the duty of us to spread awareness among the society in this regard.

TRANSGENIC TECHNOLOGIES AND ITS USES IN CROP IMPROVEMENT

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Abstract

Transgene is a foreign gene or genetic material that has been transferred naturally or any of number of genetic engineering techniques from one organism to another i.e. trangenesis. Transgenic plants whose genome is altered by adding one or more transgenes are known as transgenic plants through various gene transfer methods, biological methods, agrobacterium mediated gene transfer, plant virus vectors, physical methods, electrophoration, microprojectiles, microinjection, liposome fusion chemical and polyethylene glycol mediated methods. 1st transgenic plant produced which is an antibiotic resistance tobacco plant. 1st genetically modified crop approved for sale in USA was flavrsavr tomato plants. 1st pesticides producing crop, Bt potato was approved by USA environmental protection agency. 1st genetically modified flower moondust, bluish colored carnation. Golden rice with â- carotene developed with increased nutrient and others approaches transgenic plants for nutritional quality, herbicides resistance, insecticide resistance; abiotic stress tolerance enhanced self-life and industrial products pharmaceuticals and vaccines.

ADVANCED GENETIC TECHNOLOGIES AND ITS IMPLICATION IN CROP IMPROVEMENT

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Abstract

Genetic engineering, also called genetic modification or genetic manipulation, is the direct manipulation of an organism's genes using biotechnology. The ability of genetically modified organisms is built on years of research and discovery on how genes function and how we can manipulate them.Important advances included the discovery of restriction enzymes, DNA ligases, polymerase chain reaction, DNA sequencing, Blotting techniques, Gene addition and RNA interference etc. It is a set of technologies used to change the genetic makeup of cells by genes of desirable characters are taken from a plant, bacteria, animal and transferred to another plant by the technique of hybridization, including the transfer of

genes within and across species boundaries to produce improved or novel organisms. Thus helps in obtaining desirable agronomic characters liked Dwarfness in cereals and tallness and profuse branching in fodder crops, Longer Shelf Life (flavr svar tomato), boost nutrition (golden rice), Insect resistance (Bt cotton). In order to reduce the breeding development period the use of biotechnology or genetic engineering has rapidly been adopted at global level.

NUTRIENT UPTAKE, QUALITY AND ECONOMICS OF SESAME (*SESAMUMINDICUML*.)AS RESPONSE OF VARIETIES TO VARYING LEVELS OF SULPHUR FERTILIZATION

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Abstract

A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif,* 2015 on loamy sand soil. The experiment comprising of four levels of sulphur (0, 20, 40 and 60 kg/ha) and four sesame varieties (RT-125, RT-127, RT-346 and RT-351) thereby making 16 treatment combinations was laid out in randomized block design and replicated thrice. Results revealed that N,P and S concentration in seed and stalk, their uptake ,proteinandoilcontentinseed and oil yield were improvedsignificantlyupto40kgS/ha. Being at par with 60 kg/ha, sulphur fertilization at 40 kg/ha also fetched 12.7 and 64.2 per cent more net returns over 20 kg/ha and control, respectively. The maximum sulphur use efficiency was recorded when its level was raised from 0 to 20 kg/ha.

It is further apparent from the data that N and P concentration in seed and stalk of sesame was not influenced significantly due to different varieties while S concentration in seed is significantly higher in RT-351 than the other varieties. It also represented significant improvement is nutrient uptake, oil contentin seed and oil yield and fetched the maximum net returns of 52073/ha with the highest B: C ratio (2.74) among all the varieties. Application of sulphur at 49.19 kg/ha was found as the optimum dose for sesame as derived from response function.

INTEGRATED MANAGEMENT AND HOST PLANT RESISTANCE AGAINST DRY ROOT ROT [*MACROPHOMINA PHASEOLINA* (TASSI.) GOID] OF CHICKPEA

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Abstract

The present experiment was planned integrated management of root rot pathogen in chickpea. Occurrence of root rot disease has become a major constraint in recent years for successful and profitable cultivation of chickpea. The efficacy of Bio-agent *viz. Tricoderma viride*, Organic amendment *viz.* neem cake, Plant extract, garlic, and Fungicide, Carbendanzim applied through seed treatment and soil application were evaluated against *Macrophomina phaseolina* causing root rot disease of Chickpea. Different alternative combination of most effective treatments that tested in pot conditions for controlling root rot of chickpea exhibited. Among the treatments soil application with neem cake @ 25g/ pot+ seed treatment with carbendazim @ 2g/kg seed (16.66 and 20.00%) followed by seed treatment with *Trichoderma viride* @ 4 g/kg seed + carbendazim @ 2 g/kg seed (20.00 and 20.83%) found most effective to reducing root rot incidence over control at 40 and 60 days after sowing respectively. Twenty –nine cultivars/ germplasms tested against dry root rot of chickpea in which none of cultivars found resistant. Entries H12-24, GNG 1958, IPC 2002-31, GNG 2299, IPC 10- 134, PG 0104, IPCK 2009 -165, GL 2003, H 12-26, IPC 2007-28, CSJ 515 and BG 0109 were found moderately resistance.

WITH CHANGING CLIMATE NEED OF DRIP FERTIGATION AND ITS EFFECTS ON YIELD OF POTATO (*SOLANUM TUBEROSUM* L.)

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Abstract

Potato (*Solanum tuberosum* L.) is the most widely used vegetable crop. It is an important temperate crop which has been adopted well for cultivation under sub-tropical conditions. Irrigation and nutrients are important to enhance the productivity.Water and nutrients were the most important limiting factors for potato production which can be increased by well scheduled fertilizers application with irrigation *i.e.,* fertigation during its growing season. Water and nutrients application through drip/micro-irrigation are made directly to the plant root zone and no applications are made between rows or other non-productive areas, resulting in better weed control, disease control and significant water savings (>50%). Therefore, the present study was undertaken at Vegetable Research Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar. The experiment consist of seven treatments viz., T_1 (120% of the recommended dose of fertilizer i.e. RDF), T_2 (100% of RDF), T_3 (80% of RDF), T_4 (60% of RDF), T_5 (40% of RDF), T_6 (absolute control), T_7 (RDF) and the fertilizers are applied at three different schedules. Among different growth parameters plant height, number of haulms per hill, fresh and dry weight of plants after de-haulming and among quality parameters dry matter content, protein content, specific gravity of tubers and total tuber yield per hectare found significant at different growth stages of crop period.

ARTIFICIAL INTELLIGENCE : PARADIGM SHIFT IN AGRICULTURE FROM TRADITIONAL TO DIGITAL

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Abstract

Use of latest technological solutions to make farming more efficient, remains one of the greatest imperatives. Given the huge potential of agriculture in India, advanced technology is used to maximize the returns to the farmers and consumers. With recent advancements in technology coupled with conducive government policies, Artificial Intelligence (AI) is boosting the research as well as developments in Agriculture in terms of agricultural products and in-field farming techniques. While AI sees a lot of direct application across sectors, it can also bring a paradigm shift in today's farming. AI comes as a great boon to the agricultural sector though it is heavily dependent on unpredictable climatic conditions. Proximity Sensing and Remote Sensing are two technologies helps in soil characterization in a particular place. Drone-based images can help in in-depth field analysis, crop monitoring, scanning of fields as well. Drone-based solutions in agriculture have a lot of significance in terms of managing adverse weather conditions, crop monitoring, productivity gains, precision farming and yield management. AI in disease diagnosis and detection via leaf image processing ensure the pest identification, nutrient deficiency recognition and more. Images of different crops under white/UV-A light are captured to determine how ripe the green fruits are and crop readiness. Using high-definition images from drone or copters, real-time estimates can be made during cultivation period by creating a field map and identifying areas where crops require water, fertilizer or pesticides. This helps in resource optimization to a huge extent. Based on multiple parameters like soil condition, weather forecast, type of seeds, infestation in a certain area, cognitive solutions make recommendations to farmers on the best choice of crops and hybrid seeds. The recommendation can be further personalized based on the farm's requirement, local conditions, and data about successful farming in the past. External factors like marketplace trends, prices or consumer needs may also be factored into enable farmers take a well-informed decision. Remote sensing techniques along with hyper spectral imaging and 3D laser scanning are essential to build crop metrics across thousands of acres. It has the potential to bring in a revolutionary change in terms of how farmlands are monitored by farmers both from time and effort perspective. This technology will also be used to monitor crops along their entire lifecycle including report generation in case of anomalies. AI in irrigation, automation can help farmers better manage their water problems and saves global water resources. The future of farming depends largely on adoption of cognitive solutions and AI-powered solutions will not only enable farmers to do more with less, it will also improve quality and ensure faster go-to-market for crops.

EFFECT OF NUTRIENT MANAGEMENT ON AVAILABLE MACRO AND MICRONUTRIENT IN CHAMBAL REGION OF MADHYA PRADESH

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Abstract

A field experiment was conducted for two consecutive *rabi* seasons (2013-14 and 2014-15) on degraded sandy clay loam soil to evaluate the effect of integrated and chemical fertilizers on wheat *(Triticum aestivum* L.) at Aisah village (Ambah, district Morena) on Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya farm situated in the ravines of Chambal river. The crop cultivar MP-1203 of wheat was grown with 120:60:60 kg ha^{-1} (NPK) recommended dose of fertilizers under nutrient management practices viz., seven treatments Farmer Practices (T_1), 100% RDF (T_2), 150% RDF (T_3), STCR Based NPK Application (T_4), 50% RDF+5 tone FYM + PSB+ all deficient Micro Nutrient (T_5), 75% RDF+2.5 ton FYM/ha+ PSB+ $ZnSO_4$@ 25 kg ha^{-1} (T_6), Organics Practices FYM @10tone ha^{-1}+PSB+Azotobactor (T_7), in randomized block design, replicated three times. The maximum grain and straw yield (3984.45 kg ha^{-1} and 4454.27 kg ha^{-1}) was also noted in T_6 (75% RDF+2.5 ton FYM/ha+ PSB+ $ZnSO_4$@ 25 kg ha^{-1}), which was statistically at par with T_3 and significantly higher over rest of the remaining treatments. The minimum grain and straw yield (1914.66 and 2244.56 kg ha^{-1}) was observed in farmer practices. Significantly higher values of total soil-N (%), total soil-P (%) and total soil-K (%) content in the treatment of 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6), while lowest was noted from treatment T_1. The Available soil - N (kg ha^{-1}), Available Soil - P (kg ha^{-1}) and available-K (kg ha^{-1}) was recorded under application of 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6) in during both the years and pooled basis. The Maximum Zn (Mg kg^{-1}), Cu (Mg kg^{-1}), Fe (Mg kg^{-1}), Mn (Mg kg^{-1}) and Sulpher (Mg kg^{-1}), was registered with treatment 75% RDF+2.5 ton FYM ha^{-1}+PSB+$ZnSO_4$@ 25 kg ha^{-1} (T_6), while lowest was noted from treatment T_1 during both the years, in 2013–14, 2014–15 and Pooled basis, respectively.

EVALUATION OF GENOMIC AND EPIGENETIC FLUXES UPON INDUCED SALT STRESS IN *LUFFA ACUTANGULA* VARIETY

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Abstract

Salinity, a major abiotic stress, limits growth and productivity of crops throughout the world. Comprehension of the mechanism underlying plant response to salinity provides new insights into the improvement of salt tolerance-crops of importance. RAPD analysis used in conjunction restriction enzymes act as powerful tools for gauging temporary DNA changes, like methylation / demethylation, which may or may not manifest themselves as mutations in crops. In the present study, we report on the responses of a hybrid cultivar of *Luffa acutangula* (Jaipuri long) under induced salinity stress. An assortment of both hypomethylation and *de –novo* methylation was scored at epigenomic level at several *loci* of Jaipuri long at different salt concentration (0-200 mM NaCl). The extent of DNA damage induced with oxidative stress of NaCl was evaluated from RAPD profile employing qualitative measure Genomic Template Stability (GTS) and multiple changes in RAPD profiles (e.g. appearance of new bands, disappearance of bands in control or treated samples). GTS appeared to be destabilized with increase in NaCl concentration, with maximum at 100 mM of NaCl (30.77%). The disappeared bands were observed to be compensated by low/ high frequency newly appeared bands at 50mM or 100mM of NaCl, with an approximate molecular length in range of 400bp-700bp. Furthermore GTS is related to the level of DNA damage and the efficiency of DNA repair and replication, the results obtained herein revealed that at 50 or 100 mM of NaCl, DNA replication was radically reduced. This was observed probably due to higher level of DNA damage or changes in methylation patterns. Also it can be assumed that epigenomic damages were repaired to some extent, which might have lead to partial DNA replication and/ or partial-methylation (hypo /hyper). The extent of DNA damage and methylation scored at both genomic and epigenomic levels of *Luffa acutangula* by NaCl induced oxidative stress, in present research study thus reveal facultative *loci* which may be useful for risk appraisal of environmental contamination and remediation.

MOLECULAR FINGERPRINTING AND PHYLOGENY ANALYSIS AMONG *LUFFA ACUTANGULA* SPP. FROM INDIA EMPLOYING MLSPAP MARKER

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Abstract

With incessant transacting climatic environments around the globe, inhabitants of the Earth keep acclimatizing to the changing surroundings in order to survive. With these escalating changes there is a consequential upsurge in allelic frequencies and mutations may ensue. These deviances may be inherited by the species and passed on further to future generations provided it subsist the process of natural selection. With advancements in the field of molecular genetics it is easier to study these allelic changes using varied advanced tools. The current research endeavours to gauge the divergence at intra-varietal/ species level of *Luffa acutangula,* a member of *Cucurbitaceae*. Multi *loci* single primed amplicon band (MLSPAP) marker were used to generate a RAPD fingerprint of each of the varieties. A total of 20 random 10-mer primers were screened against 36 Indian varieties out of which 9 primers that generated discernible and reproducible bands were selected for further amplification. A total of 136 reproducible bands were generated with 9 primers across 36 individuals. Out of these 93 were polymorphic bands. The bands ranged in size from 106bp-900bp. Number of amplicons per primer ranged from 10(R1, R5)-17(R10, R12, VS3) with an average of 15.1(approx.) amplicons per primer. The percentage polymorphism ranged from 50% (R1)-76.92 %(R19). The distribution of varieties into different clades and genetic distances between them was evaluated using Jaccard's similarity coefficient. The molecular weight of the amplicons was calculated using ALPHAaes software. The kinship amongst the genotypes was also evaluated by calculating Diversity Index. A close genetic kinship among all the hybrid varieties and homozygous parental varieties in two distinct clades were discerned from the UPGMA phylogram generated using NTSYSpc programme. Also some genovars were recorded to be clubbed on basis of their geographical location as a unique clade ($p < 0.01$). Thus present study attempts to lay a preliminary platform for Plant Biotechnologist / Breeders for formulation of sustainable vegetable crops with elite genotypes.

A STUDY ON SOCIO-ECONOMICAL PROFILE AND DAILY ACTIVITY PATTERN AMONG GERIATRIC POPULATION OFSIRSA DISTRICT OF HARYANA

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Abstract

Aging is multi-dimensional change involving the physical, psychological as well as social aspects for an individual. It can be described as a progressive deterioration of the physical and mental functions resulting in decline in both the capacity of body to maintain homeostatic balance as well as the adaptation of the individual of various stressors thereby increasing the chances of morbidity and mortality. A sample of three hundred respondents out of which 150 were from urban and 150 from rural area, aged above60 years and above was selected randomly. The data regarding socio-demographic profile, anthropometric measurements, food habits, dietary pattern, physical activity and morbidity pattern was collected through valid questionnaire schedule. Majority of them were living with family (94.00%) and illiterate (49.00%). Private hospitals are major service provider among health facilities availed by elderly. Daily activity pattern of elderly showed that 9.67 per cent elderly work for 6 to 8 hours and 17 percent elderly work for 4 to 6 hours. Maximum number of respondents works for 1 to 2 hours followed by activity for 2 to 4 hours. Daily activity includes household work, animal husbandry, agricultural work and occupational activity. Elderly people have below average level of physical activity pattern. This daily activity pattern represents their physical strength involved in any kind of work or activity.

STUDIES ON EFFICACY OF PRE-MIX PENOXSULAM + PENDIMETHALIN ON ECONOMICS OF DIRECT SEEDED RICE

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Abstract

The present investigation entitled "Sudies on efficacy of pre-mix penoxsulam + pendimethalin on weed growth, yield and economics of direct seeded rice" was carried out at Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur during kharif season of 2015. The soil of experimental field was sandy loam in texture (Inceptisols), neutral in pH and

has 0.44 % organic carban, low nitrogen, medium phosphorus and high potassium content. Experiment was laid out in Randomized Block Design (RBD) with three replications. The treatments consisted of fourteen different weed management treatments viz, T1 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 20 + 480 g a.i. ha^{-1}, T_2 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 22.5 + 540 g a.i. ha^{-1}, T_3 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 25 + 600 g a.i. ha^{-1}, T_4 Penoxsulam + Treatment Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) fetched the maximum net return (Rs 46914.13 ha?^{1}) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5) (Rs 45753.13 ha?^{1}) and Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) (Rs 43905.13 ha^{-1}). While, the highest B:C ratio (2.05) was noted under the application of Penoxsulam 24% SC @ 25 g a.i. ha?^{1} (T8) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) (2.00) and Hand weeding at 20 & 35 DAS (T_{13}) (1.57). (10+240 g/l) SE @ 50 + 1200 g a.i. ha?^{1}, T5 Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1}, T_6 Penoxsulam 24% SC 20 g a.i. ha^{-1}, T_7 Penoxsulam 24% SC @ 22.5 g a.i. ha?^{1}, T8 Penoxsulam 24% SC @ 25 g a.i. ha^{-1}, T_9 Pendimethalin 30% EC @ 540 g a.i. ha^{-1}, T_{10} Pendimethalin 30% EC @ 600 g a.i. ha^{-1}, T_{11} Pendimethalin 30% EC @ 1000 g a.i. ha^{-1}, T_{12} Pendimethalin 30% EC @ 1500 g a.i. ha^{-1}, T_{13} hand weeding at 20 and 35 DAS and T_{14} untreated check. Rice The rice variety MTU-1010 was tested under different combinations of herbicide and maintining the recommended nutrient (N:P:K) doses of 100:50:30 kg ha^{-1}. Rice seed was direct seeded on June 27th, 2015 with a spacing of 20 x 10 cm and harvesting was done on October 29th, 2015.

Treatment Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) fetched the maximum net return (Rs 46914.13 ha^{-1}) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 100 + 2400 g a.i. ha^{-1} (T_5) (Rs 45753.13 ha^{-1}) and Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) (Rs 43905.13 ha?^{1}). While, the highest B:C ratio (2.05) was noted under the application of Penoxsulam 24% SC @ 25 g a.i. ha^{-1} (T_8) followed by Penoxsulam + Pendimethalin (10+240 g/l) SE @ 50 + 1200 g a.i. ha^{-1} (T_4) (2.00) and Hand weeding at 20 & 35 DAS (T_{13}) (1.57).

YELLOW MAGIC TRAP : A NOVEL TECHNIQUE FOR MANAGEMENT OF SUCKING PESTS IN VEGETABLES

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Abstract

Vegetable, the cheapest and nutrient – rich food sources within the economic reach of poor man, play a vital role in human diet since they provide carbohydrate, protein, fat, minerals, vitamins, fibers and phtyo-chemicals, which are essential for making the body immune system strong. Vegetables and spices, besides having medicinal values also play an important role in nutritional security and national economy of country since they are quick growing and short duration, and their yield per unit area per unit time is 5-10 times higher than the cereal crops. Different types of vegetable and spices *i.e*. chilli, okra, cucurbits, tomato, onion, garlic, coriander and fennel were sown under jurisdiction of KVK, Ratlam (M.P.) in two consecutive years of 2014-15 and 2015-16. These crops suffers low production and quality due to heavy infestation of different types of sucking pests *i.e.* jassids, leaf hoppers, whitefly, mites, aphids, thrips and leaf miner in fields. These pests are the most common and destructive in nature. Sometimes the losses in terms of yield due to the attack of these pests have been estimated 30 to 45% depending upon the time of infection and age of the plants. The overall seed production including viability is also hampered because of sucking pests and a major role of as a vector in virus diseases transmission (yellow mosaic disease, mosaic disease, leaf curl and leaf roll etc.) in different crops.

Small flying sucking pests are attracted by the unique yellow colour, so a trial was conducted as a OFT and FLDs used a yellow colour plastic sun pack sheet of 1x1 feet and 2mm thickness and stick to the non dying burned lubricating engine oil which are collected from after servicing of agricultural farm machinery (tractor or bike etc.) coating the trap by brushes. Peel off the protective coating from the magic sheet and hang 30-45 cm above the plants canopy with the help of stick and thread. Preferably they should be placed facing East-West direction. Continuous monitoring and the data were collected after weekly to weekly. The percentage of infestation of sucking pests in different crops was decreased 18 to 32% and also decreased insect vector transmitted diseases in crops 20 to 35% and yield of fruits/plant was increased up to 14.35 to 28.10 %. Best results will be achieved if traps are introduced early in the season, before the pest is established. This trap was non poisonous, environmentally safe and incorporated as a novel tool of IPM/IDM for management of sucking pests in vegetables.

Key words: Yellow magic trap, sucking pest, vegetables, IPM

EFFECT OF PRE-SOWING TREATMENTS ON SEED GERMINATION OF GUAVA (*PSIDIUM GUAJAVA* L.)

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Abstract

Guava is an important fruit crop of the world. It is available throughout the year except during summer. Objective of the trial is to get healthy seedling rootstocks with highest survival percentage in minimum possible time. An experiment was conducted to study the effect of pre-sowing treatments on seed germination of guava (*Psidium guajava* L.) and to get healthy seedling rootstocks with highest survival percentage in minimum possible time. 12 treatments *viz*. seeds soaked in tap water for 24 hours (T_1), seeds soaked in tap water for 48 hours (T_2), scraping of seed coat with sand paper (T_3), scraping of seed coat with sand paper + seeds soaked in GA_3 50 ppm for 24 hours (T_4), scraping of seed coat with sand paper + seeds soaked in GA_3 100 ppm for 24 hours (T_5), seeds soaked in 5% hydrochloric acid for 2 minutes (T_6), seeds soaked in 10% hydrochloric acid for 2 minutes (T_7), seeds soaked in 5% sulphuric acid for 2 minutes (T_8), seeds soaked in 10% sulphuric acid for 2 minutes (T_9), seeds soaked in 0.1 % potassium hydroxide for 2 minutes (T_{10}), seeds soaked in 0.2 % potassium hydroxide for 2 minutes (T_{11}) and control (T_{12}) were evaluated under two conditions *viz*., open field (E_1) and low cost polyhouse (E_2). Seeds scarified with 10% hydrochloric acid for 2 minutes were found to be the best one with very high seed germination percentage (54.16%), seed vigour index (196.48), survival percentage of seedlings (93.59%) and takes minimum time to obtain mean germination (24.95 days). Scraping of seed coat with sand paper + seeds soaked in GA_3 at 50 ppm for 24 hours resulted in the maximum relative elongation rate (0.088 cm) of seedlings. All the germination parameters were found best in protected environment (polyhouse) as compared to open field conditions. Sowing of seeds without pre-sowing treatment showed poor germination (23.50%) and survival percentage (74.30%).

ROLE OF PLASTICULTURE IN HORTICULTURE

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Abstract

India supports nearly 16% of world's population with 2.4% land resource and 4% water resource and just now the decreasing quality and the inconsistancy of the availability of these resources are raising serious questions on the sustainability of the agricultural practice. This problem avoid by new technology plasticulture. Plasticulture represents use of applications of plastics in Agriculture, Horticulture, Water management & related areas. Plasticulture applications offer a more benefits and are considered most important indirect agricultural inputs which results moisture conservation, water saving, reduction in fertilizer consumption, helps in precise application of water & nutrients, controlled environment agriculture is economically viable, plant protection through the use of nets and use of innovative packaging solutions help in increasing shelf-life and during collection, storage & transportation of fruits and vegetables. Plastic use in different operation drip irrigation, green house,nurseries,roof top gardening,off season cultivaton,mulching,micro irrigation, propagation, packaging etc. depend heavily on lastics.

EFFECT OF PLANT GROWTH REGULATORS ON YIELD AND QUALITY OF BERSEEM SEED

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Abstract

The field experiment entitled "Effect of plant growth regulators on yield and quality of berseem seed" was conducted at Forage Research Farm, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana during *Rabi* 2013-14. The soil of experimental field was Loamy sand in texture, low in organic carbon (0.32 per cent) and available N

(253.9 kg ha^{-1}), medium in available P (21.1 kg ha^{-1}) and high in K (332 kg ha^{-1}) with a pH of 7.6. The experiment consisted of ten treatments viz., T_1 Gibberellic acid - 75 µg ml^{-1} - one spray, T_2 Gibberellic acid - 75 µg ml^{-1} - two spray, T_3 Cytokinin - 50 µg ml^{-1} - one spray, T_4 Cytokinin - 50 µg ml^{-1} - two spray, T_5 Salicylic acid - 75 µg ml^{-1} - one spray, T_6 Salicylic acid - 75 µg ml^{-1} - two spray, T_7 Naphthalene acetic acid - 50 µg ml^{-1} - one spray, T_8 Naphthalene acetic acid - 50 µg ml^{-1} - two spray, T_9 Water spray, T_{10} Control conducted in a randomized complete block design with three replications. The application of one foliar spray of plant growth regulators was applied at flower initiation stage and second spray one week later the first spray. The investigation revealed that the application of foliar spray of plant growth regulators at flower initiation stage is known to induce more flowering and increase the seed production. Among the growth regulators, the application of one foliar spray of salicylic acid @ 75 µg ml^{-1} at flower initiation stage recorded maximum tillers per square metre, heads per square metre, seeds per head, 1000- seed weight, seed yield and seed quality i.e germination per cent, root + shoot length and seedling vigor index which were significantly higher than other treatments. It significantly improved the seedling vigor index by increasing germination count and moisture content of the seed. The application of 75 µg ml^{-1} salicylic acid @ was also economical.

RESPONSE OF CULTIVARS, DIFFERENT SPACING AND TIME OF FERTIGATION ON PARTHENOCARPIC CUCUMBER (*CUCUMIS SATIVUS L.*) UNDER NATURALLY VENTILATED POLYHOUSE CONDITION

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Abstract

An investigation was conducted on two consecutive years during 2016-17 & 2017-18 to study the response of cultivars, different spacing and time of fertigation on parthenocarpic cucumber (*Cucumis sativus* L.) under naturally ventilated polyhouse condition at Krishi Vigyan Kendra, Raisen (M.P). The whole experiment was arranged 12 treatments consisting of three cultivars V_1-Kafka, V_2 - Kian and V_3 -Hilton along with two levels of spacing S_1- 50 × 30 cm, S_2 – 50 x 50 cm and 2 levels of fertigation F_1 -once in a week, F_2- once in a 10th days interval (recommended dose of N P K-8:3.5:9 kg/500m^2.The experiment was laid out in factorial completely randomized design with three replications. The results showed that all vegetative characters under study were significantly influenced by various cultivars along with levels of spacing and time of fertigation. The effects of cultivars, spacing and time of fertigation were significant for most of vegetative characteristics except weight fruit[1]. The variety Kafka was found to be significantly superior in respect of yield and yield attributing traits having maximum values of 2.78 kg and 14.92 kg yield per vine and per square meter, respectively. The characters like vine length, intermodal distance, leaf area, days to flower bud initiation, fruit set (%), fruit drop (%), no. of fruit per vine, fruit length, fruit width, yield per vine and yield per m^2 were significantly influenced by interaction effect of variety, spacing and time of fertigation. The treatment of $V_1S_1F_1$ registered significantly highest vegetative and yield attributing characters. However, treatment combination of $V_3S_2F_2$ registered lowest yield per vine and per square meter (1.43 & 5.73kg, respectively).

EFFECT OF DIFFERENT MULCH ON GROWTH AND YIELD OF TURMERIC (CURCUMA LONGA L.) ON DRIP IRRIGATION

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Abstract

Field experiments were conducted on the Medium & shallow Black Soils at KVK, Raisen, Madhya Pradesh during 2015-2017 to determine the effect of different mulches on vegetative growth and yield of Turmeric on drip irrigation. The research trials for the consecutive two years showed that plastic mulch (T1) resulted maximum plant height, No. of suckers/ plant, Length of leaves, Width of leaves, Days to maturity, No. of rhizome/ plant, Length of rhizome, Diameter of rhizome, Rhizome yield

/plant, Rhizome yield/ha. The highest yield was observed under the treatment-1 plastic mulch 28% increase in yield as compared to without mulch (248.2 Q ha-1).

POPULATION DYNAMICS OF MAJOR PESTS IN *BT* AND NON *BT* COTTON

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Abstract

The performance of *Bt* cotton hybrid with *Bacillus thuriengensis* (*Bt*) Cry 1 AC + Cry 2 Ab gene alongwith non *Bt* cultivar of *Gossypium barbadense* was evaluated against pest complex under irrigated condition at Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India, during *Kharif* 2015.The results revealed that there were no difference between the *Bt* and non *Bt* cotton hybrid in their relative susceptibility to cotton jassids, *Amrasca biguttula biguttula*, thrips, *Thrips tabaci*, aphids, *Aphis gossypii* and whitefly, *Bemesia tabaci*.Thus the *Bt* cotton hybrid does not afford any protection to sucking pests of cotton and their tolerance or resistance is mainly dependent on the morphological or genetic base. Bollworm incidence was completely absent in *Bt* cotton hybrid as no square and boll damage was observed. Whereas, non *Bt* cotton recorded higher damage (0.27 to 76.75%) and significantly differed from *Bt* cotton hybrid (0.36 to 1.54%). Besides this, significant difference in seed cotton yield was also observed during the season. Seed cotton yield of *Bt* cotton hybrid (19.25 q/ha) was significantly greater than that of non *Bt* cotton hybrid (12.37 q/ha) under protected condition. The results indicated that *Bt* cotton hybrid cannot control sucking pests of cotton and there was no difference in sucking pests incidence in *Bt* cotton hybrid and non *Bt* cotton hybrid. The major bollworms *Helicoverpa armigera*, *Earias vittella* and *Pectinophora gossypiella* were effectively controlled in *Bt* cotton hybrid. Thus, *Bt* cotton hybrids can play a major role in combating pest problem thereby reducing insecticide usage in cotton ecosystem and helps to maintain eco balance by conserving natural enemies.

GENETIC DIVERGENCE STUDIES IN NIGER (*GUIZOTIA ABYSSINICA* (L.F.) CASS)

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Abstract

The present investigation entitled "Genetic divergence studies in niger (*Guizotia abyssinica* (L.f.) Cass)" was carried out with forty diverse genotypes to study the genetic variability and divergence between forty different genotypes of niger. Forty genotypes of Niger were grown at PGI farm, Department of Agril. Botany, MPKV, Rahuri during kharif 2013, in a Randomized Block Design (RBD) with two replications. The observations were recorded for the characters days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, number of capitula per plant, internodes per plant, number of seeds per plant, 1000 seed weight (g), seed yield per plant (g) and oil content (%). The analysis of data revealed that the significant difference among the genotypes for all the characters except inernodes per plant and branches per plant. The data reveled sufficient variability was present among the genotypes under study. Phenotypic coefficient of variation (PCV) estimates was slightly higher than genotypic coefficient of variation (GCV). High to low estimates of heritability (b.s.) were observed for all characters studied. High heritability accompanied with high genetic advance, as per percentages mean was observed in case of number of seeds per plant, seed yield per plant, oil content, capitula per plant and plant height suggesting importance of additive genetic action in the inheritance of these characters. While days to 50% flowering and days to maturity exhibited moderate to high heritability with moderate genetic gain. Other traits showed low to high heritability but very low genetic gain indicating predominance of non additive gene action. Based on genetic distance (D2 value), the forty genotypes were grouped into eight clusters indicating wider genetic diversity among the genotypes. Among the eight clusters, cluster I was the largest with twenty genotypes followed by cluster II with nine genotypes, cluster IV with six genotypes, and clusters III, V, VI, VII and VIII were monogenotypic. The clustering pattern indicated the absence of relationship between genetic diversity and geographical origin of genotypes. The maximum inter-cluster distance was observed between cluster V andVII (D^2=46.73), while lowest divergance was noticed between cluster VII and VIII (D^2=16.32). Cluster V found to be the least yielder. It comprised of single genotype IGPN-04-11, having late flowering and maturity, highest plant height, number of branching and internodes per plant, maximum oil content and minimum 1000 seed weight. Cluster II found to be high yielding

having 3.83g mean seed yield per plant. Based on inter-cluster distance and *per se* performance of genotypes *viz.,* JNS-253, ONS-167, IGPN-9001, IGPN-08-66, IGPN-03-11, IPG 76(NC), IGPN-04-11, IGPN-07-11, IGPN-1205, JNS-502 and IGPN-08-16 were diverse and classified as promising genotypes. Intercrossing among them would lead to upgrade genetic base in the base population and opportunities for obtaining the good transgressive segregants and wide sectrum of variability in subsequent generations.

COMBINING ABILITY STUDIES IN CHICKPEA (*CICER ARIETINUM* L.)

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Abstract

The present investigation on "Combining ability studies in chickpea (*Cicer arietinum* L.) was carried out at the Pulses Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri during Rabi 2011-12 with the objectives to study the general and specific combining abilities. Seven parental diallel (without reciprocal) was effected. Parents and their 21 F1's were studied for combining ability. The data was analysed statistically as per Model-I and Method-II of Griffing (1956). Observations were recorded for days to 50 per cent flowering, days to maturity, plant height, plant spread, 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 and seed yield per plant. Parents and hybrids were highly significant for studied eight characters which revealed amount of variability was present in experimental material. The parents ICCV-42 (43.5 days) and Phule G-00108 and ICCV-09112 (107.5 days) were the earliest with respect to days to 50% flowering and maturity respectively. Among the crosses, Phule G-00108 x ICCV-42 (43.5 days) and AKG-72 x Phule G-96006 and Phule G-00108 x ICCV 42 (105.5 days) were earliest with respect to days to 50% flowering and maturity, respectively. Highest number of pods per plant were observed in the parent AKG-72 (124.15) and in cross Phule G-00108 x ICCV 09112 (168.3). The highest seed yield per plant (26.65g) was observed in the parent AKG-72. Among the crosses, AKG-72 x ICCV-09112 recorded highest seed yield (42.28g) per plant. The parent ICCV-09112 recorded maximum 100 seed weight (24.55 g). The cross Phule G-00108 x ICCV-42 (33.10g) recorded highest 100 seed weight. These parents and crosses showing good general and specific combining ability could be used in future hybridization progamme to produce good desirable transgressive segregants.

TARGETED YIELD BASED FERTILIZER PRESCRIPTIONS FOR HYBRID RICE (CV. US-382) IN INCEPTISOLS OF JORHAT DISTRICT OF ASSAM, INDIA

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Abstract

Field experiments were conducted during 2015-16 to gauge the fertilizer requirements for hybrid rice (cv. US-382) under Integrated Plant Nutrient Supply in Inceptisols of Jorhat district of Assam in Assam Agricultural University. Following Ramamoorthy's Inductive cum targeted yield model, A STCR-test crop experiment composed of three gradient strips (L_0 , L_1 , L_2) and four blocks which were fertilized with $N_0P_0K_0$, $N_1P_1K_1$ and $N_2P_2K_2$ levels.The average content of available nutrients was found to increase with increasing fertility strips and the highest content was exhibited in the highest gradient strip L_2. The average available N content increased from 183.1 to 356.9 kg ha^{-1} as we move down the strips. Maximum grain yield for hybrid rice was obtained in strip L_2 followed by strip strip L_1 and strip L_0 in order. Similarly, strip-wise average nutrient uptake was in the order of strip L_2> strip L_1> strip L_0. The nutrient requirement per quintal of grain production and contribution from soil , fertilizer and vermicompost (CVC) were evaluated for hybrid rice. The per cent contribution of nutrients from soil (CS) , fertilizer (CF) and vermicompost (CVC) were found to be 35.15 , 48.65 and 26.50 for N , 47.17 , 23.06 and 12.08 for P_2O_5 and 60.32 , 55.68 and 28.69 for K_2O respectively. The fertilizer prescription equations were developed and nomograms were formulated based on the equations for a range of soil test values and desired yield target for rice. Under NPK + VC @ 10.0 t ha^{-1} , 30 , 11 , 28 kg ha^{-1} of fertilizer N , P_2O_5 and K_2O , respectively could be saved for attaining yield target of 80 q ha^{-1} for hybrid rice as compared to NPK fertilizers alone.

GLOBAL CLIMATE CHANGE : SCENARIO AND FOOD SECURITY COMBINING ABILITY STUDIES IN CHICKPEA (*CICER ARIETINUM* L.)

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Abstract

The present investigation on "Combining ability studies in chickpea (*Cicer arietinum* L.) was carried out at the Pulses Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri during Rabi 2011-12 with the objectives to study the general and specific combining abilities. Seven parental diallel (without reciprocal) was effected. Parents and their 21 F1's were studied for combining ability. The data was analysed statistically as per Model-I and Method-II of Griffing (1956). Observations were recorded for days to 50 per cent flowering, days to maturity, plant height, plant spread, 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 and seed yield per plant. Parents and hybrids were highly significant for studied eight characters which revealed amount of variability was present in experimental material. The parents ICCV-42 (43.5 days) and Phule G-00108 and ICCV-09112 (107.5 days) were the earliest with respect to days to 50% flowering and maturity respectively. Among the crosses, Phule G-00108 x ICCV-42 (43.5 days) and AKG-72 x Phule G-96006 and Phule G-00108 x ICCV 42 (105.5 days) were earliest with respect to days to 50% flowering and maturity, respectively. Highest number of pods per plant were observed in the parent AKG-72 (124.15) and in cross Phule G-00108 x ICCV 09112 (168.3). The highest seed yield per plant (26.65g) was observed in the parent AKG-72. Among the crosses, AKG-72 x ICCV-09112 recorded highest seed yield (42.28g) per plant. The parent ICCV-09112 recorded maximum 100 seed weight (24.55 g). The cross Phule G-00108 x ICCV-42 (33.10g) recorded highest 100 seed weight. These parents and crosses showing good general and specific combining ability could be used in future hybridization progamme to produce good desirable transgressive segregants.

BREEDING RICE CULTIVARS FOR BETTER ADOPTED TO CONSERVATION AGRICULTURE

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Abstract

Conservation Agriculture is a concept for resource saving agricultural crop production to achieve sustained production and conserving the environment. Function of conservation agriculture is based on three key principles, *viz.* effective resource conservation, input optimization and optimum productivity of the farming system. Certainly, the advancement in conservation agriculture is possible through genetic improvement in crops and varieties, which are suitable for better adaptation to different farming system environments. Besides, improved varieties and technologies can be assumed to improve productivity with an optimized input level. Continuing using of heavy machine and improper agricultural practices caused of soil degradation and impact on environment losses can be rectified by only conservation agriculture practices. In the case of rice, resource conservation is possible with proper technological intervention. Water is the one of the most important factor, which governs the productivity of rice in Asia. In the concept of conservation agriculture, there are two types of approaches, agronomic and breeding approaches. Under breeding approaches rice growing systems such as aerobic rice, direct seeded rice, system of rice intensification and alternate wetting and drying were introduced to conserve water. Several problems come to exist in rice growing environment under limited water such as pest, disease and weeds, which may reduce productivity. On the other hand, under breeding approaches we can go through screening and selection on the basis of desired characters, conversion of rice from C_3 to C_4 crop, thermo tolerance, transgenic herbicidal tolerance, enhancement of nutrient and water use efficiency etc. Conservation agriculture is a very important process to be looked at in order for the future generations both improvements in resource conservation and yield improvement. In addition, crop and varieties, which are suitable for better adaptation to different environment, need to be improved through breeding traits. These improved varieties and technologies can be assumed for favorable productivity with an optimized input at any farming system. Optimizing inputs and the choice of cultivar for an effective resource conserving farming practice can improve overall productivity and yield potential of crops, especially traditional cultivars.

ASSESSMENT OF CARBON BUDGET FOR REARING OF *CIRRHINUSREBA* (HAMILTON, 1822) WITH DIFFERENT STOCKING DENSITY

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Abstract

Carbon budget was performed for the nursing of spawn of *Cirhhinusreba*in 9 tanks for 45 days and each of 20 m^2(5m ×4m ×1m) water area. Three different treatments @ T_1 : 1.0, T_2 : 2.0 and T_3 : 3.0 lakh ha^{-1} fry were maintained. The experimental spawn were fed with 30% protein diet in powder form and it was formulated by using various ingredients*viz.*soybean meal, mustard oil cake, fish meal, wheat bran, broken wheat, corn flour and vitamin mineral mixture in appropriate proportion. The tanks were fertilized uniformly by application of lime @300 kg ha-1 and mustard oil cake @ 750 kg ha^{-1}. The recovery of carbon was found highest 27.84% in T_2 followed by T_1 (25.07%) and T_3 (22.99%). At the end of experiment discharged water accounted for 43.03- 52.48%°C of the total inputs. Accumulation of organic carbon in the discharged water significantly ($P<0.05$) affected by the varying stocking density.

EEOFRIENDLY MANAGEMENT OF INSECT-PESTS OF OKRA IN WESTERN PLATEAU OF JHARKHAND (SUB-ZONE V)

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Abstract

A field experiment was conducted during Kharif 2017-18 on "Eco-friendly management of insect-pests of Okra in western plateau of Jharkhand (Sub Zone V)" in a Randomized Block Design with three replications and ten treatments. All the treatments were found significantly superior over control. The treatment, karanj cake @ 500.00 kg/ha mixing in the soil at last ploughing and in combination with spraying of coragen @ 1.0 ml/3.0 l. water (two sprays). 1st spray at 50% flowering stage and 2nd spray 15 days after 1st spray recorded the best treatment for controlling the insect-pests damage in okra, which produced (105.39 q/ha) healthy and marketable fruits of okra and received the lowest incidence of leaf hopper (6.48/5 leaves) and bhindi fruit borer (6.67% fruits) followed by the treatment, karanj cake @ 500.00 kg/ha mixing in the soil at last ploughing and in combination with spraying of indoxacarb @ 0.75 ml/ l. water (two sprays) in the same manner. This plot produced (90.84 q/ha) healthy and marketable fruits and the insect-pests damage recorded, leaf hopper (7.22/5 leaves) and bhindi fruit borer (7.97 % fruits). While the control plot produced the lowest healthy and marketable fruit yield of okra (54.61q/ha) and received the highest insect-pests damage, leafhopper (14.43/5 leaves) and bhindi borer (15.23% fruits), respectively.

NETWORKING, COMMUNICATION NETWORK AND NETWORK ANALYSIS IN SOCIAL SCIENCES NEELAM BASERA, NEELAM BHARDWAJ AND BIRENDRA KUMAR

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Abstract

The field of network analysis evolved from the need to understand relationship and interactions within a group of individuals.Network Analysis provides both a visual and mathematical analysis of human relationships. It is based on the assumption of the importance of relationships among interacting units. This analysis is based on a view of structuralism in the way that social relational phenomenon, collaboration and knowledge sharing, can be explained more appropriately by an actor's location in the network structure than the individual property of the actor (Freeman, 2004). More particularly,

communication network analysisas a method of research is conceptualized by Rogers (2003) as a method of research for identifying the communication structure in a system, in which network data about communication flows are analysed by using interpersonal communication relationships as the units of analysis. More apparently, communication network analysis has been considered as a tool to understand the pathways that communication takes in a social system whereas these networks are interconnected individuals linked by patterned flows of information. Over the past decade, there has been an explosion of interest in network research across the physical and social sciences. For social scientists, the theory of networks has been a gold mine, yielding explanations for social phenomena in a wide variety of disciplines from psychology to anthropology to economics. Social scientists have tried to provide a nutshell description of the basic assumptions, goals, and explanatory mechanisms prevalent in the field using social network analysis. The present paper is an attempt to provide explanations to the concept of networks, conceptualize communication networks as well as network analysis and discuss its advantages in social sciences.

IMPACT OF MYCOFLORA ON BOTTLE GOURD SEED GERMINATION AND SEEDLING HEALTH

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Abstract

Cucurbitaceae family makes up the largest group of vegetables cultivated widely in tropical and subtropical countries during summer and rainy season. Amongst different cucurbits cultivated, bottle gourd is nutritionally and medicinally essential staple in Indian culinary art that bears bottle shaped, hard-shelled gourds as fruits.The investigations onmycoflora associated with seeds and fruits of bottle gourd revealed the association offourteen fungal species belonging to eight genera *viz.*, *Fusarium proliferatum*, *Fusarium incarnation-equiseti species complex, Aspergillus tubingensis*, *Meyerozyma guilliermondii*, *Rhizopus oryzae*, *Penicillium polonicum*, *Clonostachys roseaf.* sp. *catenulata*, *Aspergillus flavus*, *Aspergillus* sp. (I), *Aspergillus* sp. (II), *Talaromycespinophilus*, *Fusarium* sp., *Aspergillus* ***sp.*** (III) and *Colletotrichum lagenarium*. Each of the isolated mycoflora was studied *in vitro* for its impact on seed germination and seedling vigour on bottle gourd seeds. The seeds of bottle gourd were inoculated with eachmycoflora individually using ten days old mycelial growth and keeping uninoculated seeds as control. The seeds were subjected to germination tests using paper towel method and top of the paper method in three replications.The observations on per cent seed germination, germination speed and seedling vigour indices I and II revealed that *Fusarium proliferatum* was highly virulent among all the bottle gourd isolates. *Fusarium proliferatum* followed by *Fusarium incarnation-equiseti* (species complex) causedupto 69.3 and 60.7% germination inhibition of bottle gourd seeds as compared to 28.0% germination inhibition in check. On the contrary, *Penicillium polonicum*, *Rhizopusoryzae*and *Talaromyces pinophilus*had positive impact on germination of bottle gourd seeds and there was significant increase in seed germination when inoculated into bottle gourd seeds. The increase in germination upto 80.7, 76.7 and 76.7%, respectively, was observed in seeds inoculated with *Rhizopus* oryzae, *Talaromyces pinophilus* and *Penicillium polonicum*, respectively. The increse in seed germination and seedling health may be a result of some secondary metabolites released by these isolates. Seedling vigour and speed of germination were also decreased as a result of inoculation with *Fusarium proliferatum* and *Fusarium incarnation-equiseti* (species complex). *Fusarium proliferatum* was found to be a major constraint in reducing bottle gourd seed germination and deteriorating fruit quality.

ASSESSMENT OF DIFFERENT FUNGICIDES AGAINST POWDERY MILDEW (*ERYSIPHE POLYGONI* DC.) DISEASE OF PEA (*PISUM SATIVUM* L.)

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Abstract

Powdery mildew disease of pea (*Pisum sativum* L.) caused by *Erysiphe polygoni* DC. Is one of the important disease which affecting the crop and loss the yield. A field trial was conducted in the experimental field of Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh during *Rabi* season of 2017-18 to find out the effective fungicidal application for its

management. The crop was sprayed with six different fungicides including control with three replications were taken up by using RBD. Treatments of two foliar sprays of tebuconazole (Folicur 25.9 % EC) @ 0.25% (T1), hexaconazole (Contaf 5 % EC) @ 0.2% (T2-) dinocap (Karathane 48 % EC) @ 0.1% (T3), carbendazim (Bavistin 50 % WP) @ 0.1 % (T4), wettable sulphur (Sulfex 80 % WP) @ 0.3 % (T5) and control (T6) (Spray of plain water) were applied at the first appearance of the disease. Effect of each treatment on the disease incidence was recorded. Observations were recorded at 7 and 14 days after spray. The disease incidence was significantly reduced in the treated plots when compared to the untreated control. Analysis of the data showed that spraying of Dinocap @ 0.1 % (T3) was found to be the best fungicide which significantly reduced the powdery mildew disease of Pea (Pisum sativum), followed by Tebuconazole @ 0.25 % (T1) as compared to control (T6) which recorded maximum disease intensity.

EVALUATION OF DIFFERENT FOLIAR FUNGICIDES MOLECULES ON THE MANAGEMENT OF BLAST (*PYRICULARIA ORYZAE* CAV.) DISEASE IN RICE (*ORYZA SATIVA* L.)

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Abstract

Rice blast caused by *Pyricularia oryzae* Cav. is one of the major disease of rice and cause approximately 30-35 % yield losses. The present study was conducted at the experimental field of Krishi Vigyan Kendra Majhgawan, Satna (Madhya Pradesh) during *Kharif* season of 2017-18 to evaluate different foliar fungicides against leaf blast (*Pyricularia oryzae* Cav.) disease in rice. The six fungicides with three replications were taken up by using RBD. The fungicides namely- tebuconazole + trifloxystrobin (Nativo 75 % WG) @ 0.8 % (T_1), hexaconazole (Contaf Plus 5 % SC) @ 0.2 % (T_2), tebuconazole (Folicur 25.9 % EC) @ 0.2 % (T_3), pyraclostrobin (Headline 20 % WG) @ 1.33 % (T_4), azoxystrobin (Amistar 23 % SC) @ 0.1 % (T_5) and carbendazim (Bavistin 50 % WP) @ 0.1 % (T_6). Observations were recorded at 10 and 20 days after spray. Analysis of the data showed that among the six fungicides, highest per cent inhibition of mycelial growth of fungus was recorded in Tebuconazole + Trifloxystrobin (75 % WG) @ 0.8 % (T_1) 98.40, 99.90 and 99.90% at all the concentration tested with mean of 99.40 per cent, followed by Tebuconazole (25.9 % EC) @ 0.2 % (T_3) with the inhibition of 97.73, 99.90 and 99.90 per cent, respectively with mean of 99.18 per cent. Minimum inhibition of mycelia growth was observed in Carbendazim (50 % WP) @ 0.1 % (T_6) with 55.83, 63.62 and 70.52 per cent, respectively with mean of 63.66 per cent.

INTELLECTUAL PROPERTY RIGHTS AND BIODIVERSITY CONSERVATION: ISSUES AND KEY CHALLENGES

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Abstract

Biodiversityharbouring a variety of animal and plant species of economic, ecological and socio-cultural importance. Efforts to protect these resources against destruction and loss have involved, among other things, setting aside some tracks of land as protected areas in the form of national parks, nature reserves, game reserves, game controlled and wildlife management areas. However, these areas and adjacent lands have long been subjected to a number of emerging issues and challenges, which complicate their management, thus putting the resources at risk of over exploitation and extinction. These issues and challenges include, among other things, government policies, failure of conservation (as a form of land use) to compete effectively with alternative land uses, habitat degradation and blockage of wildlife corridors, overexploitation and illegal resource extraction, wildfires. Based on a survey of the major national and international initiatives undertaken to protect Traditional Knowledge (TK) since 1990s, the Abstract states that the task of reconciling TRIPS with CBD and other related TK laws is fraught with difficulties. After examining various IPRs in relation to TK, the Abstract argues that there are clear limits to which former can accommodate the latter especially when it comes to positive protection of TK and related cultural expressions. The main argument in this Abstract is that sui generis legislations are more effective for the protection of TK and

related cultural expressions. A sui generis legislation that views TK as a composite resource, having both economic and cultural features has a better prospect of ensuring protection of TK, besides enabling benefit sharing. By having international regulations that harmonize protection measures, it is guaranteed that national efforts at protection are not wasted due to absence of reciprocity

DEVELOPMENT OF LASSI USING WHEY AND MORINGA POWDER

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Abstract

In current time, people of all age groups required different types of vitamin, mineral, protein etc. which are sufficient available in moringa leaf lassi. Lassi is one of the most popular options all over the global liked by people of all age groups. It is resolve health problem and to provide enough nutrition at a low cost to a large population. In consideration of the above the discussed issue the outline of present study was drawn (i.e.) to make moringa leaf powder lassi by using whey, sugar, moringa powder and syrup. The present study was conducted to know the chemical, microbial attribute of moringa leaf powder lassi blended with whey sugarserum. It was prepared from standardization milk. Moringa leaf powder was added different level (0.5%), (1%), and (1.5%) of milk and whey syrup. Founded to be addition of whey sugar serum, pectin (0.1%) and vanilla improved sensory quality and acceptability of the product. Various analysis parameters were analyzed by two way ANOVA to obtained a predicted optimum result/ prepared lassi was subjected to chemical, microbial, and sensory analysis to evaluate the suitability of lassi were sample T_2 protein (2.89%), fat (2.39%), ash (0.77%), Viscosity (cp) (252.12±1.46) and carbohydrate (16.69%) as comparable to control without adversely affecting the sensory parameters. Based on the result it was indicated that beneficial component of high protein in curd, Whey and Moringa powder made them more favorable choice for dairy technologist to develop lassi especially for healthy breakfast.

STATUS OF AGRICLINICS AND AGRIBUSINESS CLINICS IN INDIA

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Abstract

The Agri clinics and Agribusiness Centres (AC&ABC) Scheme playing an important role to supplement the public extension services in agriculture in India and has become very popular among agriculture graduates. The Scheme has been implemented across the country since 2002. The study was conducted on the status of the Agri clinics and Agribusiness Centres (AC&ABC) Scheme in India from the year 2002 to 2017. Assistance under the scheme is purely credit linked and subject to sanction of the projects by banks based on economic viability and commercial considerations. The eligible financial institutions under the scheme are Commercial Banks, Regional Rural Banks, State Cooperative Banks, State Cooperative Agriculture and Rural Development Banks and Such other institutions eligible for refinance from NABARD. Ceiling of project cost for subsidy has been enhanced to Rs.20 lakhs for an individual project (25 lakhs in case of extremely successful individual projects) and to Rs.100 lakhs for a group project. Depending on the type of venture with a moratorium of up to 2 years, Agriclinics and Agribusiness Centre Loans can be repaid within 5 to 10 years as per easy installment plans. However, since the inception of the AC&ABC Scheme, the bank sanction rate is only 11.60 per cent. As on 2017, the number of trained peoples accounts for 54,496 under the scheme. The number of agri venture established during this period was estimated to be 23501depicting a success rate of almost 43 per cent. There are 132 Nodal Training Institution (NTIs) identified by MANAGE all over the country for training purpose, whereas Maharashtra has maximum number of Nodal Training Institutes (26). It was observed that various states have different success rates in implementing the scheme. States in the Northern and Southern region have very encouraging record, while states of North Eastern region have shown poor performance in terms of setting up of agriventures. Although, agriclinics and agribusiness centres scheme provides specialized training, credit facility, subsidy and handholding support for the establishment of agribusiness/agriventure, but the success rate of total agriventure

establishment was found low against total trained candidates in the country. There is a need to rethinking on the whole gamut of components of scheme such as training programme, nodal training institutes, credit assistance, subsidy and monitoring of scheme for successful implementation of the scheme. The objectives of scheme such as technology transfer, employment generation and strengthen the extension service system, has been met to some extent, yet there is a need to involve private extension staff and agribusiness experts to improve the performance of the scheme.

EMPOWERING THE FOOD SECURITY AND AGRICULTURE IN INDIA

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Abstract

India has been perceived as a development enigma: Recent rates of economic growth have not been matched by similar rates in health and nutritional improvements. To meet the second Sustainable Development Goal (SDG2) of achieving zero hunger by 2030, India faces a substantial challenge in meeting basic nutritional needs in addition to addressing population, environmental and dietary pressures. In India, food system from crop production to household-level availability across to better understand the potential of reduced food chain losses and improved crop yields to close future food deficits. Food security has a huge relation with agriculture. India is a net agricultural exporter, particularly of milk, fruits and vegetables, and cereals.However, food security is affected by climate change and declining water resources on agriculture output. Economic access to food by about a fourth of the population living below the poverty line is a very big problem in India, despite impressive economic growth in the recent years. It is also obvious with increased population, the augmented demand for food will also increase the competition for land, making food security and access to adequate and safe food and changing lifestyles and diets in developing countries have changed the demand for food.Food security is assured by increasing agriculture productivity in India.Plant biotechnology and innovation systems in agricultural practices, sustainable agriculture productivity, and social sustainability and finally the ecological use of natural resources must ensure food production in a sustainable way, ecosystems services and biodiversity.

IMPACT OF BIOCHEMICAL AND MORPHOLOGICAL TRAITS AGAINST BRINJAL FRUIT AND SHOOT BORER

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Abstract

Brinjal or eggplant, one of the important cosmopolitan vegetables grown in India and other parts of the world. Insect pests are the main constraint in the successful cultivation of brinjal, among which, the shoot and fruit borer is the most severe pest causing fruit damage. It is a monophagous pest and voracious feeder. The affected fruits lose their market value besides considerable reduction in yield. The pest poses a serious problem because of its high reproductive potential, rapid turnover of generations and intensive cultivation of brinjal both in wet and dry seasons of the year. Farmers use large quantities of chemical insecticides singly or in combination to get blemish free fruits, which fetch premium prices in the market. This practice of indiscriminate use of insecticides leads to build up of pesticide residues in the produce, destruction of beneficial insects, pest resurgence, pesticide exposure to farm workers and environmental pollution. Keeping this in view, an experiment was conducted on 36 genotypes and concluded that there is ample scope for selection of promising lines for future breeding programme. Biochemical factors of the host plant have been reported to play a vital role on resistance to various insect and disease pests and relatively resistant varieties contained higher amount of secondary metabolites inherently. Expression of resistance to BFSB was associated with low total sugars content, high polyphenol oxidase activity and high total phenolic content showed lesser infestation of the noxious pest. High total anthocyanin content of leaves and fruits also marked lesser

incidence of BFSB. Besides, it has been found that round fruits having higher fruit girth were more prone to infestation compared to long fruits with more fruit length and less fruit girth may be used in hybridization programme to develop cultivars with resistance to BFSB.

DEVELOPMENT OF MANUALLY OPERATED *MUNG WADI* (GREEN GRAM NUGGETS) MAKER

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Abstract

Mung wadi (Green Gram nuggets) is heritage food prepared manually by skilled women. Mechanization for the process of making *mung wadi* is necessary to speed up the operation and increase the capacity of production. The principle components of manually operated *mung wadi* (Green gram nuggets) maker consist of cylinder, piston, piston driving mechanism, trigger and handle assembly and the extrusion plate with collar. The machine is operated by pressing the trigger against the handle which actuates the piston. The grip plates moves relative to the piston causing the openings to grip the piston and move it into the cylinder. The piston plate compresses the batter against the extrusion plate hole thus forming the *mung wadi*. The *mung wadi* maker was optimized at three parameters namely diameter of extrusion hole, moisture content of batter and length of stroke. The machine parameters [extrusion hole diameter 0.2 mm, length of stroke 0.4 mm and moisture content of batter 45-50%(wb)] of *mung wadi* making machine were found to be suitable on the basis of size of *wadi,* capacity of machine and optimum cooking time of *mung wadi.* The maximum capacity of machine was found to be 635.93 g/min with minimum value for optimum cooking time of 5.683 min. This machine is advantageous for small scale production.

MUTATIONAL ANALYSIS FOR IMPROVING GRAIN QUALITY AND STRESS RESPONSES IN RICE

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Abstract

Rice (*Oryza sativa* L.) is a major staple cereal crop of Asia ensuring food security to millions of people. The realized yield potential in rice is mainly achieved through genetically stable high yielding varieties. Continuous breeding for specific trait predominated by few varieties led to narrow genetic base making the rice ecosystem highly vulnerable to different environmental stress. The possibility of increasing the genetic variability of rice varieties might be useful for breaking yield plateau, developing stress tolerance, and improving grain quality in rice. In present investigation two rice varieties of rice namely Rajendra Mahsuri-1 and Rajendra Kasturi were irradiated with different doses of gamma rays. The LD_{50} for both the genotypes were found to be 350Gy. A large number of M2 generation mutants were screened for different agronomical, nutritive and abiotic stress tolerance parameters. Different mutants group like early maturing, reduced plant height, increase in length and number of panicle, Increase in length/breadth (LB) ratio of mature gain, change in grain colour were identified. Interestingly, few dark brown coloured rice mutants which showed upto 4 fold increase in iron content, enhanced level of total polyphenols and super oxide dismutase (SOD) activity were identified. The mutants were also screened on 15% PEG for drought tolerance and 150mM NaCl in hydroponically grown seedlings. The variations in mutant phenotypes were studied at molecular level by pooled PCR analysis. These studies clearly indicate different mutants could be either directly used for varietal improvement or used in breeding programme for rice improvement.

TO STUDYOF POPULATION BUILTUP AND EXTENT OF ATTACK OF DIFFERENT FOOD PLANTS OF *CHRYSOCORIS STOLLI* WOLF. (HETEROPTERA-PENTATOMIDAE -SCUTELLARANE)

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Abstract

Insecta is the largest class of phylum arthropoda and members of this class are characterized by the presence of three pairs of legs; hence, called Hexapoda, Besides, these tracheate organisms have usually one or two pairs of wings. Insects always have

been associated with mankind in one way or the other as some of them are beneficial other are pests of crops and house hold articles. Studies on the population dynamics of insect pests are essential from economic point of view. In view of this population dynamics of *C. stolli* was carried out in 5 blocks of district Saharanpur mainly Saharanpur proper, Behat.Nakur, Sarsawa and Nagal on Bajra and *Cassia occidentalies*. Population count was made on randomly selected ten plants. Weekly observation were taken and noted. On these basis monthly population was calculated and pooled in table 1The count was made infield for two consecutive years, 2005 and2006.The data of table-1 depict that population built up of *C. stolli* starts in the month of late February or March on *Cassia occidentalies* plants and on Bajra**.**. The population goes on peak level on these plants during July to September when in nature abundant food supply is available. During this period all stages of bugs are available in field such as eggs, nymphs and adults. Population begins to decline in October and finally goes on low level in November. No bugs occur in nature during late November to February because due to low temperature *C. stolli* hibernates in all the 5 block of district Saharanpur. Further, data of frequency (F), abundance (A) and density (D) table – 50revealed that during 2005 at Saharanpur proper density varied from 1.35 to 4.15, frequency (F) was 30 to 100% percent and abundance was 1.42 to 4.08 during peak period of occurrence of bugs on *Pennisetum typhoides* (Bajra) crop. During 2006 density was 1.35 to 4.15, frequency 35 to 100% and abundance was 1.42 to 4.08.Calculation of frequency, density and abundance was carried using following formula. Density (D) = Total No. of individuals Total No of quadrates studied Frequency (F) = Number of quadrates in which the sp. Occurred Total No. of quadrates studied. Abundance (A) = Total No. of individuals Total No. of quadrates of occurrence.

ROLE OF ITK IN INCLUSIVE AGRICULTURAL DEVELOPMENT

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Abstract

Traditional knowledge (TK), indigenous knowledge (IK), traditional ecologic knowledge (TEK) and local knowledge generally refer to knowledge systems embedded in the cultural traditions of regional, indigenous, or local communities. Traditional knowledge includes types of knowledge about traditional technologies of subsistence (e.g. tools and techniques for hunting or agriculture), midwifery, ethno botany and ecological knowledge, celestial navigation, ethno astronomy, the climate etc. These kinds of knowledge are crucial for the subsistence and survival and are generally based on accumulations of empirical observation and interaction with the environment. The integration of scientific and traditional knowledge would help to develop technologies which are need based better problem solving, locally available easily acceptable, cost effective, convincing and credible to the rural clientele. local people could be consulted to determine the milk yields of animals under 'real' conditions where scientific testing had not been carried out; indigenous observers might be encouraged to report back on changes in the species composition of pasture as an early warning system for environmental deterioration; farmers could be used in crop reporting systems instead of extension personnel; and so on. Many such possibilities might be opened up with little technical difficulty: often all that is required is standardisation of systems of measurement. However, one should not simply think in terms of how ITK can be used in isolation, but rather consider ways in which it can be brought into creative synthesis with science. In attempting to mount such an exercise it is also important to recognise that ITK is not distributed evenly among the members of a society. It is likely to be controlled and manipulated by certain groups and classes in the pursuit of their own interests

MOLECULAR CHARACTERIZATION OF GARLIC (*ALLIUM SATIVUM* L.) GENOTYPES BASED ON ISSR MARKERS

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Abstract

Garlic (*Allium sativum* L.) is a monocotyledonous vegetable belongs to family Alliaceae and one of the most important crops grown throughout the world for cooking purpose and for its medicinal uses. The availability of genetic variability within

crops, both in *ex situ* and *in situ* collections, is of pivotal importance for a sustainable agriculture since the improvement of any crop is proportional to the magnitude of its genotype's genetic variability. So, it is important to characterize and conserve genetic variation in the local landraces/varieties for future breeding programme. Molecular markers have been applied to assess genetic diversity in many crops because they are unlimited in number, not affected by the environment and can be organized into linkage maps. In the present study, Molecular characterization and genetic diversity analysis of fifty five genotypes of garlic was carried out using Inter-simple sequence repeat (ISSR) markers. Total 10 ISSR primers of UBC series were used, out of which 9 primers showed amplification and generated 35 fragments. Total 32 polymorphic bands were obtained in which 31 were shared and 1 band was unique with an average of 3.56 bands and 90.37% polymorphism per primer. The Polymorphism Information Content (PIC) values for ISSR marker were ranged from 0.43 in ISSR primer UBC-836 to 0.8 in primer UBC-849 with an average value of 0.56 per primer. ISSR primer index (IPI) differed from 0.96 (UBC-825) to 4.00 (UBC-849) with an average value of 2.28 per primer. UPGMA cluster analysis on basis of ISSR profiles was carried out using Jaccard similarity coefficient. The similarity coefficient of cluster analysis ranged from 32.10% to 100%. The dendrogram constructed by ISSR markers produced two major clusters, Cluster-I and cluster-II. In Cluster-I, genotypes RGP 429, RGP 117, RGP 445, RGP 495 and RGP 609 showed maximum similarity, whereas in cluster-II, genotypes RGP 235 and G 282 showed maximum similarity. Genotype GAG-6 and RGP-26 were found as most diverse genotypes among all the genotypes used in this study and can be utilized for further crop improvement programmes.

FARMERS' ROLE IN SOIL AND WATER MANAGEMENT & CONSERVATIONS TECHNOLOGIES DECISION-MAKING ON ADOPTION OF MITIGATION AND ADAPTATION OF CLIMATE CHANGE PRACTICES IN AGRICULTURE

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Abstract

Mitigation and adaptation planning needs more than legal frameworks and compliance to ensure that decisions are effective in meeting the challenges of vulnerability reduction in the context of a changing climate and its impact on agricultural production systems. If farmers' role inSoil & Water Management and Conservations Technologies decision-making on adoption of mitigation and adaptation of climate change practices in agriculture are not taken up appropriately and thoroughly studied, any initiatives on mitigation and adaptation approaches in coping with the climate change for small holder vulnerable farmers to increase their production through adoption of appropriate techniques are likely to fail due to improper decision making. Considering above instances, the following research objective has been inked for the study. To study farmers' role in decision-making on adoption of mitigation and adaptation of climate change practices in agriculture. The study followed exploratory research design. A total of 60 farmers were selected by way of proportionate random sampling method. The role of farmers in decision-making on adoption of various areas of mitigation and adaptation of climate change practices in agriculture was quite minimal, excepting domains of Soil Management and Crop Production Systems in which 55 per cent and 50 per cent of respondents respectively took role in final decision making.

SOCIO ECONOMIC IMPACT OF THE IMPROVED GOAT HUSBANDRY PRACTICES ON TRIBAL

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Abstract

Government has planned its approach by collecting information of tribal's through various sources; however, magnitude of work on tribes is beyond the effort made. As such, in order to achieve National objective of the government to bring the tribal into the mainstream of national life, it is necessary to add as many efforts as possible to study these weakest masses and find out solution to make them fellow travelers in our way to progress. This study was conducted in three adopted villages of Ahore Block of Jalore district under Tribal Sub Plan (TSP) programme in the year of 2017-18. Majority of the selected respondents learnt more skill on use of vaccine like PPR, ET, and FMD, deworming of goats, feeding of colostrums to neo natal kids,

keeping improved bucks and dipping of goats to control ectoparasites etc. In the case of socio-economic indicators, majority of the selected respondents had reported that the goat has been a ready cash riding dependence on high cost private credit, increased share of income from goat to family's total income from goat to family's total income, increase profit /goat/annum and increased awareness about commercial goat farming and its advantages.

RNA INTERFERENCE : AN ENVIRONMENT FRIENDLY APPROACH FOR THE FLOWER COLOUR MODIFICATION

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Abstract

Ornamental plants paint the world around us with a plethora of flower and leaf colour. Man has pursued his quest to improve flowering plants from the domestication or import of wild species to the increasingly sophisticated breeding strategies. Some ornamental flowers only have a narrow colour spectrum, while in others species, specific colours are lacking. Genetic engineering played a vital role in floriculture industry to broaden the colour spectrum of flowers. The extensive information available on the genetics and biochemistry of pigment biosynthesis gives a strong base in the production of transgenic flowers. Down regulation of flavonoid genes: Reppression of the flavonoid pathway at a single enzyme step resulted in the impairment of pigment synthesis. Gene silencing is a suitable genetic tool for down regulation of flavonoid genes. Sense RNA (Co-suppression), Antisense RNA, and RNAi (RNA interference). RNA silencing is a novel gene regulatory mechanism that limits the transcript level by either suppressing transcription (TGS) or by activating a sequence- Specific RNA degradation process.

PERFORMANCE OF PROMISING GENOTYPES OF GAILLARDIA (G*AILLARDIA PULCHELLA* L.) IN RESPECT OF YIELD ATTRIBUTES AND STORAGE STUDY

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Abstract

The present investigation was carried out during the year 2016-2017 at Modibaug garden of Horticulture Section, College of Agriculture, Pune. The experiment was laid out in Randomized Block Design with three replications. Significantly more number of flowers per plant was recorded in the genotype MG-10-4 (217.00) followed by the genotypes MG-6-2 (209.08), MG-2-2 (205.65) and MG-9-1 (204.37). The genotypes MG-3-1 recorded significantly maximum weight of 100 flowers (297.30g). The weight of flowers per plant, yield of flowers per plot and yield of flowers per hectare were recorded significantly highest in MG-9-1 (580.41 g, 23.21 kg and 32.21 tones) respectively.The genotype MG-9-1 recorded maximum vase life (4.42 days) followed the genotype MG-2-2 (4.28 days) for cut flowers.The genotype MG-9-1recorded significantly maximum shelf life (2.21 days) followed by the genotype MG-2-2 (2.16 days).

CORRELATION AND PATH ANALYSIS FOR QUANTITATIVE TRAITS IN DURUM WHEAT (*TRITICUM DURUM*)

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Abstract

Forty cultivars of durum wheat were evaluated for yield and yield contributing traits at Wheat Research Station, Junagadh Agricultural University, Junagadh during Rabi 2016-17 in randomized block design (RBD) with three replications to find out genetic variability, character association, direct and indirect effects. The characters studied were days to 50% flowering, days

to maturity, grain filling period, plant height, number of productive tillers per plant, ear length, number of grains per main spike, grain weight per main spike, grain yield per plant, biological yield per plant, harvest index and 100-grain weight. Significant genotypic differences were observed for all the 12 quantitative traits studied, indicating presence of considerable amount of variation among genotypes. The correlation coefficient analysis showed significant and positive correlation of grain yield per plant with biological yield per plant, harvest index, number of productive tillers per plant, number of grains per main spike and grain weight per main spike. Significant and positive correlations were observed for number of productive tillers per plant with biological yield per plant; number of grains per main spike with grain weight per main spike and harvest index; grain weight per main spike with harvest index and 100-grain weight; harvest index with 100-grain weight. Path coefficient analysis was used to determine the direct and indirect effects of different characters on grain yield per plant. The genotypic path coefficient analysis revealed that the biological yield per plant and harvest index exhibited high and positive direct effects on grain yield per plant. Biological yield per plant, grain weight per main spike, number of grains per main spike, number of productive tillers per plant and harvest index merit special attention in formulating selection strategy in durum wheat for developing high yielding varieties.

RELATIVE TOXICITY OF VARIOUS INSECTICIDES AGAINST ECTO-LARVAL PARASITOID, *GONIOZUS NEPHANTIDIS* (MUESEBECK) (BETHYLIDAE : HYMENOPTERA) OF COCONUT BLACK HEADED CATERPILLAR, *OPISINA ARENOSELLA* WALKER

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Abstract

The coconut palm, *Cocos nucifera* L. belongs to family Arecaceae is "Tree of Life" as well as "Kalpa vriksha" provides livelihood to billions of people across the world. The coconut palm is infested by a number of insect pests. Among them, *Opisina arenosella* Walker causes the severe damages to the foliage, black headed caterpillar is attacked by many entomophagous insects during its developmental stages. Among them, *Goniozus nephantidis* (Muesebeck) is a gregarious larval parasitoid. Use of pesticides which are incompatible with natural enemies has caused some adverse effects such as target pest resurgence, secondary pest outbreaks and reduction in non-target organisms. Therefore, present investigation was conducted to know the relative safety of various insecticides against *G. nephantidis* under laboratory conditions with field concentrations. The study on relative toxicity of different insecticides against *G. nephantidis* revealed that there was no insecticide under testing found totally safe except control treatment (water spray) to the adults of *G. nephantidis.* However, spinosad 45 SC was comparatively harmless to the adults. Moreover, indoxacarb 15.8 per cent EC, emamectin benzoate 5 per cent SG, quinalphos 25 per cent EC, flubendiamide 39.35 per cent EC and profenofos 50 per cent EC were slightly harmful. Furthermore, triazophos 40 per cent EC, dichlorvos 76 per cent EC and chlorpyriphos 20 per cent EC were moderately harmful, while none of insecticide was categorized as harmful to the adults of *G. nephantidis* under laboratory conditions.

STUDY OF INTERCROPPING OF ANNUAL FLOWERS IN ROSA INDICA FOR YIELD ATTRIBUTES AND ECONOMICS

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Abstract

The present investigation was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during the year 2014-15 to study the suitable intercrop in rose. The intercrops grown were African marigold, French marigold and Gaillardia. The experiment was laid out in Randomized Block Design with 10 treatmentsviz. T_1 = Rose + African marigold (1:1), T_2 = Rose + African marigold (1:2), T_3 = Rose + Gaillardia (1:1), T_4 = Rose + Gaillardia (1:2), T_5= Rose + French marigold (1:1), T_6= Rose + French marigold (1:2), T_7 = Rose sole, T_8 = Gaillardia sole, T_9 = African marigold sole, T_{10} = French marigold sole. The highest rose equivalent yield (11.2 t/ha) was observed from the treatment T_2 (Rose + African marigold 1:2). Whereas, the lowest (6.79 t/ha) was observed from the treatment T_7 (Rose sole).

In view of the LER, highest value was recorded from intercropping Rose + French marigold 1:2 (1.54). However, lowest (1.0) from sole rose. This shows profitability of intercropping over sole cropping. Economic point of view, highest net income per ha was obtained from Rose + African marigold 1:2 (Rs. 7,11,980/ha) followed by Rose + French marigold 1:2 (Rs. 6, 65,802/ha) while lowest (Rs. 3,61,930/ha) was recorded from sole cropping of rose. Maximum BCR (4.32) was noted from Rose + African marigold 1:2 followed by Rose + French marigold 1:2 (3.77) while least BCR (2.50) was obtained from sole rose. In terms of performance on the basis of LER and profitability, Rose + African marigold (1:2) was found best intercrops. Profitability of African marigold can be attributed to its quality in combination with market price of the flowers.

EVALUATION OF LAWN GRASSES FOR TURF QUALITY FOR GROWTH PARAMETERS AT PUNE CONDITION

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Abstract

The present investigation was carried out during the year 2015-2016 at Modibaug garden of Horticulture Section, College of Agriculture, Pune. This experiment was laid out in Randomized Block Design with three replications. The highest grounds cover (100%) observed in American blue grass and Bermuda grass at 60 days after transplanting. At 150 and 180 days after transplanting stage of crop growth significantly highest shoot length was recorded by phosphelone grass over rest of treatment. The stem thickness was significantly maximum in Argentine grass followed by Pensacola grass and minimum in American blue grass and Bermuda grass. The Weeping love grass significantly recorded maximum leaf length followed by Argentine grass recorded and Taiwan grass recorded minimum leaf length. Significantly maximum leaf width was observed in the species Phosphelone grass followed by Argentine grass, St. Augustine grass, Pensacola grass. There were difference detected in the root lengths of Weeping love grass, Bermuda grass and Pensacola grass followed by Argentine grass , Phosphelon grass, American blue grass. It is seen Bermuda grass, American blue grass and Korean grass.

NANOTECHNOLOGY : IMPROVING FOOD SECURITY AND PRODUCTIVITY

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Abstract

Nanotechnology is the art and science of manipulating and rearranging individual atoms and molecules at nanoscale to create useful materials, devices and systems. This is an interdisciplinary field where science, technology and engineering interconnect conducted at the nanoscale, which is about 1 to 100 nanometers. Nowadays, the agricultural researchers face a great challenge representing in producing the sufficient quantity and quality of food to feed the ever-increasing global population without degrading the soil health and agroecosystems. Recent scientific data indicate that nanotechnology has the potential to positively impact the agriculture & food sector, minimizing the adverse problems of agricultural practices on environment and human health, improving food security and productivity (as required by the predicted rise in global population), resolve current challenges like declining farm profitability, reduction in natural resources, resurgence of the new pest and diseases, global warming, and climate change while promoting social and economic equity. Methods Involving Nanoparticle (NP) Synthesis-there are four methods *viz*. Physical method, Chemical method, Aerosol Methods (Physio-chemical), Biological method. Nanotechnology can contribute to enhancing agricultural productivity in a sustainable manner, using agricultural inputs more effectively, and reducing by-products that can harm the environment or human health. Nanotechnology applications in basic agriculture, value addition, preservation of crops and food can therefore bring a sea change in the agriculture scenario of India. Thus, applications of nanotechnology in agriculture can prove to be a big boon.

EVALUATION OF DIFFERENT GENOTYPES OF CROSSANDRA (*CROSSANDRA SPP.)* IN RESPECT OF YIELD AND PERCENT DISEASE INTENSITY

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Abstract

The present investigation was conducted at AICRP on Floriculture, National Agricultural Research Project Ganeshkhind, Pune7, MPKV; Rahuri, during 2015-2016. The experiment was laid out in randomized block design with three replications and seven genotypes viz., Arka Ambara, Arka Kanaka, Arka Shrvya, Arka Shreeya, Local-1, Local-2, Local-3. Arka Shrvya was significantly superior over all genotypes, which recorded maximum number of flowers per spike, number of flowers per picking, weight of flowers per picking, weight of 100 flowers and yield per plant. The flower colour was recorded by comparing florets with Royal Horticulture Society colour chart. The superior genotype Arka Shrvya having Jasper Red colour with colour code o18/1.The wilt disease incidence varies significantly among different genotypes under natural field condition. Arka Shrvya genotype was found free from wilt disease (0.00 PDI)

HERBICIDE RESISTANCE IN WEEDS AND THEIR MANAGEMENT

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Abstract

Green revolution took place all over the world to provide food for burgeoning human population, which resulted in excessive use of agrochemicals and monoculture practices. In rice-wheat cropping system of India, weeds were controlled by herbicides with higher intensity during green revolution period mostly by Isoproturon for *Phalaris minor* in wheat makes the weeds resistant to herbicide. Now, the management of herbicide resistant in weeds is a new challenge because weeds losses the food grains by 33% on one hand and food production must increase by 70% to fulfil the food grain demand for increasing human population (1.7 billion by 2050 in India) on another hand. The adequate agronomic management of herbicide resistant in weeds will help in getting food security. There are several ways to control the resistant biota to herbicides in different parts of the world; agronomic management is also one of them.

EFFECT OF DIFFERENT IRRIGATION AND HYDROGEL LEVELS ON GROWTH, YIELD POTENTIAL AND ECONOMICS OF MUSTARD (*BRASSICA JUNCEA* L.) UNDER SEMI ARID REGION OF RAJASTHAN

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Abstract

A Field experiment was conducted to evaluate the effect of different irrigation and hydrogel levels on growth, yield potential and economics of mustard (*Brassica juncea* L.) at S.K.N. College of Agriculture, Jobner, Rajasthan during *Rabi* season of 2015-16. The experiment consisted of 12 treatments were replicated three times in split plot design. The research results indicated that progressive increase in IW/CPE ratio upto 0.6 brought about significant improvement in yield attributing characters, seed yield and net returns over 0.4 IW/CPE ratio and no irrigation. It recorded the seed yield of 19.18 q/ha with net returns of 50637/ha which were 10.42 and 13.00 percent higher over 0.4 IW/CPE ratio and 36.70 and 50.70 percent over no irrigation, respectively. However, it was found at par with 0.8 IW/CPE wherein the maximum yield (20.17 q/ha), net returns (Rs 53595 /ha) and B:C ratio (3.28) were obtained. Further irrigation at 0.4 IW/CPE ratio and no irrigation resulted in the lowest yield as well as net returns. Further examination of the data showed that different levels of hydrogel varied widely in seed yield and returns. Application of hydrogel at 5.0 kg/ha resulted in the significantly highest seed yield of mustard (19.58

q/ha). However, it was found at par with 2.5 kg/ha which, corresponded to seed yield of 18.48 q/ha. But the net returns (Rs 48430 /ha) were found maximum with application of hydrogel at 2.5 kg/ha, which was significant over control but at par with 5.0 kg hydrogel application /ha.

EFFECT OF DIFFERENT IRRIGATION AND HYDROGEL LEVELS ON GROWTH, YIELD POTENTIAL AND ECONOMICS OF MUSTARD (*BRASSICA JUNCEA* L.) UNDER SEMI ARID REGION OF RAJASTHAN

Parvati Deewan[1], Ram Pratap[2] and Rajhans Verma[3]

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STUDIES ON THE PERFORMANCE OF WHEAT VARIETIES IN DISTRICT PILIBHIT (U.P.)

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Abstract

An on farm trial was conducted during the Rabi Season of 2013-2014 and 2014-2015 at farmers Field with full participatory mode in district Pilibhit to study the performance of Wheat varieties namely PBW-343, PBW-550 and DBW -17 . Recommended crop production practices were followed in growing the crop. The mean performance of tested varieties indicated that variety DBW -17 gave highest yield (50.92 q/ha) followed by the varieties PBW-550 (49.29 q/ha) and PBW -343 (44.08q/ha) . The cost of cultivation was calculated by DBW -17 (Rs. 48100 /ha) and getting a net profit (Rs. 28280 /ha) with Bc ratio1:1.59. Variety PBW -550 getting a net profit (25835/ha) . Farmer's practices variety PBW -343 getting net profit (Rs. 20620/ha). From above observation it is apparent that wheat variety DBW -17 has perform better. Hence it could be a potential variety for large scale adoption under farmer circumstances.

EFFECT OF DIFFERENT LEVELS OF NITROGEN ON THE YIELD OF RICE VARIETIES UNDER DIRECT SEEDED CONDITION

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Abstract

The experiment was conducted during *Kharif* season of 2017 at the JNKVV College of Agriculture Instruction Farm, Rewa (M.P.). The experiment was laid out in a split plot design consist in main plot three nitrogen levels and sub plot twelve verities

of rice with four replications. The three nitrogen levels are (50, 100 and 150% RDF i.e. N_{50}, N_{100} and N_{150}) and twelve varieties are IET24797 (V1), Gotra Bidhan (V_2), PR 124(V_3), Juit (V_4), Sahbhag (V_5), PS-5 (V6), DRR Dhan 43 (V_7), PS-3 (V_8), JR-767(V_9), JR -81 (V_{10}), US 314 (V_{11}) and IR -64(V_{12}). The combination of variety IR-64 and 150 kg N/ha was found the best in respect of grain yield (53.91 q/ha) followed by US-314 sown with 150 kg N/ha (47.90 q/ha).

STUDY OF GENETIC DIVERSITY OF QUANTITATIVE TRAITS WITH GRAIN YIELD IN BREAD WHEAT (*TRITIVUM AESTIVUM* L.)

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Abstract

Wheat is the most important food crop in India after rice. Total production of wheat worldwide during 2017 was 754.31 million tonnes whereas India contributed 97.4 million tonnes. The field experiment under present investigation was conducted during *rabi* season 2017-18 at Agricultural Research Farm of B.R.D.P.G. College (Campus), Deoria (U.P.). The experiment was conducted to evaluate 72 wheat germplasm line in normal soil under timely sown and irrigated condition with Augmented Block Design. 72 wheat genotypes were investigated to understand the extend of genetic diversity through 14 quantitative traits. Mahalanobis D_2 analysis established the presence of wide genetic diversity among these genotypes by the formation of I different non-over lapping clusters. Cluster I had highest number of genotype 15, followed by cluster VI with 14 entries, cluster III with 11 entries, cluster II with 10 entries, cluster VII with 9 entries cluster iv with 6 entries, cluster VI with 5 entries, cluster V had 4 entries and cluster IX represented by only one entry. Higher inter cluster distance indicated greater genetic divergence between the genotypes of those clusters while lower inter-clusters were not much genetically diverse from each other. The inter and intra cluster group mean show that cluster mean for different traits indicated considerable differences between cluster.

STUDIES ON THE EFFECT OF PLANT GROWTH REGULATORS AND NUTRIENTS IN KINNOW MANDARIN

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Abstract

The present experiment entitled the "Studies on the effect of plant growth regulators and nutrients in Kinnow mandarin" was conducted at Chaudhary Farm House, Village Malapur, Hisar during the year 2015-16. Citrus fruits are an excellent source of vitamin C with fair amount of minerals such as calcium, phosphorus and iron and vitamin A and B.Kinnow, a mandarin, is commercially cultivated due to its good yield, high processing quality, fresh consumption, aromatic flavour and better adaptation to agro-environmental conditions, however, fruit drop is one of the major reasons of low productivity of Kinnow in India. Although few reports on the effect of 2,4-D on fruit drop and yield of Kinnoware there in the literature but the effect of growth regulators on fruit drop and yield of Kinnow has not yet been evaluated. Hence, the present study was undertaken. The treatments comprising of 2,4-D 10, 15 and 20 ppm, GA_3 10, 15 and 20 ppm,$K_2SO_4$1%, 1.5% and 2% and $ZnSO_4$0.25%, 0.50% and 0.75% along with control were laid out in randomized block design with three replications. The data were recorded on initial fruit set, fruit dropi.e June drop and Pre-harvest fruit drop, number of fruits per plant, fruit yield, final fruit retention. For recording data on these parameters, thirty nine plants were randomly selected in the orchard.The maximum initial fruit set was recorded in treatment $ZnSO_4$ 0.25% (57.33%) and minimum initial fruit set was recorded in treatment 2,4-D 15 ppm (52.33%). The minimum June drop was recorded with foliar application of 2,4-D 20 ppm (44.96%),whereas, the maximum fruit drop was recorded with control treatment (57.24%). The maximum pre-harvest drop was found in treatment 2,4-D 20 ppm (12.69%)and maximum pre-harvest drop was found in control treatment (16.25%). The highest number of fruits per tree was obtained from the plant sprayed with 2,4-D 20 ppm (611.63), while the minimum number of fruits per plant was recorded under control treatment (538.59).The maximum fruit yield was obtained in treatment 2,4-D 20 ppm (100.55 kg/plant) and the minimum fruit yield was registered under control treatment (86.51kg/plant). The maximum fruit retention was recorded with the treatment 2,4-D 20 ppm (26.32%).

IN-VITRO CONSERVATION OF PLAN BIODIVERSITY

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Abstract

Plant biodiversity is the totality of plant species, genes and ecosystem of a region. Plant biodiversity conservation is a global concern. It has been established that one third of the global plant species are threatened in different level according to the "International Union of conservation of Nature." The Threat to rapid loss and extinction of genetic diversity due to disturbance of ecosystem, distraction of habitats, climate change, pollution, human population pressure, ever increasing agricultural pressure and practices etc. are responsible factors. Long term conservation of plant biodiversity by in situ methods have several problems and limitation. Therefore certain *in vitro* techniques such as plant cell culture, plant tissue culture, micro propagation, anther culture, ovule culture, embryo culture, endosperm culture, cryopreservation are useful and applicable techniques fro *ex- situ* conservation. Plant biodiversity will not only help in increasing agricultural productivity but also in developing disease resistant varieties. Advances in plant bio technology provided new options for collection, multiplication and for collection, multiplication and short to long term conservation of plant biodiversity, using in vitro techniques.

INFLUENCE OF GROWING CONDITIONS ON ECONOMY OF SUMMER SQUASH PRODUCTION

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Abstract

Summer squash (*Cucurbita pepo*) is a tender, bushy and very nutritious cucurbit vegetable. It is grown in many temperate and subtropical regions, ranking high in economic importance among vegetable crops worldwide. To study the influence of two growing conditions (open field and naturally ventilated polyhouse) on the economy of summer squash production, the experiment was carried out with ten varieties of summer squash namely ASV- 3098, Cora, Cheongma, Champion, Catherina, Golden Yellow, Green Star, Long green, Sunny House and Yellow Zucchini collected from different sources. The experiment was conducted during the rabi season of 2016-17. Field plot was laid out in a randomized block design (RBD) using three replications. The economic analysis of summer squash was carried out for three months and it was estimated that cultivation under naturally ventilated polyhouse significantly adds to the cost of cultivation as compared to open conditions with plastic mulch. Cost of cultivation was significantly higher under polyhouse condition than open field condition. Subsequently, the best B:C ratio obtained was 2.89 in variety Champion under open growing condition with plastic mulch and 2.03 in Cora under naturally ventilated polyhouse. Therefore, to save the cost of cultivation under polyhouse, it is recommended that variety Champion can be grown in open conditions with plastic mulch for off-season cultivation at the farmer's field under *tarai* condition of Uttarakhand.

STUDIES ON POMEGRANATE PROPAGATION THROUGH CUTTINGS

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Abstract

An experiment was conducted at the Centre for Quality Planting Material, CCS Haryana Agricultural University, Hisar in the year of 2017 to study pomegranate propagation through cuttings. The treatments comprised of ten different rooting media T_1: Sand; T_2: Cocopeat; T_3: Cocopeat + sand (1:3); T_4: Cocopeat + vermicompost (4:1); T_5: Cocopeat + perlite + vermicompost (4:1:1); T_6: Cocopeat + perlite + vermicompost (6:1:1); T_7: Cocopeat + perlite + vermicompost (8:1:1); T_8: Cocopeat + perlite + vermiculite (4:1:1); T_9: Cocopeat + perlite + vermiculite (6:1:1); T_{10}: Cocopeat + perlite + vermiculite (8:1:1), time of

planting cuttings (February and March), IBA treatment (IBA 2000 ppm and without IBA). All the treatments were effective in improving the shoot parameters, however, the cuttings planted in the month of February after giving IBA 2000 ppm treatment and planted in the media combination of cocopeat, perlite and vermicompost in ratio of 4:1:1 was found superior. All the shoot parameters including number of sprouts per cutting, sprouted cutting percentage, sprouted cutting survival percentage, plant height, stem diameter, number of leaves, shoot fresh weight and shoot dry weight significantly increased in cuttings planted in the month of February after giving IBA 2000 ppm treatment and planted in the media combination of cocopeat, perlite and vermicompost of 4:1:1 ratio. The number of days taken for sprouting and root to shoot ratio was found minimum in cuttings planted in the month of February after treatment with IBA 2000 ppm and planted in the cocopeat, perlite and vermicompost media in ratio of 4:1:1. The content of chlorophyll (a, b and total), Nitrogen, Phosphorus and Potassium was found maximum in leaves of pomegranate taken from cuttings treated with IBA 2000 ppm and planted in cocopeat, perlite and vermicompost media (4:1:1) in February month.

INFLUENCE OF DIFFERENT BIOFERTILIZERS AND ORGANIC MANURES ON QUALITY OF STRAWBERRY *(FRAGARIA × ANANASSA DUCH.)* C.V. CHANDLER

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Abstract

Use of bio fertilizers is one of the important components of integrated nutrient management, as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable horticulture. Several microorganisms and their association with crop plants are being exploited in the production of bio fertilizers. There is a tremendous pressure on non-renewable energy resource to meet the ever-increasing demand of quality fruits. Hence, it has become imperative to turn to more eco-friendly method of nutrition management in horticultural crops of which bio fertilizers stands with prime importance. So, that the aim of the present study was to find out the effect of different Biofertilizers and Organic manures on quality of Strawberry *(Fragaria×ananassa* Duch.*)* cv. Chandler." An experiment was conducted at research field, Department of Horticulture, Allahabad School of Agriculture, Sam Higgibottom Institute of Agriculture, Technology & Sciences, Allahabad during the months of November 2015 to March 2016; the experiment was laid out in a Randomized Block Design having 12 treatments of bio-fertilizers and organic manure at different levels and three replications. The treatments are Treatments T_1 Control(RDF), T_2 (Phosphobacter 5kg/ha + Azatobacter 5 Kg/ha),T_3 (Phosphobacter 5kg/ha + Azatobacter 5 Kg/ha +FYM 25 t/ha), T_4 (Phosphobacter 5kg/ha + Azatobacter 5 Kg/ha + Poultry manure 12 t/ha), T_5 (Phosphobacter 5kg/ha +Azatobacter 5 kg/ha + Vermicompost 12 t/ha), T_6 (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha + FYM 13 t/ha), T_7 (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha + Poultry Manure 6 t/ha), T_8 (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha + Vermicompost 6 t/ha), T_9 (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha +FYM 13 t/ha +Poultry manure 6 t/ha), T_{10} (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha + FYM 13 t/ha +Vermicompost 6 t/ha), T_{11} (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha + Vermicompost 6 t/ha + Poultry Manure 6 t/ha), T_{12} (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha + FYM 6 t/ha + Vermicompost 3 t/ha + Poultry Manure 3 t/ha]. The result revealed that treatment T_{12} (Phosphobacter 5kg/ha + Azatobacter 5 kg/ha + FYM 6 ton/ha + Vermicompost 3 ton/ha + Poultry Manure 3 ton/ha) was found to be best in terms of TSS (8.54 ^{0} B), acidity (0.46%), pH of juice (4.40) over other treatments.

EFFECT OF PLANT-PARASITIC NEMATODES ON WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

Wheat is cultivated in the world over a large area and under different climatic conditions ranging from sub-tropical to temperate. India is the second largest producer of wheat in the world after China. Next to rice, wheat is the most important

food-grain of India and is the staple food of millions of Indians, particularly in the northern and north-western parts of the country. Plant-Parasitic Nematodes (PPNs) are the important biological constraints limiting the wheat production. PPNs are important pathogens of many agricultural crops worldwide. The most common and damaging PPNs are the root-knot (*Meloidogyne* spp.), cyst (*Globodera* and *Heterodera* spp.), burrowing (*Radopholus* spp.) and root-lesion (*Pratylenchus* spp.) groups. *Pratylenchus thornei* (Sher et Allen) is one of the root-lesion nematode that is considered important plant pathogen. It has a worldwide distribution and has been reported in many countries, including Algeria, Australia, Canada, India, Israel, Italy, Mexico, Morocco, Pakistan, Syria, Turkey and Yugoslavia. A nematicide that can be safely applied to growing plants and is translocated to the roots in sufficiently large amounts to kill endoparasitic or ectoparasitic nematodes has not been discovered. Methyl bromide is considered to be a most reliable material for soil fumigation because of its high vapour pressure. However, Methyl bromide has been classified as a highly toxic chemical for human beings and other mammals. Therefore, development of resistant cultivars is the most efficient and cost-effective option for protecting crops against PPNs in low-value cropping systems as nematicides are prohibitive in cost and can have deleterious environmental effects. Crop rotation is one option for management of this pathogen, but its broad host range makes finding crops to rotate difficult.

BAGGING IN FRUIT CROPS: A TECHNOLOGY FOR QUALITY IMPROVEMENT

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Abstract

During the growth and development of fruits undergo several physical and chemical changes and are susceptible to insect pest infestations, various pathogens and mechanical damage, all of which can reduce their commercial value and thereby cause significant yield and economic losses. To prevent the losses caused by biotic and abiotic factors, several good agricultural practices like bagging of individual fruits becoming popular throughout the World. The development of alternative techniques to improve the appearance and quality of fruits and to reduce diseases and insect infestations is becoming increasingly important as consumer apprehension over the use of manmade agro-chemicals and environmental awareness increases. Bagging is a physical safeguard technique commonly applied to many fruits like mango, guava, peach, apple, longan etc. Thus, more emphasis is being placed on reducing the use of pesticides to ensure worker safety, consumer health, and environmental protection. So, Pre-harvest fruit bagging is an emerging, as one of the new technologies for gaining fruits with very good size and quality fruits. Bagging is the procedure of covering individual fruits with specially designed different materials like degradable plastics, newspapers and coloured bags. Bagging of fruits prior to harvest is the well-known alternative to avoid adverse effect by causing physical damage and improve the commercial value of the fruit, namely, improving fruit coloration, reducing splitting mechanical damage, sunburn of the skin etc. It also provides an estimation of the number of harvestable fruits on a tree. It also helps to produce cleaner fruit skin with impressive colours. Preharvest cultural practices and environmental conditions during fruit development profoundly influence post harvest performance and final quality of the fruits.The affected fruits getting poorer price in the market and such fruits are also rejected for processing. It causes serious economic loss to fruit growers. It can, not only, protect the fruit from diseases and pests, but also, change the micro environment of fruit development, which exerts multiple effects on the growth and quality of fruits.

MOLECULAR EVALUATION OF STERILITY MAINTAINERS AND FERTILITY RESTORERS FOR WILD ABORTIVE RICE CYTOPLASM

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Abstract

A set of forty-five test crosses involving two wild abortive type cyto-sterile lines and twenty-eight pollen parents was evaluated to assess pollen and spikelet fertility restoration for identification of sterility maintainers and fertility restores of wild abortive cyto-sterility system in rice. Using a panel of thirty-two microsatellite primers, genetic polymorphism at

molecular level was examined for characterization and differentiation of sterility maintainers and fertility restorers identified among pollen parents. Analysis of pollen and spikelet fertility in test crosses clearly reflected the sterility maintaining ability of pollen parents TCP-134-2, TCP-150-1, TCP-188-3 and TCP-185-3. Similarly, the pollen parents TCP-17-1, TCP-28-3, TCP-86-1, TCP-174-4, TCP-104-1, TCP-183-1, TCP-190-3, TCP-191-3 and TCP-193-3 were identified as effective fertility restorers. Altogether 256 allelic variants including 112 unique alleles and 144 shared alleles were identified with an average of 8.0 alleles per primer using a panel of 32 primer pairs covering all the chromosomes, The primer targeting tri-nucleotide and di-nucleotide repeat motifs, in general, detected more allelic variants than primers targeting tetra-nucleotide repeat motifs. Further, primers with GA, TG, AC, CT and TA di-nucleotide repeat motifs detected more allelic variants than the primers with TC and AG di-nucleotide repeat motifs. The primer pairs RM 216, RM 6100, RM 280, RM 3873, RM 10313, RM 558, RM 250, RM 283, RM 171, RM 3233, RM 341, RM 427, RM 206, RM 5373, RM 152, RM 591, RM 524 and RM 17 appeared to be highly polymorphic and comparatively more informative for the purpose of molecular profiling of entries. Analysis of divergence pattern allowed discrimination of effective fertility restorers from partial fertility restorers and complete sterility maintainers. Clustering pattern of the entries based on hierarchical classification, neighbour joining tree and principal co-ordinate analyses yielded more or less similar results. Allelic diversity data generated from amplification pattern of the six fertility restoration related primer pairs, namely, RM 591, RM 1108, RM 3233, RM 3873, RM 6100 and RM 8146, also unambiguously discriminated eight effective fertility restorers from two partial fertility restorers and four complete sterility maintainers. Therefore, these six primer pairs were validated with sufficiently greater efficiency (94.4%) for identification of sterility maintainers and fertility restorers of wild abortive type cyto-sterility sterility system in rice.

ASSESSMENT OF POSTURAL DISCOMFORT AMONG FARM WOMEN DURING VEGETABLE CULTIVATION

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Abstract

Farmwomen perform hard physical work in plantation of crops, care and management, harvesting, threshing/processing, marketing, bartering of produce, child bearing and rearing simultaneously. The farmwomen undergo hard physical drudgery especially while vegetable transplanting with bending position for a long time in rains and scorching sun, harvesting by bending with traditional sickle, weeding by hand in sun, rain and cold for a long hours, drying of produce, standing in scorching sun, winnowing in dust and sun for a long time by traditional arduous methods with hard physical labour, dehusking/ shelling, pounding, grinding of cereals, pulses by hand as well as hand operated chakki. These are the main causes of hazards for developing various kinds of musculoskeletal disorders among women performing vegetable cultivation. Since people vary greatly in size and spent most of the day time in a static standing position incorporating ergonomics into workstation that accommodate various sizes of women can be difficult task. Therefore, study was conducted with the main objective to study to assess physical parameter and postural discomfort during various vegetable cultivation activities. Total 20 women were randomly selected for the ergonomic assessment. The descriptive type of research design was used. The average working heart rate values were up to acceptable limits whereas, the peak heart rate values (HR25-35 – 110.93; 111.44; HR35-45 – 106.22, 110.58 beats/ min.) were beyond acceptable limits. Both average and peak heart rate values were significantly related with elder age group, indicating work to be stressful especially with increase in age. Thus, it is recommended to generate awareness regarding faulty working habits and to develop women friendly technologies to improve efficiency and output of women workers.

IDENTIFICATION AND MAPPING OF GENE(S) FOR RESISTANCE TO BPH IN RICE (*ORYZA SATIVA* L.)

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ABSTARCT

Identification and the incorporation of new BPH resistance genes into modern rice cultivars are important breeding strategies to control the damage caused by new biotypes of BPH. DNA marker based technology is being increasingly used to overcome

difficulties of plant breeding based on phenotypic characters like insect resistance. Molecular breeding approaches facilitate the early and efficient selection for resistance genes. Simple sequence repeats (SSR) or Sequence Tagged Microsatellite Site (STMS) markers are tandem repetitions of mono, di, tri or tetra nucleotide units. Studies in various organisms provide evidence that the number of microsatellite sequences in a genome, their length, composition, mutation rate and chromosomal distribution can vary drastically among taxa (Temnykh *et al.,* 2000). These features coupled with the ease of detection and transferability between laboratories has made them an excellent marker system for genome analysis. Simple sequence repeat (SSR) marker loci are widely distributed in the rice genome and can be easily analyzed using PCR (Mc Couch *et al.,* 2002). SSR markers have been extensively used to map rice for disease and insect resistance.

The gene mapping involves identification of polymorphic markers between parents and establishing marker- trait association using segregating populations. QTL mapping involves construction of genetic maps and searching for relationship between traits and polymorphic markers. A significant association between traits and the markers is the evidence of QTL near the markers. In rice, a substantial progress has been made to identify and map several genes conferring BPH resistance. Now, efforts are underway to refine the map positions of important BPH resistance genes and QTLs using molecular markers to enable marker assisted selection for BPH resistance in breeding programmes.

STATUS OF *IN VITRO* PROPAGATION OF BREADFRUIT (*ARTOCARPUS ALTILIS*)

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Abstract

Breadfruit (*Artocarpus altilis*, Moraceae) is one of the staple food in many tropical regions due to good source of carbohydrate (76.7%), protein (1.07%), and nutritional energy (431kJ). Fruit can be readily consumed at all stages of maturity in diverse usage. Generally there are two types of cultivars such as yellow fleshed and white fleshed which are known to both seeded and seedless. These seeded cultivars propagated by seed while seedless cultivars multiplied throughroot suckers and air layering.The area under cultivation of breadfruit has limited due to difficulty in propagation.*In vitro* multiplication of bread fruit is difficult due to its woody nature leads to more phenolic browning and contamination. However, number of protocols for multiplication usingauxiliary shoot tips (0.5–1.00 cm) have been performedin many regions of world with an inadequate accomplishmentbut supply is very limited andthose are not yet commercial scale. So standardization of *invitro* propagation protocol in bread fruit for rapid and uniform production of planting material in order to reduce the long juvenility thereby making it available throughout the year and indirectly aiding in conserving the germplasm. Hence breadfruit need systematic studies for *in vitro* propagation.

HIDDEN HARVESTING: AN ALTERNATE STRATEGY TO PRODUCE DECONTAMINATED PRODUCE

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Abstract

The rapid increase in the anthropological activities such as urbanization, industrialization and deforestation gradually causing the climate change which is attributed to contamination of soil, water and air. The soil in the urban area is greatly contaminated with toxic chemicals and hazardous heavy metals which is responsible for production of ultimate contaminated end product. Hidden harvesting is one of the novel strategy to obtain a decontaminated produce from contaminated soil and is the most useful in region with great threat of soil contamination. The principle of this strategy is to take use of affected area for cultivation of fruit trees, vegetables and flowers, with knowledge of natural biological barriers which trees have to filter out contaminants before they reach the fruit. However the inhibition of uptake of soil pollutants by the trees due to the action of numerous natural barriers. The dilution of soil contaminants at root zone as a result reduced transportation from soil to root,

root to shoot and shoot to fruit barriers which indicates that the obtained fruits and nuts are expected to have lowest contaminants levels of all plant tissues.These fruiting and nutting trees can be grown directly in the contaminated land whereas vegetables and flowers may be grown by building raised bed garden and container garden.Adoption of several recommended risk mitigation measures along with hidden harvesting strategysuch as washing fruits, peel out the vegetable before cooking, eating, adding clean soil in the affected area in order to dilute the soil concentration. Hence hidden harvesting need more systematic studies and this strategy could be further exploited to overcome the problems related to food security and malnutrition,in that wayproducing healthy and risk free foods.

INFLUENCE OF WEED AND FERTILIZER MANAGEMENT ON NUTRIENT DEPLETION BY SOYBEAN (*GLYCINE MAX*) CROP IN VERTISOLS OF S-E RAJASTHAN

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Abstract

Slow initial growth rates of soybean and heavy rainfall during growing season provide congenial environment for abundant population and growth of weeds. To minimize the magnitude of nutrient drain by weeds and more effective utilization of fertilizer by crop plant require the control of weeds. Herbicides causes an appreciable decrease in nutrient depletion by weed growth as a consequence of which considerable improvement in nutrient uptake at the crop plants and enhancement in crop yields occurred. Therefore, an attempt was made to develop the suitable weed management practices for decreasing the nutrient removal by weeds and increasing the uptake by soybean crop and it yield. The experiment was conducted in split plot design comprising twelve weed control treatments in main plots viz. Two hand weeding at 30 and 45 days after sowing (DAS); Alachlor 2.0 kg ha^{-1} as pre-emergence (PE); Alachlor 2.0 kg ha^{-1} + one hand weeding at 30 DAS; One hand weeding (HW) at 30 DAS; Chlorimuron-ethyl (CE) 9 g ha^{-1}; Fenoxaprop-p-ethyl (FPE) 70 g ha^{-1}; Quizalofop-ethyl (QE) 50 g ha^{-1}; Chlorimuron-ethyl + Fenoxaprop-p-ethyl (9 + 70 and 6 + 50 g ha^{-1}); Chlorimuron-ethyl + Quizalofop-ethyl (9+50 and 6+37.5 g ha^{-1}) as post-emergence(POE) and three fertility levels (75% of recommended dose of fertilizers (RDF), 100% and 125% RDF) in sub plots. The soil was clay-loam with 367 kg available N, 24.0 Kg P and 310 Kg K ha^{-1}. Soybean cv. "Pratap Soya" inoculated with Rhizobium culture and was sown with the on set of monsoon. The results revealed that weeds in soybean depleted the soil fertility by removing 69.2 Kg N, 12.4 Kg P and 76.7 Kg K under unweeded check. Alachlor 1.0 kg PE + 1 HW at 30 DAS and tank mix application of chlorimuron-ethyl + fenoxaprop-p-ethyl at 9+70 and 6+50 g ha^{-1} at 10-20 days after sowing significantly reduced the NPK depletion by 171.83% N; 165.14P and 141.74 per cent over weedy situation by both categories of weeds while their alone applications proved effective in reducing the nutrient removal by individual weed categories. Pre-emergence alachlor @ 1.0 $Kgha^{-1}$ followed by one hand weeding at 30 days and tank mixture of chlorimuron-ethyl + fenoxaprop-p-ethyl (9+70 and 6+50 g ha^{-1}) resulted in significant reduction in total nutrient removal by weeds and significant improvement in nutrient uptake by soybean and consequently gave higher seed yield (22.07, 22.21 & 22.52 q ha^{-1}) respectively. Nutrient application at recommended level and to the extent at 125 percent, resulted in significantly higher nutrient uptake by all the weed species individually and in totality and gave higher seed yield also.

GENETIC VARIABILITY STUDIES IN CLUSTER BEAN [*CYAMOPSIS TETRAGONOLOBA* (L.) TAUB]

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Abstract

An present investigation was carried out at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences Allahabad during during Kharif 2016-17. Fifteen genotypes of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] were evaluated to estimate variability, broad sense heritability and genetic advance over mean for vegetable pod yield and related attributes. Maximum range of variability was observed for plant height 90 days (cm), number of branches 90 days, fruit clusters per plant, pod/plant, pod yield per plant (g) and pod yield/ha (q). High heritability coupled with high genetic gain in percentage was observed for all studied traits excepted days to 1st flowering, days to 50% flowering, days to 1st pod picking, pod width, pods/cluster. Showed high genotypic coefficient of variation as well as high phenotypic coefficient of variation was recorded for number of

branches/plant 45 days while recorded minimum for days to 1st pod picking. The results of present investigation suggested that selection based on plant height 90 days (cm), number of branches 90 days, fruit clusters per plant, pod/plant, pod yield per plant (g) and pod yield/ha (q) might bring simultaneous improvement in vegetable pod yield of cluster bean.

VARIABILITY, CORRELATION AND DIVERGENCE STUDIES IN CLUSTER BEAN (*CYAMOPSIS TETRAGONOLOBA* L.)

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Abstract

Cluster bean is the most important horticulture crop in terms of industrial utilization. There was many research had done in the field of cultivation of the cluster bean. The present investigation entitled, "Variability, correlation and divergence studies in cluster bean [*Cyamopsis tetragonoloba* (L.) Taub]" was undertaken to study the extent of variability, heritability (b.s.), genetic advance, correlation, path analysis and genetic divergence among fifteen diverse genotypes of cluster bean during summer, 2016 at Horticulture Research Farm, Department of Horticulture, SHUATS, Allahabad. The treatment mean sum of squares for Analysis of variances were significant for all characters studied, suggesting the presences of variability in genotypes evaluated. The cluster bean genotype Sukomal identified as desirable with pod yield per ha. (q) and RGC-1047 for seed yield per ha. (q). PCV is higher than GCV for all most of the characters. The estimates of GCV and PCV were high in magnitude for branches 45 days, ten fresh weight, branches 90 days indicating the presence of good amount of variability for these characters. The correlation coefficient at genotypic level is higher than corresponding phenotypic level, indicating that there is a strong association between these traits and pod yield genetically. Pod yield/plant showed significant and positive correlation with plant height 45 days, number of pods/plant and days to 50% flowering at both phenotypic and genotypic level. Seed yield/plant (g) showed non-significant and positive correlation with fruit cluster/plant, pod/cluster and 100 seed weight at both phenotypic and genotypic level. Pods/plant had positive direct effect on pod yield/plant. It exhibited positive indirect effect through days to taken 1st flowering, days to 50% flowering. Cluster II was the largest cluster having (6) genotypes followed by cluster I (5), cluster III (4). Cluster IV (1) of each cluster. The maximum intra-cluster distance was found in cluster IV followed by cluster I and cluster III. The cluster II was monogenotypic and recorded the least value (0). The maximum inter-cluster distance was observed between cluster II and cluster III (13811.78) followed by cluster IV (8357.305). Hence, these genotypes can be utilized as parents in further hybridization programme.

EFFECT OF MOLYBDENUM, BORON AND SALICYLIC ACID APPLICATION TO SOYBEAN SEEDS USING POLYMER COATING ON PLANT GROWTH AND SEED YIELD

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Abstract

Salicylic acid (SA) in combination with boron (B) and molybdenum (Mo) was applied to soybean seeds as thin layer polymer coating in different doses to study its effect on soybean plant growth, yield, seed quality and tolerance to field weathering. Salicylic acid is reported to induce abiotic as well as biotic stress tolerance. Boron is key element for embryo development and molybdenum for better nodule formation and more nitrogen fixation. Three doses of SA (25, 50 and 75 ppm) were applied in different combination with 1g molybdenum and 200mg boron. Highest seed yield was obtained with 75ppm SA, 1g Mo and 200mg B application to seed. All the doses of SA were found to be effective to control disease incidence. SA, Mo and B were effective to improve seed quality. Maximum seed germination (90%) was obtained in 75ppm SA, 1g Mo and 200mg B application to seed as compared to control (76%). Comparative improvement in seed yield was also obtained with 75ppm SA application to seed but seed quality in combination with molybdenum and boron was higher. Plants form all the treatments were left in the field beyond harvesting stage to see the interaction of treatments with field weathering. The treatment combination of 75ppm SA, 1g Mo and 200mg B was found significantly effective to reduce the effect of field weathering and maximum seed germination after field weathering was 76 per cent as compared to control 56 per cent. 20 per cent gain in germination was achieved even if crop was exposed to adverse condition.

SCREENING OF INDIAN SOYBEAN VARIETIES FOR RESISTANCE TO FIELD WEATHERING

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Abstract

Hundred and ten varieties were given field weathering treatment to screen the resistant variety. They were harvested 15 days delay from harvest maturity coupled with water spray. Seed quality /seed germination was tested after harvest of field weathered seeds. It was found that variety MAUS 61-2, JS2034, NRC 37 , RVS 2001-4 and Kalitur were least affected to field weathering and maintained higher germination more than 80% even after field weathering. Most susceptible varieties for field weathering are Davis, SL 295, PS564, PS1024, PK416, PS262 NRC 7 and Bragg. The germination pattern of soybean varieties as influenced by natural rain during harvest maturity was studied and it was found that out of 110 varieties germination of 31% varieties was above **70%**, 39% varieties between **50-70**% and 27% varieties between **20-50**%. Among the late and medium maturity group JS 97-52, ADT-1, CO Soya 1, CO Soya 3, Hara Soya, Durga, VLS 47, Punjab 1 were less affected due to harvest rain than early varieties and had more than 80% germination. The variety which got rain (JS 9560, PRS1, LSB1) during maturity had shown maximum loss with maximum number of dead seeds due to weathering. It was found that Hara Soya, Hardee, JS 9752, JS 20-29 and PS1029 yielded the best against adverse climatic condition and field weathering

DEVELOPMENT OF ORGANIC PACKAGE FOR SYSTEM BASED HIGH VALUE CROP (SOYBEAN–DURUM WHEAT)

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Abstract

A field study carried out on organic package from 2005 – 06 to 2014 – 15 revealed that Soybean – Durum Wheat 100% chemical fertilizer application gave significantly higher yield (16.29 q/ha and 46.09 q/ha) WEY (63.78 q/ha) NMR (51185.85 Rs./Q) and B:C ratio (2.71) as compared to (50% NPK + 50% N as FYM) and 100% organic fertilizer (1/3 FYM + 1/3 vermin compost +1/3 neem cake). The total uptake of major nutrient NPK increased significantly in all the treatments while soil properties viz. OC and ECds/m were improved under all the treatments. The farmers of M.P. state using large quantity of fertilizer as well as pesticides for getting good yield from recommended varieties of all the crops which badly affecting the eco-system of health. The scope of organic farming varies according to soil climate, cropping system, vegetation, irrigation, allied enterprises as well as harmony between different components. However, the basic nutritional components of biological farming are organic manures such as farm yard manure, enriched compost, green manure, besides the mandatory recycling of crop residue and applied of bio-fertilizers and bio-pesticides. Recycling of crop residue may be a potential organic source to sustain the soil health. Incorporation of crop residue of either rice or wheat increase the yield of rice and nutrient uptake and also improve the physico – chemical properties of the soil ensuring better soil environment for crop growth.50% recommended NPK through fertilizer + 50% n through FYM to both crops (soybean – wheat) stable yield and total productivity of the system. A significant improvement in soil properties also takes place.Sustainable agriculture is possible only when integrated nutrient management system is adopted by the farmers. It hold more promise for small and marginal farmers who are resource poor and cannot afford full package of fertilizer application through inorganic source.

THREAT ASSESSMENT OF MEDICINAL PLANT BIODIVERSITY IN VINDHYAN REGION OF UTTAR PRADESH

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Abstract

Medicinal plants are one of the important components of plant biodiversity, which are economically important and essential for health security. It has been identified as one of the most important plant diversities for rural development. The forest areas

in the state of Uttar Pradesh are very rich in variety of medicinal plant species particularly in the Vindhyan region where various medicinal plants grow naturally. But due to negligence, industrialization, overgrazing, overexploitation and ignorance and adverse climatic conditions, medicinal plant diversity of Vindhyan region is depleting very fast. Therefore, present study was conducted to document medicinal plants diversity in Vindhyan region and there threat status in the region. Under this study a survey was conducted in selected blocks of Mirzapur and Sonbhadra districts by personnel contacts and interview with the local people. Major thrust has been given on contact with local people and *Vidhya* who are directly concerned and have been in close proximity since 30-40 years with in the natural forest. The information on availability of species during 30-35 year back and at present time was gathered from the respondents and matched to know the threat status of a species. This information was also verified by the field visits in different localities. Species were grouped under different categories of threat and tabulated along with their ethno medicinal uses. Highest numbers of species were grouped under vulnerable category which includes *Tinospora cordifolia, Gymnema sylvestris, Euphorbia lingularia, Cissus quandrangularis, Withania somnifera, Asparagus racemosus* etc. Among all the species *Pueraria tuberosa, Gloriosa superva, Strychnos nux-vomica, Chlorophytum tuberosum Litsea glutinosa, Mucuna pruriens, Raulfia serpentina, Piper longum, Acorus calamus etc.* were found under the category of endangered species and have high risk of extinction from the region. Most of the threatened species are herbs and climbers. Therefore, there is urgent need to prioritize useful threatened medicinal plants and conserve them *in-situ* and *ex-situ* for sustainable utilization in health security, otherwise these species may get extinct from the region in near future.

MANAGEMENT OF SOIL HEALTH BY INTEGRATED FARMING SYSTEM

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Abstract

Integrated farming system plays an important role in maintenance of soil health by increasing nutrients availability in soil, improving the physical condition of the soil like improving water holing capacity, aeration and aggregation stability and higher microbial activity. The farmers concentrate mainly on crop production which is subjected to a high degree of uncertainty in income and employment to the farmers. It is imperative to evolve suitable strategy for augmenting the income of a farm. Integration of various agricultural enterprises *viz.,* cropping, animal husbandry, fishery, forestry etc. have great potentialities in the agricultural economy with this we can also improve the soil health by using the by-products of individual IFS enterprises helps to build up soil organic carbon. By-products from the IFS enterprises are used as raw materials for preparation of bulk organic manures like Compost, Enriched Compost, Vermicompost, Vermiwash and FYM *etc*. Organic matter in soils plays an essential role in improving soil physical, chemical and biological processes. Soil organic carbon is one of the most important indicators of soil quality and soil health which can be maintained by incorporation of residues produced from IFS enterprises into soil. Also conservation measures including conservation agriculture, good agricultural practices and integrated plant nutrient sources. Further, problematic soils management with proper soil amendments is very essential for accelerating productivity and enhancing soil health for future productivity.

STANDARDIZATION OF NURSERY TECHNIQUES : A TOOL FOR CONSERVATION AND DOMESTICATION OF *BUCHANANIALANZAN* (CHIRONJI)IN VINDHYAN REGION OF UTTAR PRADESH

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Abstract

Buchananialanzzan (Chironji) is a medium sized highly valuable threatened minor fruit tree species of family Anacardiaceae which is generally found in dry deciduous forest of central India. The species was in abundance in the past, at that time it was the backbone of rural economy and nutritional security of tribals particularly in Bundelkhand, and Vindhyan region of Uttar Pradesh. Due to some natural and anthropogenic causes, the species population is depleting very fast from its natural habitat.

Therefore, in order to augment its depletion, species needs to be brought under large scale plantation in its natural habitat as well as domestication on farmer's field under Agri-horticulture system of agroforestyry. But, Chironji is not generally preferred by the farmers for domestication, even though it has very good prospects in livelihood security and economic development of the farmers. It may be due to very hard propagation ability, non-availability of seedlings in the nursery and slow growth rate of the Chironji plants. To solve this problem quality planting stock production in the nursery is the first and important step in this direction. In this regard, present study was done during 2012-2014 to develop package and practices for better seed germination and production of good quality Chironji seedlings. Therefore, from the present study it can be recommended that seed storage in tin containers, pretreatment of seed by mechanical breaking of seed coat, seed sowing at 0.5-1.0 cm depth in 6 x 12 and 4 x 8 inch poly bags filled with red soil + FYM (1:1) or red soil + sand + FYM (2:1:3) must be preferred to produce good quality and quantity of seedlings which can withstand harse climatic and edaphic conditions of chironji growing areas. By this way it will promote and popularize large scale plantation of *B. lanzan*in natural forest as well domestication in the farm lands under Agri-horticulture system of agroforestry, Therefore, present findings will be helpful in conservation of the species and improving livelihood of the farmers.

BIOTECHNOLOGICAL INTERVENTIONS FOR DROUGHT TOLERANCE IN PEARL MILLET [*PENNISETUM GLAUCUM* (L.) R.BR.]

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Abstract

A field experiment was conducted to study varietal characterization and effect of drought stress on morpho-physiological, biochemical and molecular characters in seven hybrids of pearl millet *viz*. HHB-67, MPMH-17, RHB-173, GHB-558, GHB-744, MP-7792 and GHB-732. Results showed that plant height, days to 50% flowering, days to maturity; ear head length, girth & weight; test weight; seed, stover & biological yield and harvest index were recorded maximum in MP-7792 over other hybribs of pearl millet. Plant height, days to 50% flowering and days to maturity were minimum recorded in HHB-67. Relative water content (RWC), membrane stability index (MSI), chlorophyll and carotenoid content; total soluble sugars (TSS), proline & protein content and antioxidants (catalase, guaiacol peroxidase, superoxide dismutase were highest recorded in hybrid MP-7792 than other hybrids of pearl millet. RWC, MSI and carotenoid content were minimum recorded in hybrid MPMH-17 whereas chlorophyll content was minimum recorded in hybrid GHB-732. All the hybrids of pearl millet showed diversity in accounts of RAPD analysis. The clustering analysis separated all the seven isolates in three major groups. Group A included HHB-67, RHB-173 & GHB-732 isolates, Group B included GHB-558, GHB-744 & MP-7792 isolates whereas, Group C included isolate of MPMH-17. On the basis of this morpho-physiological, biochemical and molecular observations, it may be concluded that MP-7792 have higher seed production potential that other hybrids of pearl millet and found best suited among the hybrids studied.

INCREASING PRODUCTIVITY AND PROFITABILITY OF WHEAT (*TRITICUM AESTIVUM* L.) IN RWCS UNDER FLDS : A WAY TOWARDS DOUBLING FARMER'S INCOME

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Abstract

Nutritional food security is an important issue and wheat has pivotal role in ensuring food security in the country. Adoption of faulty practices by majority of farmers' in eastern U.P. under rice-wheat cropping system has resulted in deterioration of soil health and environmental pollutions with hampering food security by producing lower grain yield. Considering the country needs towards food security to ever increasing population and doubling farmer's income, the Krishi Vigyan Kendra, Azamgarh (UP) has already been conducted front line demonstrations (FLDs) in 20.0 hectare area at selected 48 progressive farmers' field *rabi* during 2009-10 to 2012-13. In general, the soils under study were sandy loam to sandy clay loam in texture with neutral in reaction (7.2 to7.6 pH). The wheat variety K 307 (Shatabdi) was sown in line through ZT drills from mid to end

of November in each year. Results on average basis also reveal that demonstration yield lies in between 10.0 q/ha lower than potential production and higher than farmer's practices. Per cent change in yield over the check had fluctuated over the years in increasing order from 31.8 to 38.9% respectively. A wider technology gap identified during last two years of study than preceding years. However, production year 2010-11 was the only year which recorded maximum grain yield (47.7 q/ha) by narrowing the technological gap (7.30 q/ha) than remaining years. Actual monetary gain of Rs. 7482 per hectare was received by least investment of Rs. 3018 per hectare as an additional cost. It also indicates that a double income can be obtained by adoption of scientific practices as per the need & situations of crop from seeding to harvesting.

SOIL ENZYME ACTIVITIES AS BIOLOGICAL INDICATORS OF SOIL HEALTH

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Abstract

soil enzyme activities have great potential to provide a unique integrative biological assessment of soils and the possibility of assessing the health of the soil biota. Some enzymes only facilitate the breakdown of organic matter (e.g. hydrolase, glucosidase), while others are involved in nutrient mineralization (e.g. amidase, urease, phosphatase, sulfates) With the exception of phosphatase activity, there is no strong evidence that directly relates enzyme activity to nutrient availability or crop production. The soil enzymes are the mediators of organic matter decomposition and soil transformations. Nutrient cycling in soils involves biochemical, chemical and physicochemical reactions. All biochemical reactions are catalyzed by enzymes, hence making enzymes suitable as indicators of biological activity. Enzymes are the indicator of soil biological quality, responding to soil management changes much before other soil quality indicator changes are detectable. In the dynamic climate change era, the influence of climate change on soil productivity can be assessed by monitoring soil enzyme activities as well as changes occurring in soil properties. Thus, knowledge of soil enzymes is essential to design and evaluate new sustainable crop management practices. Soil enzyme activity is a good indicator of agricultural management practices, as well as of the impact of pollution or severe perturbations on soil health, and of the efficacy of remediation activities. Finally, although certainly a promising indicator of soil health, the use of soil enzyme activity requires sound judgment in the interpretation of the data.

RELATIONSHIP BETWEEN ARRIVALS AND PRICES OF WHEAT IN DIFFERENT REGULATED MARKETS OF MADHYA PRADESH

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Abstract

The study has been under take in different grade regulated markets to analysing the pattern of market arrivals and prices in Madhya Pradesh for wheat as it is the main crop of the state. The present investigation is restricted to the four different grade of regulated markets (Krishi UpajMandi) of wheat i.e. Sehore, Mhow, Kalapipal and Katangi, which have been selected randomly from each grade (A, B, C and D Grade) regulated markets in Madhya Pradesh. The arrivals and prices in different grade of regulated markets exposed that there was found weak correlation between arrivals and price in wheat in different months of the year. Whereas the prices increases the arrivals also increases in the market. But it's not true in the in the case of D grade regulated market, which is might be due to lack of facilities in this particular grade of regulated market. Therefore, the policy implication lies in encouraging the farmers to dispose their produce at the opportune time to get good remunerative prices. It requires providing finance to farmers and better storage facilities either at village level or at market level to be created so as to spread the arrivals reasonably in the lean months of the year. Marketers need to design creative solutions like e-marketing to overcome challenges typical of the rural environment such as physical distribution, channel management

promotion and communication. The "anytime-anywhere" advantage of e-marketing leads to efficient price discovery, offers economy of transaction for trading and more transparent and competitive setting.

EFFECT OF REPLACEMENT OF MAIZE WITH PROSOMILLET ON EGG YOLK COLORATION AND EGG QUALITY IN WHITE LEGHORN LAYER FEED

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Abstract

Replacement of maize with prosomillet (*Panicum miliaceum*) at 50% and 100% levels was tried in the layer's ration and its effects on egg yolk pigmentation and other egg quality parmeters were studied. It was observed that replacement of maize with prosomillet produced paler egg yolk, though it did not affect any of the internal or external qualities of egg. The paleness of egg yolk in replacement diet was attributable to the lower beta carotene content in prosomillet (4.21 mg/kg) than in maize (8.99 mg/kg).

ROLE OF MULCHING IN ORGANIC FARMING

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Abstract

The global temperature has been increasing over the years due to climate change that, directly or indirectly, affects water and energy consumptions in the agriculture sector. The application of mulching practices reduces soil evaporation, conserves soil moisture, suppresses weed growth, controls soil structure and temperature, influences soil micro-organisms and is aesthetically pleasing. Synthetic mulches like black plastic provide an effective barrier to most weeds and are amenable to mechanized application, but they must be removed at the end of the season. Organic mulches like straw suppress annual weed seedlings, conserve moisture and add organic matter as they break down. Natural organic mulch eventually breaks down and adds organic material to the soil. The increase of the amount of soil organic carbon is regarded as the main advantage of organic mulches. The application of organic mulches as a soil cover is effective in improving the quality of soil and increasing crop yield, especially in organic farming. The influence of organic mulches on crop yield is unequal. Mulching improves plant growth; yield and yield quality. Organic mulching materials are inexpensive and eco-friendly. The selection of an appropriate mulching material is, however, guided by crop type, crop management practices and climatic conditions. Future research is needed on the effects of low-cost biodegradable mulching materials on microclimate modifications, soil biota, soil fertility, crop growth and crop.

URBAN AGRICULTURE : A NEW APPROACH FOR SUSTAINABLE AGRICULTURE

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Abstract

Agriculture has always been the part of parcel of Livelihood for Indian countryman but the increasing population over the last 10 years has rapidly elevated the rate of urbanization. According to the trend line of Indian population census it has been observed that people residing in urban areas in India according to 1901 senescence was 11.4 % which has increased to 28.53% in 2001 and crossed over 30% as per Census 2011 standing at 31.63%. Further, according to the survey by UN state of the world population report in 2007 it is expected that by 2030, 40.76% of country population is expected to reside in urban areas. Therefore keeping in view the current peace of increasing population it has become a necessity of our to focus on increasing food production to feed a population of 1.3 billion. Despite this increasing rate of population the total arable land area happens

to be stable of fixed. Therefore there is a heavy need to adopt various new technologies and method of cultivation in small areas and living areas and basic living area to meet the increasing food demands of growing population. Thus, urban agriculture has become a new trend of the cultivation practices. It is one of the solutions that perceived globally to meet the demand of food of urban population. There is a number of ways through which urban agriculture have an impact on urban food security. It is practice of cultivating, processing and distributing food in the in or around the village, town and city. It can also involve animal husbandry Aquaculture, agroforesty, and horticulture. These activities also occur in pri- urban as well. At the household level, urban agriculture can be a source of income, provide direct access to a large number of nutritionally rich foods i.e. vegetables, fruits, meats and a more varied diet increases the stability of household food consumption against seasonality or other temporary shortages, and increases the time mothers spend caring for their children as opposed to non agricultural activities that are located far away from the home. The idea of urban farming is dynamic concept that comprises a variety of livelihood system ranging from subsistence production and processing at household level to more commercialized agriculture. The most beneficial thing in urban farming is people get organic, flavorful, fresh and naturally repined products where artificially maintained. Thus adoption and practice of such technology is very important in present day conditions.

EFFECT OF SEED PRIMING AND FOLIAR SPRAY OF STRESS MITIGATING CHEMICALS ON CHICKPEA (*CICER ARIETINUM* L.) UNDER CONSERVED MOISTURE CONDITION

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Abstract

An experiment was conducted to find out the effect of seed priming and foliar spray of stress mitigating chemicals for ameliorating moisture stress in Chickpea (*Cicer arietinum* L.) at Agricultural Research Station, AAU, Dhandhuka, *Bhal* region of Gujarat state under conserved moisture condition during *Rabi* season 2015-16. The experiment consisted four levels of seed priming (S_0 - No seed soaking (Control), S_1-Seed soaking with Thiourea for 1hour (500 ppm), S_2 - Seed soaking with Salicylic acid for 1hour (50 ppm) and S_3 - Seed soaking with Thioglycolic acid (TGA , 50 ppm) for 1hour) and five levels for foliar spray of stress mitigating chemicals (C_0 - No spray (Control), C_1-Water spray, C_2 - Thiourea spray (1000 ppm), C_3 - Salicylic acid spray (100 ppm) and C_4 - Thioglycolic acid (TGA, 100 ppm) spray) making thereby 20 treatments combinations. The experiment was laid out in Factorial Randomized Block Design with three replications and chickpea variety GG-2 was used as a test crop. The two spray of stress mitigating chemicals was applied on two stages of crop, first on vegetative stage (30-35 DAS) and second on pod filling stage (45-50 DAS). The result indicate that due to different treatments plant stand / m (7.52), plant height (45.79 cm), no. of branches per plant (7.21), no. of pods per plant (74.63), test weight (33.30 gm), seed yield (1284 kg/ha) and seed protein (17.83 %) was found significantly higher with S_1 (Seed soaking with Thiourea 500 ppm) treatment over control while plant stand and height found at par withS_1 & S_3 treatment. Effect of all treatments on biological yield (2051kg/ha) was found non-significant but statically higher data recorded with S_1 treatment. Result further indicate that significantly superior data of plant stand/m (7.7), plant height (46.65 cm), no of branches/plant (7.30), no of pods /plant (74.98), test weight (33.13 gm) and seed yield (1337kg/ha) was found with C_2 (Thiourea spray 1000ppm) treatment over control. Effect of all treatments on biological yield was found non-significant over control but statically higher data recorded with C_2 (2083 kg/ha) treatment.

ASSESS THE SITE SPECIFIC NUTRIMENTS MANAGEMENT TOOLS TOWARD MAXIMIZE PROFITABILITY OF RICE WITH MAINTAINING THE SOIL HEALTH

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Abstract

Agricultural production in India has increased from 50 Mt in 1950 to 271.91 Mt in 2016–2017 by the intensive use of external inputs. The negative nutrient balance due to the imbalanced fertilization to the tune of 8–10 Mt is reported, resulting in nutrient

mining, stagnation and/or deceleration in productivity and soil health decline. The indispensable role of site-specific nutrient management (SSNM) for efficient uses of resources and nutrients for food production target 300 Mt by 2025. Site-specific nutrient management (SSNM) is a plant-based approach for managing the nutrient requirements of rice. It provides principles and tools for supplying rice with nutrients as and when needed to achieve high yields while optimizing use of nutrients from indigenous sources. The approach mainly involved (a) prediction of site specific optimum fertilizer NPK rates using indigenous nutrient supplies and (b) development and implementation of a site-specific N management that accounted for real-time variation in crop N demand at major rice growth stages. Keeping these facts in mine the present field experiment was conducted at different three locations of Katihar district during two consecutive years of 2015-16 and 2016-17 to investigate the effect of site specific nutriments management tools toward maximize profitability of rice with maintaining the soil health was under taken. The soil is non-calcareous light gray in colour flood plain belongs to the alluvial gangetic plain (Agro climatic zone II). The study was done in randomized block design with three treatments and six replications with rice variety RM1 to evaluate the observation regarding growth attributes and yield components of individual plant parameters were recorded from randomly selected plants in each plot. The major nutrients nitrogen, phosphorous and potash applied through applied SSNM technologies approaches and tools which are able to enhance NUE, crop productivity and profitability. It is based on the concept when and how much to feed. The main benefit for farmers from improved nutrient management strategy is an increase in the profitability and reducing the cost and environmental threats. The SSNM reduces the wastage of fertilizers by preventing excessive use of fertilizers and avoiding fertilizer application when the crop does not require nutrient inputs. It also assures that N, P and K are applied in the ratio required by the intended crop. It aims to achieve high yield and high efficiency of nutrient use, leading to high cash value of the harvest per unit of fertilizer invested and manage the soil health. Much of the nutrients required by cereal plants come from the soil but the supply of nutrients is not able to meet the nutrient requirements for realizing higher rice yields. It is clear from the data available on farm sites in showed that NE significantly increased rice yields and economic returns compared to the generalized Farmers' Fertilization Practice (FFP). NE's impact on fertilizer use in rice shifte K application upwards while also minute upwards N and P application rates. We used recent advances in information and communication technology (ICT) and computer base applications of "Nutrient Expert for Rice", which transform the science of SSNM into guidelines matching the field specific needs and conditions of a farmer. Across all sites, NE rice increased yield and economic benefit (i.e. gross return above fertilizer costs) over FFP.

VALUE ADDITION OF UNRIPE PODS OF *PROSOPIS CINERARIA (SANGARI)*

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ABSTARCT

Shekhawati region of Rajasthan specially in Thar desert of Sikar, Jhunjhunu, Churu (Sardarshahr) are endowed with fertile vegetation and give extent help to human beings, livestock and the nutrient deficient soils. The local people like to use the vegetation of unripe fruit (sangri) make vegetable and health care, ripe fruit known as 'Kho-Kha' orally eaten by children and cattle. People successfully manage different diseases using plant-based medicines. Recently survey for ethno botanical plants among the people of these localities recorded the use of many species of dicotyledonous plants. Indian and traditional systems of Medicine are among the well known wide desert area of medicine. Ayurveda, Siddha and Unani has been also necessary information on systems has also been provided. The arid plant Prosopis cineraria (Fabaceae) is known as Khejri/Shami/ Janti or the 'kalp virkash' of Indian thar deserts. The unripe and dried pods are consumed as a vegetable and leaves as traditional medicine. The antibacterial activity of the various extracts of the stem bark of Prosopis cineraria the leaves (green and dried) are also benefit fodder for cattle feeder. Roots of these plants are benefits for nitrogen fixation. Rajasthan (Sikar, Jhunjhunu, Churu) has the distinction of producing 17 of the total 60 varieties of Indian spices which are being regularly utilized for special desert cuisines most common of them is panchkuta/sangri vegetable. Value-Added is the process of taking a raw commodity and changing its form to produce a high quaility end product.Value-Added is defined as the addition of time, place, and/or form utility to a commodity in order to meet the tastes/preferences of consumers. In other words, value-added is figuring out what consumers want, when they want it, and where they want it – then make it and provide it to them. There is a significant traditional knowledge available on various remedial uses of arid foods along with a great potential in the field of processing and value addition. Therefore a good future scope lies in the field of value addition in view of abundant availability, deliciousness, quality and remedial uses of arid fruits and vegetables.

CHARACTERIZATION OF GROUNDWATER QUALITY FOR IRRIGATION IN KAITHAL DISTRICT, HARYANA, INDIA

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Abstract

The present study examined the quality of groundwater in a Kaithal district is located between 29°31'- 30°12' north latitudes and 76°10'- 76°42' east longitudes of Haryana State, India. It has a total geographical area of 2317 sq. km the district has been divided into six blocks namely Kaithal, Guhla, Kalayat, Pundari, Rajound and Siwan. In order to ascertain the quality of groundwater, water five hundred thirty samples were collected and analyzed for various haydrochemical parameters pH, EC, (Ca^{2+} , Mg^{2+} , Na^{+} and K^{+}) and anions (CO_3^{2-} , HCO_3^{-}, Cl^{-} and SO_4^{2-}) by using standard procedures. Irrigation indices such as SAR, RSC, were calculated for these samples. The pH, EC, SAR and RSC in groundwater ranged from 7.01-9.80, 0.30-8.25 (dSm^{-1}), 2.55-27.67 $(mmoll^{-1})^{1/2}$ and 0.00-6.90(mel^{-1}), respectively. The trend among the average ionic concentration of cations and anions are $Na^{+} > Mg^{2+} > Ca^{2+} > K^{+}$ and $Cl^{-} > SO_4^{2-} > HCO_3^{-} > CO_3^{2-}$. According to AICRP classification, 47.2, 12.1, 7.7, 11.3, 13.0 and 8.87% were of good, marginally saline, high SAR saline, marginally alkali, alkali and highly alkali, respectively. Variable maps of EC, SAR, RSC and water quality of groundwater used for irrigation in the Kaithal district were prepared through GIS to study spatial variability.

BIOSENSORS-AN EMERGING TECHNOLOGY FOR AGRO-FOOD INDUSTRY

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Abstract

The worldwide agro-food market has produced increased biological, chemical and physical threats to food products, and a bigger consumer demand on process control, quality and safety of these products. As a result, food processors are using technological tools to allow for the quick, effective and efficient determination of hazards inherent to safety and quality of products. While traditional techniques that are highly selective and sensitive exist, there is still a need for simpler, more rapid and cost- effective approaches to food safety testing. Within this context, the field of safety biosensors has emerged. Biosensors pave way for the rapid detection of pathogens, allergens as well as pesticide residues in food. Biosensors are promising alternatives to conventional analytical tools since they offer advantages in size, cost, specificity, rapid response, precision and sensitivity. Biosensors have the potential to produce an analytical revolution to resolve the challenges in the agricultural and the food industries. This review gives an overview of various types of biosensors used in the Agro-food industry and outlines its future prospects.

IMPACT AND ADAPTATION STRATEGIES IN MUSTARD UNDER CLIMATE CHANGE SCENARIO IN RAJASTHAN

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Abstract

As per the IPCC report, the global mean air temperatures are projected to increase by 1.8 to 4.0 °C by the end of this century (IPCC, 2007). The increased levels of CO_2 favour the crop growth and productivity. But, higher temperatures coupled with increased CO_2 levels could result in altered growth and productivity of crops. Since, mustard is *rabi* season crop and is sensitive to high temperatures, a simulation study was carried out to quantify the impact of increased temperatures (1, 2, 3, 4

and 5 °C) and elevated CO_2 (369, 450,550 and 650ppm) alone and in combination on the mustard yield using InfoCrop model at five locations of different agroclimatic zones of Rajasthan differing in agroclimatic conditions and topography viz. Ajmer and Jaipur (Zone IIIa-Semi Arid Eastern Plain), Sawai Madhopur (Zone IIIB- Flood prone Eastern Plain), Sriganganagar (Zone IB-Irrigated North Western Plain) and Banswara (Zone IVB-Humid Southern Plain). An assessment as an adaptive strategy is also provided on the possible gains due to change in sowing time and crop duration. Though elevated CO_2 alone increased the mustard yield, increase in temperature by 1°C at 369 ppm CO_2 concentration, reduced mustard yield by 6.6 to 11.1 %. The combined impact of increased temperature and elevated CO_2 resulted in net decline in yield in spite of CO_2 fertilization. Planting short duration cultivars in future and changing to timely planting time may reduce the adverse impacts of climate change on mustard yield. Adapting to climate change through a combination of improved input efficiency, additional fertilizers and adjusting the sowing time of current varieties can increase yield by about 15 to 18 % in mustard.

PERFORMANCE OF *SUEADA NUDIFLORA* BASED SILVIPASTORAL SYSTEMS ON ARID SALT AFFECTED SOIL IN RAJASTHAN

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Abstract

Increasing grazing pressure on the available land resources and continuous shrinkage lead to over-exploitation of grazing lands necessitating search for additional land resources in Rajasthan Here large area (0.38 mha) suffers from salinity and alkalinity problems utilization of these land for silvipastoral system could provide an alternative to improve pastoralism in the arid region, The study area was located in gangani village (Latitude 26.50 Longitude 73.21) of Jodhpur district of arid Rajasthan, The soil pH ranged from 8.2 to 8.8 and EC from 4.2 to 16 d Sm^{-1}. Salt encrustations were observed at many places with EC values as high as 48 d Sm^{-1}. After initial field trials with *Atriplex lentiformis*, an excretory halophyte, for six years the EC was reduced to 1.3 to 14 dsm^{-1}. Now another field trial with Suaeda *nudiflora* in combination to agriculture crop was laid on improved salty soil in 2013. The results of four years are presented here. S. *nudiflora,* (Chenopodiaceae), is an evergreen shrub with numerous slender, erect branches, endemic to coastal regions around the world. In India the foliage has been used traditionally as a vegetable and forage/fodder especially for camels. It is found on mud flats along sea coast or in saline soils in Bharoach, Cambay, north Gujarat (Kharaghoda), Saurashtra and Kutchh region of Gujarat state. *S. nudiflora* seedlings, planted in August 2013 at a spacing of 4x5 m on double ridge mounds, were established well. and the mean percent survival was (64.5%) in October 2017. Shrubs attained appreciable growth and the mean height was 201.1 cm, crown diameter (172.6cm) and collar diameter (7.52) cm. In the year 2016 Bajra variety HHB-67 (IMP) was sown in the inter row spaces of *S. nudiflora* and it showed good survival and growth but succumb to water logging Again it was sown in July 2017. 80% germination was observed after 10 days and 4-5 cm long height. There was rain in the first week of August. The crops height ranges from 2 ft to 1 ft from lesser to more saline soil in the first week of August one month after crop sowing. The crop attained height~ 3feet with flowering initiation from the normal soil to 2 ft in saline soil. However, after that there was no rain and no flowering and fruit setting took place. The crop dried in the first week of September and harvested. The calculated green straw mass ranged from 561.2g/m2 to 256.7 g /m2 This indicate that salty area has improved substantially and agriculture crop could be grown on the site. Therefore, the improved silvipastoral systems could provide an alternative to improve pastoralism in the arid region, giving a greater buffer capacity and allowing for sustainable production even in critical years.

EFFECT OF DRIP IRRIGATION REGIMES AND MULCHING ON GROWTH, YIELD AND WATER PRODUCTIVITY OF MANGO *CV*. PANT SINDURI

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Abstract

The present experiment was conducted at PFDC block of Horticultute Research Centre, Govind Ballabh Pant University of

Agriculture and Technology, Pantnagar (Uttarakhand) to study the impact of drip irrigation levels along with plastic mulching in mango cv. Pant Sinduri during 2015 - 2016. The trial was laid out using Randomised Block Design having three replications. The experiment was consisted of four irrigation levels *i.e.,* 0.3 PE, 0.4 PE, 0.5 PE, 0.6 PE with and without mulch as well as conventional method of irrigation. The observations regarding tree height, tree girth, canopy area, canopy volume, canopy diameter, leaf area, leaf area index, leaf chlorophyll content, fruit drop, fruit retention, fruits/ panicle, fruit length, fruit width, fruit weight, fruit volume, specific gravity, total soluble solids (TSS), acidity, TSS: Acidity ratio, ascorbic acid, total sugar, reducing sugar, non reducing sugar, total carotenoides, yield, water use efficiency and water productivity were recorded.

The experimental results revealed that performance of mango was significantly influenced by different irrigation levels along with mulch. Drip irrigation at 0.5 PE along with mulch was proved to be positive for tree growth characters as well as yield was also recorded best in this treatment. Total yield (18720 kg/ ha) was recorded best at 0.5 PE along with mulch. Maximum water use efficiency was recorded in treatment drip irrigation at 0.3 PE along with mulch (3.32 kg/ ha-mm) and minimum in conventional method of irrigation at 100% PE.

INFLUENCE OF RICE HUSK BIOCHAR UNDER WHEAT CULTIVATION

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Abstract

Wheat is one of the most important growing cereal crop all over the world. It is Rabi seasonal crop and grown in a wide range of climatic zones. The biochar is the residue left after thermal decomposition of any organic matter. Pyrolisis occurs when organic material are burn under anaerobic condition. It is charcoal which is used as reclamation of soil's physical condition. Due to the presence of more C: N ratio, rice husk not easily degradable to the soil. Biochar application is one of the best solutions for improvement of wheat production. Biochar is mainly used to increase soil fertility, increase water holding capacity because it have more surface area. It helps to deflect soil properties and increase the microbial activity to absorb organic and inorganic compound. The major benefits of this amendment is, it have high nutrient availability due to the presence of higher amount of potassium, phosphorous and zinc which is known as essential element for plant growth and development. The experiment was carried out in Lovely Professional University, Phagwara at experimental field to check out the growth and development of wheat in biochar applied soil. On the basis of field trial, biochar may significantly improve the different morphological parameters like no. Of tillers, no. of panicle, panicle length, stem grith were measured at 45 DAS, 60 DAS, 75 DAS,& 90 DAS. Hence this is the very simple way to give nutrient to the soil and subsidiary agricultural development. (0.43 kg/tree-mm). The marked improvement in growth and yield parameters was recorded due to irrigation levels and mulch treatments owing to overall enhancement in vigour and crop growth and optimum availability of moisture in the root zone at the critical stages. Similar results were also obtained in regards of water productivity also as maximum water was consumed to produce unit fruit (water productivity) in conventional method of irrigation (23.52 l/ kg) and minimum was consumed in 0.3 PE along with mulch.

RESPONSE OF POTATO VARIETIES TO DIFFERENT NITROGEN LEVELSFOR GROWTH AND TUBER YIELD

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Abstract

An experiment was conducted at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during winter season of 2016-17. The treatments comprising of two potato varieties (Kufri Surya and KufriSadabahar) and five nitrogen levels (0, 75, 150, 225 and 300 kg/ha) laid out in RBD (factorial) with three replications.The data were recordedon various growth and yield parameters, which were influenced significantly by potato varieties and different levels of nitrogen.The results reveal that among the nitrogen levels, the nitrogen 300 kg/ha was the best for most of the growth

parameters and showed maximum value for plant height at 45, 60, 75 and 90 days after planting(46.6, 71.3, 78.6 and 80.0 cm, respectively), number of leaves at 60 days after planting(67.2), weight of foliage (3.59 kg/m^2) and biological yield(696.4 q/ha) closely followed by the nitrogen dose 225 kg/ha, while for yield parameters, nitrogen level 225 kg/ha was the best and showed maximum value for numberof tubers in grade >25-50, >50-75, >75 g per plot and total tuber number per square meter (101.1, 90.0, 117.8 and 47.42, respectively),weight of tubers in grade >25-50, >50-75, >75 g per plot and total as well as marketable tuber yield (5.25, 8.25, 22.60 kg, 379.63 and 358.99 q/ha, respectively) and dry matter content of tubers and haulms (18.03 and 10.52%, respectively)closely followed by the nitrogen level 300 kg/ha. Harvest index was noted lowest for the nitrogen dose of 300 kg/ha (53.6%)and being highest where no nitrogen was applied(65.3%). So far the variety is concerned, KufriSadabahar was significantly better for all the recorded parameters than the variety Kufri Surya.The highest net income (Rs. 1,60,287/ha) and benefit to cost ratio (1.78) was achieved from KufriSadabaharvariety supplied with nitrogen 225 kg/ha followed by the same variety supplied with nitrogen 300 kg/ha.

UTILIZATION OF GENETIC MARKERS IN CROP GERMPLASM FOR VARIOUS REVERSE AND FORWARD GENETIC APPROACHES

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Abstract

Genetic markers represent genetic differences among individuals of a species. Genetic markers have evolved from morphological marker through biochemical to DNA marker. The development and use of molecular markers has revolutionized the understanding the organization and diversity of plant genomes. DNA markers are the DNA sequences which show variation in individuals of the same or different species. They have been classified into three broad categories *i.e.* hybridization based (RFLP), PCR based (RAPD, AFLP, SSR) and DNA sequence based (SNP). Germplasm are endowed with abundant genetic diversity and are source of valuable genes which need to be exploited for crop improvement program. Advances in PCR, molecular markers and data analysis has resulted in powerful techniques used for characterization and evaluation of germplasm. Molecular markers have been employed for many studies like characterization, genetic diversity estimates, phylogeny study, synteny study, sorting the duplicates, studying population structure and association mapping. For the above analysis the four markers (RFLP, RAPD, AFLP and SSR) have been compared on various grounds which include level of polymorphism, mode of inheritance, method of assaying, genome coverage, reproducibility, efficiency and cost required. Also some parameters like expected heterozygosity, multiplex ratio, marker index and dendogram based genetic similarity have been compared for all four markers. As no single marker could be an ideal marker yet on comparing we get that SSR marker could be the marker of choice. However the third generation marker like SNP markers having high throughput, can replace the SSR markers.

WATER PRODUCTIVITY, WATER USE EFFICIENCY AND PRODUCTION EFFICIENCY OF CEREALS-BASED CROPPING SYSTEM AS INFLUENCED BY SOIL MOISTURE CONSERVATION MEASURES IN NORTH WEST IGP

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Abstract

Conservation and judicious use of natural resources like soil and water play an important role in sustainable crop production under irrigated farming in north west IGP. In India there is a very limited scope for increasing area under crop production to meet the food and fodder requirements of increasing human population. The only solution is to increase the crop productivity per unit area per unit time. This can be achieved through scientific management of soil and water resources. The soil and

moisture conservation measures such as broad bed and furrow, conservation furrow, ridge and furrow, compartment bunding, tied ridge and furrow, contour cultivation, etc., mainly aim at uniform distribution of moisture in inter terraced area and to check the possible sheet or rill erosion. The basic rule of soil and moisture conservation is to stretch the infiltration opportunity time, for increased rainfall use efficiency and drainage of excess rainfall safely out of the crop fields. Cropping system is a management of natural and other farm resources for cropping activity in such a manner that their maximum efficiencies are harnessed to attain and sustain potential yield levels per unit of land area per unit time without causing any deterioration in quality of environment of any level of ecological hierarchy. Cereals based cropping system approach, addresses the issues related to economic aspects of cropping activity, available resources and micro-environment at farm level in holistic manner. Therefore moisture conservation practices i.e. the wide raised beds plots increased the water use efficiency of 15.12 and 15.78 kg grain ha^{-1}mm. The per cent increased in water use efficiency under wide raised beds over conventional tillage was 38.67 and 39.23 %. Among water regimehighest net profit (Rs. 65256.4 and Rs. 61976.7 ha^{-1}) with B: C ratio of 2.24 and 2.04 was recorded with the application of three irrigations at 22, 65 and 105 DAS in wheat crop. The wide raised beds plots increased the water use efficiency of 15.12 and 15.78 $kgha^{-3}$and water productivity (1.28 and 1.18 kg ha^{-3}). The per cent increased in water use efficiency under wide raised beds over conventional tillage was 38.67 and 39.23 %, respectively. Thus for introducing a suitable management practice, it is necessary to now the yield reductions level of plant water deficit in different tillage/water regimes practices.

SCREENINGOF RICE CULTIVARS FOR SALINITY TOLERANCE THROUGH *IN VITRO*SEED GERMINATION AND SEEDLING GROWTH

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Abstract

Six selected cultivars of rice namely BPT-5204, MTU-7029, CSR-30, Narendra Usar Dhan-3, Rajendra Bhagwati and Pusa Basmati-1 were screened for salinity tolerance on the basis of *in vitro* seed germination and seedling growth under different salt stress (0-2.5%) created by a salt mixture of NaCl, $CaCl_2$, Na_2SO_4 in 7:2:1 ratio. At 2% salt stress, germination was only observed in cultivars CSR-30 and Narendra Usar Dhan-3, while at 2.5 % no seed germination was observed. The frequency of seed germination gradually decreased with increasing concentrations of salt stress. As observed with seed germination, seedling growth was also adversely affected with the increase of salt concentrations. The shoot growth was more affected than the root growth. The salt tolerance index (STI) of the rice cultivars was calculated on the basis of seed germination, seedling shoot and root dry weights at different levels of salt stress. Cultivars CSR-30 and Narendra Usar Dhan-3 were found to be salt tolerant, cvs. MTU-7029 and BPT-5204 moderately salt tolerant and cvs. Rajendra Bhawati and Pusa Basmati-1 as salt susceptible respectively on the basis of STI. Thus *in vitro* study can be used for evaluation of salinity tolerance of rice cultivars.

EFFECT OF CLIMATE CHANGE ON FOOD SECURITY

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Abstract

Climate change, also called global warming, refers to the rise in average surface temperatures on earth. Uneven rainfall patterns, increased temperature, elevated CO_2 content in the atmosphere are important climatic parameters which affects crop production. Research studies indicate that climatic factors influence more than the other factors like soil and nutrient in crop production. “Sustainability broadly means balancing economic, social and environmental system so that one system does not adversely impact the other two”. At present food security “security of food for future” we can only attain by sustainable agriculture. In agriculture all factors which affect crop production should maintain at a favorable level. Due to this climate change means rise in surface temperatures crop growth affects which ultimately targeted the crop yield in large scale which raises a question mark on security of food at global scenario.

INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND QUALITY OF CABBAGE (BRASSICA OLERACEA VAR. CAPITATA)

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Abstract

The field experiment was conducted during *Rabi* season of 2017-18 at the Horticulture Research farm, AKS University, Satna (M.P.). The experiment was laid out in a randomized block design with three replications. The treatments consisted of nine combination of different agro input management practices viz., treatments 100 % RDF (Control) (T_1), 75 % RDF + 25 % N through VC (T_2), 75 % RDF + 25 % N through FYM (T_3), 50 % RDF + 50 % N through VC (T_4), 50 % RDF + 50 % N through FYM (T_5), 100 % RDF + 25% N through VC (T_6), 100 % RDF + 25% N through FYM (T_7), 100 % RDF + 25% N through FYM + *Azotobacter* @ 2 kg ha^{-1}+PSB @ 2 kg ha^{-1} (T_8), 100 % RDF + 25% N through VC+ *Azotobacter* @ 2 kg ha^{-1}+PSB @ 2 kg ha^{-1} (T_9). The maximum net profit/ha was recorded under treatment T_9 (Rs. 182392.68) while minimum net profit/ha was obtained in treatment T_4 (Rs. 123469.25). The maximum gross profit/ha was recorded in treatment T_9 (Rs. 230115.00) whereas, minimum gross profit/ha was recorded in treatment T_4 (Rs. 167260.00). Thus, the maximum income (both gross and net) was obtained with T_{10}. The significantly maximum B:C ratio 4.54 was recorded under the treatment (T_1). And the minimum B:C ratio 2.66 was recorded under the treatment (T_5).

NEED AND ROLE OF BIO FERTILIZERS IN CROP PRODUCTION

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Abstract

The adverse effects of agro-chemicals are clearly visible on soil structure, microflora, quality of water, food and fodder. The quality of the produce is deteriorated due to the entry of chemical residues in the plant body and then to the food chain. The concerns such as declining factor productivity, depletion of soil organic carbon and mineral nutrients, waterlogging and salinization, increasing nitrate concentration in well water, are the consequents of the modern crop production system with its unbalanced and injudicious use of chemical fertilizers and pesticides. The emerging scenario necessitates the need for the adoption of practices which maintain soil health, makes the production system more sustainable, and provides quality food for meeting the nutritional requirements. Besides above facts, the long term use of bio-fertilizers is economical, eco-friendly, more efficient, productive and accessible to marginal and small farmers over chemical fertilizers. In this context, bio-fertilizers would be the viable option for farmers to increase productivity per unit area.Bio-fertilizers plays major role in improving soil fertility, yield attributing characters and thereby final yield has been reported by many workers. In addition, their application in soil improves soil biota and minimizes the sole use of chemical fertilizers.Bio-fertilizers play vital role in maintaining long term soil fertility and sustainability by fixing atmospheric di-nitrogen (N=N), mobilizing fixed macro and micro nutrients or convert insoluble P in the soil into forms available to plants, there by increases their efficiency and availability.

EFFECT OF PANCHAGAVYA ON SOIL FERTILITY

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Abstract

Panchagavya is an organic product produced by using five different by-products of cow like cow dung, cow urine, cow milk, cow ghee, cow curd and other ingredients. It has the potential to play the role of promoting growth and providing immunity in plant system thereby confers resistance against pest and diseases. Panchagavya contains several nutrients i.e. macronutrients

like N, P, K and micronutrients which are required for the growth and development of plants and also contains various amino acids, vitamins, growth regulators like Auxins, Gibberellins and also beneficial micro-organisms like pseudomonas, azatobacter and phosphorous bacteria etc thus increase the soil health and it also improves water holding capacity of soils because it acts as organic manure. Hence Panchagavya is a component of crop production and it plays a crucial role in each and everycomponent of crop management like integrated soil fertility management, integrated pestmanagement and integrated disease management.

REACTION OF BT COTTON HYBRIDS AGAINST SUCKING INSECT PESTS IN MALWA REGION OF MADHYA PRADESH

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Abstract

The experiment was undertaken on medium black cotton soil in *Kharif* season of 2015 at College of Agriculture Farm, Indore in randomized block design with nine selected cotton hybrids in three replications with the plot size of 3 x 3 m and plant to plant spacing of 0.6 x 0.6 m. Hybrids were sown on July 1, 2015. These hybrids were ACH-1BG–II, ACH-104-2 BG-II, ACH-152-2BG–II, ACH-115-2BG-II, ACH-1133-2BG-II, ACH-1199-2BG-II, RCH- 2 BG-II (standard check), ACHB-90-1BG-II and MRC-7918 BG-II (standard check). The population of aphid, jassid, thrips and whitefly, were recorded at 20, 30, 40, 50, 60, 70, 80, 90, 100, and 110 days after germination (DAG) on 5 observational tagged plants from two lower, two middle and two upper leaves per plants. The cotton yield was recorded on whole plot basis and converted into kg per hectare. All the received data were analysed statistically. On the basis of overall mean of all the intervals the minimum jassid population was noted in ACH-1199-2BG-II (5.85**)** and found at par with standard Check MRC-7918 BG-II (6.29). The continuous increasing trend from first to last observation was observed for whitefly, aphid and thrips. The mean whitefly population was recorded least in ACH-1199-2BG-II (8.04) and found at par with standard check MRC-7918BBG-I**I** (8.51) and standard check RCH-2BGII (8.53). In relation to aphid, standard check RCH-2BG-II(17.57) showed minimum population and found at par with ACH-1199-2BG-II (17.83). The least thrips population was noted in ACH-1199-2BG-II (15.17) and found to be at par with standard check MRC-7918BBG-II (15.93), ACH1133-2BG-II (16.01) and standard check RCH-2BG-II(16.37). The Highest seed cotton yield was observed in ACH-1155-2BG- II (2669kg/ha) and showed non significant difference with ACH-1199-2BG-II (2602 kg/ha), ACH-152-2BG-II(2262 kg/ha) and other hybrids.

CALIBRATION AND VALIDATION OF AQUA CROP MODEL TO PREDICT THE DIFFERENT IRRIGATION SCHEDULES FOR BITTER GOURD

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Abstract

The great challenge of the agricultural sector is to produce more food from less water. Estimation of water requirement of crop is essential for crop planning on farm, designing and monitoring irrigation projects. It simulates crop yield response to water and is particularly suited to address condition where water is key limiting factor in crop production. The important of the water productivity of this study was calibrated and validated Aqua crop model for bitter guard and to predict the response of bitter guard to different irrigation schedules. The model was calibrated by varying parameters such as harvest index, water productivity, water use efficiency and crop evapotranspiration were simulated for different treatment using the calibrated model. The model provided excellent simulation of canopy and yield. The harvest index was observed as 85 per cent for bitter gourd. The formulated alternative delivery schedules were optimized based on water use efficiency. The simulation were carried out with calibrated model for the required period of irrigation schedule with 85 per cent crop evapotranspiraion saved 13.80 per cent water with only 0.043 per cent increased in the yield of bitter gourd.

GUJARAT JOWAR-43 (GJ-43) : A NEW HIGH YIELDING DUAL PURPOSE SORGHUM VARIETY FOR GUJARAT STATE

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Abstract

Sorghum or Great millet [*Sorghum bicolor* (L.) Moench] is the fourth most important cereal crop in India after rice, wheat and pearl millet. The major states in the country where this cereal grain produced are Maharastra, Karnataka, Andhra Pradesh, Madhya Pradesh, Gujarat and Rajasthan. Sorghum is grown in almost all the districts in Gujarat to meet the grain and fodder requirement for maintaining the milch animals. At present released cultivars GJ 38, GJ 40, GJ 42 and GNJ 1 for grain, GJ 39 for dual and GFS 5, GAFS 11, CoFS 29, GAFS 12 and CSV 21F for fodder are get adopted by the farmers. The local varieties have high infestation of pest, late maturity and poor yields both for grain and fodder. Therefore, it is a need to develop a variety having high grain as well as fodder yield potential with early maturity. The sorghum genotype DS 127 (GJ-43) was developed from cross (AKR 354 x SPV 1616) followed by continuous evaluation and selection at Sorghum Research Station, S. D. Agricultural University Deesa. After found promising in preliminary evaluation trial in Kharif 2014, it was tested in multilocation trial at different research stations of Gujarat state from kharif 2015 to kharif 2017. On the basis of 16 testing trials proposed variety GJ-43 (2752.81 kg/ha) produced 46.85 and 22.66 per cent higher grain yield over the over the local check GJ-39 and national check CSV 20. Whereas, for dry fodder yield variety GJ-43 (143. 80 q/ha) showed increment of 32.13 and 14.90 per cent over the local check GJ-39 and national check CSV 20. Further this variety also exhibited desirable characteristics like Good height with long and broad leaves, long to medium peduncle with medium long semi compact panicle, short glume length with pearly white grains. It showed moderately resistance to ergot and grain mold diseases lesser infestation for shoot flies and stem borer than check varieties. It contains 10.13 per cent protein and low tannin (0.70 mg/g) in seed and 6.51 per cent protein and 39.00 per cent crude fiber in fodder, indicated good quality of grain and dry fodder. It is therefore, found suitable and released for dual purpose in kharif season for whole Gujarat State.

INFLUENCED OF PHOSPHORUS, ZINC AND ZINC SOLUBILIZER ON NUMBER OF ROOT NODULES AND PODS OF FENUGREEK (*TRIGONELLA FOENUM-GRAECUM*)

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Abstract

Fenugreek (*Trigonella foenum-graecum* L.) popularly known by its vernacular name "*methi*" has been in culinary and medicinal uses due to its restorative and nutraceutical properties for more than 2500 years. Phosphorus deficiency is usually the most important single factor which is responsible for poor yield of legume crops on all types of soil. Zinc is one of the imperative micronutrients required relatively in small concentrations (5-100?mg/kg) in tissues for healthy growth and reproduction of plants. Microbes are potential alternate that could cater plant zinc requirement by solubilising the complex zinc in soil. An experiment was conducted at Rajasthan Agriculture Research Institute (RARI), Durgapura-Jaipur, during *rabi* and *kharif* seasons of 2015-16 and 2016-17. The treatments comprises of four levels of phosphorus (0, 20, 40 and 60 kg P_2O_5/ha) and six treatments of zinc and zinc solubilizer [0, 2.5 and 5.0 kg Zn/ha, zinc solubilizer (*Bacillus endophyticus*), 2.5 kg Zn/ha + zinc solubilizer & 5 kg Zn/ha + zinc solubilizer) in split plot design with three replications. A uniform dose of 20 kg N/ha along with phosphorous and zinc as per treatments were drilled through diammonium phosphate and zinc sulphate (21%), respectively. To compensate the sulphur obtained from different levels of Zinc compensatory dose of sulphur will be applied through elemental sulphur before 21 days of sowing. The fenugreek variety Rmt-305 was sown on 03 November 2015 and 15 November 2016, with 30 cm row to row and 10 cm plant to plant spacing. Results revealed that increasing levels of phosphorous significantly increased the number of symbiotic root nodules/plant and pods/plant up to 40 kg P_2O_5/ha beyond that the response obtained was not significantly different. Among all zinc treatments application of 5.0 kg Zn/ha + zinc solubilizer produced the highest number of symbiotic root nodules/plant at 45 and 90 DAS, and pods/plant at harvest followed

by 2.5 kg Zn/ha + zinc solubilizer. At 90 DAS, during 2015-16 and at 45 DAS, during 2016-17, all the treatments found significant variations to each other except treatment effect of 5.0 kg Zn/ha that was found statistically at par with 2.5 kg Zn/ha + zinc solubilizer, however, at 45 DAS, during 2015-16, and at 90 DAS, during 2016-17, effect of zinc solubilizer was statistically at par with that of 2.5 kg Zn/ha.In number of pods/plant treatment effect of 2.5 kg Zn/ha + zinc solubilizer remaining at par with the 5.0 kg Zn/ha + zinc solubilizer and 5.0 kg Zn/ha, however, application of zinc solubilizer and 2.5 kg Zn/ha when applied alone, were also effective over control but were statistically at par to each other, during both the years.

SEASONAL INCIDENCE OF INSECT PEST OF OKRA, *ABELMOSCHUS ESCULENTUS* (L.) MOENCH. UNDER SEMI ARID REGION OF RAJASTHAN

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Abstract

Investigations on "Seasonal Incidence and Management of Insect Pest of Okra, *Abelmoschus esculentus* (L.) Moench under Semi Arid region of Rajasthan" were carried out at research farm of Rajasthan Agricultural Research Institute, Durgapura, Jaipur, during *kharif,* 2016 and 2017. The major insect pests infesting okra observed during two consecutive seasons were leaf hopper, *Amrasca biguttula biguttula* (Ishida); whitefly, *Bemisia tabaci* (Genn.) and okra shoot and fruit borer *Earias vittella* (Fab.) and *Earias insulana* (Boisd.). The infestation of leaf hopper commenced in the second week of July 2016, first week of July 2017, and reached its peak in the fourth and first week of August of 2016 and 2017, respectively. The maximum and minimum temperature had negative correlation with leaf hopper population in 2016 and 2017, while relative humidity and rainfall had positive in both the year. Whitefly *B. tabaci* commenced in the second week of July and reached its peak in the 36th and 33th SMW during 2016 and 2017, respectively. The population exhibited non significant correlation with climatic factors during both the year. Shoot infestation reached its peak in second week of September and third week of August in 2016 and 2017, respectively. Infestation of borer on fruits exhibited negative significant effect with maximum temperature, and positive significant correlation with relative humidity (r= -0.63, r= 0.61) during 2016. The same trend has been recorded in 2017. The pooled data of both the years revealed 34.02 per cent avoidable loss.

Maximum nitrogen content in leaf of okra was observed in treatment where, 75 percent nitrogen was applied through urea and 25 per cent was applied through vermicompost. Maximum population of leaf hopper and whitefly was observed in treatment where, all the nitrogen was applied through urea (6.94 & 8.37 per plant) and minimum population was recorded from treatment where, all the nitrogen was applied through vermicompost (2.27 & 2.34 per plant). Maximum fruit infestation was recorded in treatment, where all the nitrogen was applied through urea i.e. 14.39% (on number basis) and 21.55% (on weight basis). The efficacy of ten insecticides revealed that the acetamiprid, imidacloprid, spiromesifen, and acephate, formed a significant group and proved most effective insecticides against leaf hopper and spiromesifen, acetamiprid, acephate, thiamethoxam and imidacloprid formed significant group of most effective insecticides against whitefly. Acephate proved to be most effective followed by imidacloprid and acetamiprid in suppressing the shoot infestation by shoot and fruit borer. Acephate was found as most effective treatment, where minimum fruit infestation was recorded on both number basis and weight basis. The highest fruit yield of 91.65 q ha^{-1} was recorded in the plots treated with acephate followed by acetamiprid (87.40 q ha^{-1}), imidacloprid (87.00 q ha^{-1}), spiromesifen (86.05 q ha^{-1}) and thiamethoxam (83.80 q ha^{-1}). The highest B: C ratio was found in acephate (56.88) followed by acetamiprid (49.14), imidacloprid (48.45) and thiamethoxam (47.84). Dissipation study of acephate at 562 g. a.i. ha^{-1} in okra friut revealed 18.40 %, 34.41%, 58.97% and 100% dissipation after 1,3,5 and 7 days respectively.

EVALUATION OF NEWER INSECTICIDES AGAINST PESTS INFESTING GERBERA UNDER POLYHOUSECONDITIONS

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Abstract

Six newer insecticides were evaluated of against pests infesting gerbera under polyhouse conditions" Among the chemicals

chlorantraniliprole @ 0.30 ml/l found most superior incontrolling Whitefly with 87.54 per cent mortality at the end of second spray and lamdacyhalothrin @ 0.60 ml/l found to be the second best in reducing whitefly in gerbera. Thrips population was effectively controlled by spinosad @ 0.30 ml/l with 82.71 per cent reduction at the end of second spray. Next best was cyantraniliprole @ 1.50 ml/l proved to be more or less similar with chlorantraniliprole @ 0.30 ml/l. The only botanical under study, M-impact @ 1ml/l found on moderately effective against thrips and whitefly. All the treatments were found safe in terms of phytotoxicity.

IMPACT OF VOCATIONAL TRAINING PROGRAMME CONDUCTED BY KRISHI VIGYAN KENDRA DISTRICT TIKAMGARH DISTRICT OF MADHYA PRADESH

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Abstract

Human resource is the very important and the backbone of every association as well as every humanity, so the effectiveness and efficiency of human resource is very essential for the growth and development of organization or society. Krishi Vigyan Kendra (KVK) Tikamgarh imparted vocational training to farmer's, farm women and rural youth on Food processing and Mushroom Production, Bee-Keeping, Soft Toys Making and Value Addition at on and of Campus of the duration 2 to 15 days with the objective to assess the understanding of the content by the trainee's, to assess the likeliness of the training and to assess the impact of vocational training programme on knowledge gain by the rural youth. The results indicated that content of training on Soft toy making was majority understood by rural youth (81.48 %). Likeliness of the training was extreme in case of training on Soft toy making as 82.33 % respondents fully liked the training. Over all Knowledge gained during training programme in mushroom production training was very least (22.81 %). Extent of gain in knowledge was maximum among respondent in value addition (66.56%). Thus it can be concluded that training conducted by KVK for Rural youth was understandable, liked by trainees and enhanced the knowledge level of respondents.

KNOWLEDGE OF RURAL WOMEN IN PROCESSING AND PRESERVATION OF FRUITS IN TIKAMGARH DISTRICT OF MADHYA PRADESH

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Abstract

The objective of the present study was to identify the knowledge of rural women in processing and preservation of fruits in Tikamgarh District. The study was conducted in Tikamgarh and Prathvipur block of Tikamgarh district of Madhya Pradesh state. From each block, two villages were included in the study. The sample consisted of purposive selected 100 rural women, 25 from each village. Interview method was used for data collection. Frequency and percentage were used for analysis of data. Finding of the study reveals that respondents had poor knowledge in fruit processing and preservation practices with overall mean percent score of 13.20. The outcome of the study that the respondents possessed poor knowledge about different components of fruit processing and preservation namely-grading (38.75 MPS), processing and preservation (30.49 MPS), processing implements hygiene (19.25MPS), packaging (21.17 MPS), marketing (24.30 MPS) and storage (18.90 MPS).

A NOTE ON EPIDEMIOLOGYOF POULTRY COCCIDIOSIS IN UTTARAKHAND STATE

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Abstract

The present study aimed at epidemiological investigation of poultry coccidiosis in and around tarai region of Uttarakhand. A total of 16 commercial poultry farms were screened and 9 were found positive for coccidiosis. Out of coccidiosis positive

farms, six were broiler farms and three were layer farms. The overall prevalence was 56.25%, with 60% in broiler and 50% in layer flocks. The maximum prevalence was recorded during Aug-Sep (50%) followed by June-July (33.3%) and Dec-Jan (16.6%) in broilers, while there was equal prevalence during June-July (33.3%), Aug-Sep (33.3%) and Oct-Nov (33.3%) in layer farms. The management system mainly consisted of deep litter (87.50%) followed by cage system (12.50%). The identification of coccidian parasite was done by gross lesion site, oocyst morphology and coccimorph software. The most prevalent coccidian parasite identified was *E. tenella* (66.6%) in both type of farms followed by *E. maxima* (50%) and *E. necatrix* (33.3%) in broiler, while in layers *E. maxima* (33.3%) and *E. acervulina* (33.3%).

STUDIES ON YIELD MAXIMIZATION IN RICE FALLOW BLACK GRAM

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Abstract

Blackgram (*Vigna mungo* L.) is one of the important pulse crops in Tamil Nadu which is grown under irrigated, rainfed and rice-fallow conditions. Pulses are sown under rice fallow condition in about 2.6 lakh hectares in Tamil Nadu which is 30.8% of the total area under pulses in this state. The rice fallow pulses are cultivated in Thiruvarur, Thanjavur, Nagapattinam Districts and some parts of Pudukottai, Trichi and Cuddalore Districts in Cauvery Delta Zone with an average productivity of 204 kg/ha. In the residual soil moisture of the Cauvery Delta soils, pulses particularly black gram and green gram are broadcasted 7 to 10 days before the harvest of paddy and allowed to germinate and grow. Since pulses are grown under paddy stubbles, the pulse crops have to survive in the residual moisture of the soil. Besides, supplemental irrigation during the period will also provide all comfort to grow well and yield within 65 to 70 days of sowing. ADT 3 is most common variety for black gram in the canal dependent samba rice area of the Cauvery Delta where the soil is heavy clayey in nature. A new black gram variety LBG 752 which is resistant to YMV and escapes terminal moisture stress predominantly grown in Andra Pradesh during rice fallow season needs to be tested in the Cauvery Delta Zone of Tamil Nadu. Seed rate is playing an important role for maintaining optimum plant population. Selection of suitable black gram variety, irrigation and optimization of seed rate are the prime importance to achieve higher yield in rice fallow black gram. Hence, this study was undertaken.

Field experiments were conducted at Tamil Nadu Rice Research Institute, Aduthurai during rice fallow season 2013 and 2014 to study the effect of irrigation, varieties and seed rate on the productivity of rice fallow black gram. The experiments were laid out in split plot design with three replications. The main plot treatments comprised of irrigation (one supplemental irrigation at 25 DAS and no irrigation) and black gram varieties (ADT 3 and LBG 752) and the sub plots were assigned three levels of seed rate (30, 40 and 50 kg/ha). The results revealed that the growth, yield attributes and grain yield of rice fallow black gram were significantly higher under supplemental irrigation at 25 DAS than no irrigation. Black gram variety LBG 752 registered higher plant height compared to ADT 3. However, yield attributes and yield were comparable with ADT 3. Black gram sown at 40 kg/ha registered significantly higher yield attributes and grain yield over 30 kg/ha. The lower grain yield was observed in black gram sown at 50 kg/ha. Thus, black gram variety ADT 3 or LBG 752 sown at 40 kg/ha followed by one supplemental irrigation at 25 DAS could be recommended for higher productivity under rice fallow condition.

ESTIMATION OF RUNOFF USING USDA SCS-CURVE NUMBER AND AUTOREGRESSIVE TIME SERIES MODEL PARAMETERS FOR KACHHINDA WATERSHED, MORENA DISTRICT, MADHYA PRADESH

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Abstract

Hydrological modeling is a powerful technique of hydrologic system investigation for both the research hydrologists and the

practicing water resources engineers involved in the planning and development of integrated approach for management of water resources. The present study involved two hydrologic runoff model *viz*. SCS-Curve Number method and autoregressive time series model. In these study SCS-CN method has been applied for the estimation of surface runoff, CN and AMC condition for Kachhinda watershed. The Kachhinda watershed area is about 600 ha and is located under Morena district of MP. The SCS-CN is applied to generate curve number and to estimate the surface runoff with help of potential maximum retention the curve number of the watershed was estimated comparison of observed and estimation runoff show that the value is in close agreement with each other. The regression model between observed and estimated runoff was developed and also observed that the correlation coefficient was found to be 0.974. Autoregressive models of order 0,1 and 2 were tried for annual stream flow series and the annual stream flow was predicted. The goodness of fit and adequacy of models were tested by box-pierce portmanteau test, Akaike information criterion and by comparison of historical and generated data correlogram. For runoff the AIC value for AR(1) model is (0.919158) which is lying between AR(0) is (0.207433) and AR(2) is (5.9767).

EXISTING WATER PRODUCTIVITY AND CROPPING INTENSITY OF RIGHT BANK CANAL COMMAND OF SAMRAT ASHOK SAGAR PROJECT OF VIDISHA DISTRICT MP

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Abstract

The existing water productivity and cropping intensity of right bank canal command area was found 0.60 kg/m^3 and 163% respectively. The right bank canal comprises of five water user association namely Sarchampa, Ucher, Medaki, Sayar and Neemkheda whose existing cropping intensity was found to be 181%, 149%, 158% 177% and 172%, respectively. The cropping intensity of villages under study varies between 110% to 200%. It was also found that only six village out of 55 villages were having cropping intensity less than 140%. On the higher side, only five villages were having cropping intensity more than 190%. The lowest cropping intensity 115% was found in Sunari village of Medaki WUA. This village was having 245 ha net sown area in *Rabi* season but very less net sown area (84 ha) in *Kharif*season due to unavailability of water. Similarly less cropping intensity 118% was found in Anouriberkhedi village. This village was having 264 ha net sown area out of 455 ha in Rabi season and 272 ha net sown area out of 455 ha in *Kharif* season. The total water supplied in M m^3 excluding losses from RBC was collected from water resources department and the data on total production of wheat was collected from revenue record of Vidisha district to assess the existing water productivity. The existing water productivity of the command area was found to be 0.60 kg m^{-3} for *Rabi* season.

STUDY OF THE IMPACT OF PESTICIDES ON THE HEALTH OF APPLICATORS IN PILIBHIT

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Abstract

Pesticides are an integral part of the modern agriculture by reducing losses caused by the insect pests, diseases and weeds that reduce the amount of harvestable produce. The credits of pesticides include enhanced economic potential in terms of increased food production and decrease in vector-borne diseases. On the other hand indiscriminate and injudicious use of pesticides has given rise to several short-term and long-term adverse effects such as environmental pollution, ecological imbalances, and pesticides residues in food, fruits and vegetables, fodder, soil and water, pest resurgence, human and animal health hazards and destruction of bio-control agents. In India, 51% of food commodities are contaminated with pesticide residues and out of these, 20% have pesticides residue above the maximum residue level values on a worldwide basis. It has been observed that their long-term, low-dose exposure are increasingly linked to human health effects such as affecting the nervous system, immune-suppression, hormone disruption, diminished intelligence, reproductive abnormalities and even cancer. Present study was planned with the objective to study the health hazards related to pesticide application in the terai district of Pilibhit. Findings reveal that majority of the farmer used pesticide thrice in a crop. Majority of the respondents (66.34%) used hand sprayer for pesticide application followed by 22.56 per cent respondents that used pesticide spraying machine. Almost two-third of the respondents (67.71%) consulted shopkeepers for the pesticides to be used for a particular pest. Health hazards associated with pesticide includes feeling of dizziness, vomiting & nausea (18.65%), suffocation and itching (14.83%),

fatigue, backache, shoulder pain (8.62%) feel like faint (7.76%), pain in upper arm, shoulder and back (8.52%) and blister (4.76%). There were 2.89 percent cases of pesticide poisoning also. Study further reveals that personal protective equipments were least used by the farmers/farm workers during pesticides application. Other than covering the face with cloth, negligible number of farmers used coveralls, goggles, gloves, rubber boots or face masks. Hence, there is need of training farmers about the benefits of organic farming and proper use of pesticide in order to achieve sustainability in agricultural development.

EFFECT OF ORGANIC AND INORGANIC SOURCES OF NITROGEN ON GROWTH, YIELD AND QUALITY OF GARLIC *(ALLIUM SATIVUM* L.) VAR. GG-4

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Abstract

A field experiment was conducted at Regional Horticultural Research Station, Navsari Agricultural University, Navsari (Gujarat) during *rabi* season of 2015-16 for evaluating the effect of organic and inorganic sources of nitrogen on growth, yield and quality of garlic (*Allium sativum* L.) var. GG-4. The soil of the experimental plot is clay in texture, lower in available nitrogen, high in available phosphorus, fairly rich in potassium. The experiment was laid out in a Randomized Block Design with three replications and 9 treatments comprising of 25% RDN through FYM + 75% RDN through urea (T_1), 50% RDN through FYM + 50% RDN through urea (T_2), 75% RDN through FYM + 25% RDN through urea (T_3), 100% RDN through FYM (T_4), 25% RDN through VC+ 75% RDN through urea (T_5), 50% RDN through VC + 50% RDN through urea (T_6), 75% RDN through VC+ 25% RDN through urea (T_7),100% RDN through VC (T_8) and control (T_9). Results revealed that among the different sources of organic and inorganic nitrogen applied, the plant height at 30 DAS showed non significance whereas at 60 DAS and 90 DAS T_4 (100% RDN through FYM) showed significantly highest plant height of 45.73 cm and 61.80 cm, respectively. The applied fertilizers at 30 DAS and 60 DAS showed non-significant result in number of leaves per plant, however at 90 DAS T_4 (100% RDN through FYM) showed significantly highest number of leaves (11.96). Data projected on different treatment revealed that there was significant influence of different nitrogenous fertilizers and manures on the days to maturity of garlic bulb. It was noticed that application of 100% RDN through FYM was recorded the earliest to maturity (127.15 days).

The application of organic and inorganic nitrogen sources showed significant result among the treatments,T_4 (100% RDN through FYM) significantly increased fresh(24.46g) and dry weight of bulb (20.46g), diameter of bulb (39.15mm), no. of cloves per bulb (19.57), clove length (3.51 cm), clove weight (2.10g), yield (4.06kg/plot) and yield (8.16 t/ha). Meanwhile, maximumstorage days (164.00 days) with minimum sprouting (6.66 %) was significantly influenced by T_8 treatment (100% RDN through VC). The quality parameters like TSS (^{0}Brix) andascorbic acid content (mg/100g) was significantly influenced by T_8 (100% RDN through VC) with maximum value 45.39 ^{0}brix and 16.60 mg/100g, respectively. However, total sulphide content showed non-significant difference among different treatments.The treatment T_8 (100% RDN through VC) showed highest nitrogen content 546.66 kg/ha which was increased by application of treatment when compared before application of 380 kg/ha nitrogen content in the soil. Whereas phosphorus and potassium showed a medium range ofconten*t.e.* 51.33 kg/ha and 214.66 kg/ha, respectively.Based on the results obtained in the investigation, it can be concluded that the maximum net return with BCR value of 4.86:1was achieved under the treatment of 100% RDN through FYM (T_4) was found economical, profitable and proved highly remunerative.

EVALUATION OF LAND FORSUITABILITY OF DIVERSIFIED CROPPING SYSTEM FOR BARELI WATERSHED IN SEONI DISTRICT, MADHYA PRADESH USING GEOSPATIAL TECHNIQUE

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Abstract

A study was undertaken to evaluate Five soil series belonging to Bareli watershed in Seonidistrict of Madhya Pradesh for

sustainable land use planning. Currently cotton, pigeonpea, sorghum, soybean and maize are the main crops of this watershed and for the diversification of current cropping system some aromatic, medicinal and vegetable crops are studied for their suitability. The soil series were Diwartola, Diwara, Bareli-1, Bareli-2, and Bareli-3 mapped into twenty-four mapping units and soil map was generated using GIS technique.The soils were grouped into land capability sub-classes IVs and IVst and land irrigability sub-classes 2st, 3s, 3st and 4st. Soils of Diwartola, Bareli-1 and Bareli-3 are average and soils of Diwara and Bareli-2 are poor in soil productivitybased on limitations of erosion, drainage and physicochemical properties. Soil-site suitability assessment reveals that Bareli-1 are moderately suitable (S2) for cultivation of medicinal and vegetable crops like Ashwgandha, Mucana, Dawana, Lemongrass and Tomato, Chili, Cabbage, Turmeric and Ginger with moderate limitations of effective depth and slope, while the soil of Diwartola and Bareli-3 area is marginally suitable (S3) for cultivation of these crops and Diwara and Bareli-2 are not suitable for these crop. Whereas soils of Diwartola Bareli-1 and Bareli-3 are moderately suitable (S2) while soil of Diwara is marginally suitable (S3) and Bareli-2 is not suitable for Onion with the severe limitation of effective rooting depth and landform characteristics.

DRIP IRRIGATION LEVELS AND BLACK PLASTIC MULCH AFFECT THE PLANT GROWTH AND FRUIT YIELD OF BELL PEPPER UNDER NATURALLY VENTILATED POLYHOUSE

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Abstract

Bell pepper (*Capsicum annum* L. var. *grossum*) is a popular vegetable of the family Solanaceae. Despite its economic importance, production of good quality capsicum under open field condition is not easy due to its specific climatic requirements. However, it can successfully be cultivated under protected condition in Uttarakhand. For getting the maximum return form capsicum under naturally ventilated polyhouse, optimum nutrient management through fertigation and management of hydrothermal regime in the soil through mulching are important aspects need to be considered as soil moisture stress during the growing period reduces the yield and quality. In present conditions, water has become scarce natural resource due to rapid population growth, industrialization and urbanization. Keeping the above concerns, judicious use of irrigation water through drip system along with plastic mulch in naturally ventilated polyhouse has become inevitable. The present investigation was carried out in Randomized Block Design with four drip irrigation levels (100, 80, 60 and 40 % of crop water requirement) and surface irrigation in conjunction with or without plastic mulch. Drip irrigation at 80 percent of crop water requirement with black plastic mulch showed the highest yield of fruits (88.99 t/ha), whereas, yield was noticed minimum in surface irrigation (66.99 t/ha). It was also observed that drip irrigation both with or without plastic mulch registered much higher WUE compared to surface irrigation. As far as net return and Benefit Cost ratio was concerned, maximum net return of Rs 19,026.04 /100 m^2 and benefit cost ratio of 2.56 was also noticed in treatment receiving irrigation at 80 percent crop water requirement through drip system under plastic mulch.

ROLE OF AGRICULTURE IN PREVENTING CLIMATE CHANGE THROUGH CARBON SEQUESTRATION

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Abstract

The shift in global temperature has occurred since the advent of mankind. Particularly in the 20th Century this shift is in rapid phase. Today it is well known that the temp increases because of rise in carbon dioxide and other greenhouse gases released from the burning of fossil fuels, deforestation, agriculture and other industrial processes. Simultaneously Soil organic carbon is getting depleted particularly by the use of Intensive agricultural practices however carbon sequestration can occur through a variety of agriculture practices. Agriculturesinks of greenhouse gases are reservoirs ofcarbon that have been removed from theatmosphere through the process of biologicalcarbon sequestration. Carbon sequestration in the agriculture sector refers to the capacity of agriculture lands and forests to remove carbon dioxide from the atmosphere and fixing them into soil thus

forming soil organic carbon (SOC). Several farming practices and technologies can reduce greenhouse gas emissions and prevent climate change by enhancing carbon storage in soils; preserving existing soil carbon; and reducing carbon dioxide.The ability of agriculture lands to store or sequester carbon depends on several factors, including climate, soil type, type of crop or vegetation cover and management practices.By employing farming practices that involve minimal disturbance of the soil and encourage carbon sequestration, farmers may be able to slow or even reverse the loss of carbon from their fields.

DISASTER MANAGEMENT AND ROLE OF THE EDUCATIONAL INSTITUTIONS

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Abstract

A Disaster is a sudden calamitous event bringing great damage, loss or destruction of the functioning of a community or a society involving wide spread human, material, economic or environmental loss, which exceeds the ability of the affected community or society. It is man-made or natural incident. The disasters can be categorised in to three categories- disaster of least serious category, comparatively more serious nature and the mast dangerous disaster. Which are very harmful. Disaster management refers to how we can protect or preserve many lives and property. The Indian sub-continent due to its geographical feature is more susceptible to natural disasters. The floods, cyclones, droughts, earthquakes, forest fires, avalanches and lands slides are some commonly occurring disaster. Thus natural hazards cause colossal losses of life and property every year. Disaster management requires the Pre-Preparation, Recovery action, Rehabilitation and return to normal life and Prevention and planning to reduces the risk. All the four aspects are important but the first one is the most important. It is involves the Community awareness and education, Preparation of Disaster Management Plan for individual, school, family and community, Moc-drill, training and regular practice, Resource list and its generation, Development of warning system, First- Aid facilities and their training, A system for mural coordination, Identification of insecure groups. Such educational programmes should be fill-up at all levels of education including professional education.

EXTENT AND MAGNITUDE OF THE ADOPTION OF NEW SUGAR CANE PRODUCTION TECHNOLOGY IN MUZZAFARNAGAR DISTRICT OF U.P.

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Abstract

Sugar Cane is an important source of Sugar making in our country. It growing almost in all the tropical and Subtropical States. The low yield is an indication of Non of partial adoption of recommended package of Sugar cane Production technology. Although a great deal of information has been generated on the sugarcane package of practices in recent years yet the availability and adoption of such technology at one place is lacking. The present investigation is based on 150 respondent which were selected 75 each from reserve and free area of sugar factory. The total sample was draw through random sampling technique from Muzzafarnagar District of Uttar Pradesh in the Agriculture year 2014 - 15. Further all the selected respondent were classified in three categories on the basis of technology adoption. Result show that a large number of farmers i.e. 71 percent were not treated the seed before sowing. Regarding to fertilizers application a majority of sugar cane growers not applied balance and recommended dose of nitrogen, phosphorus and potassic fertilizers. Although an average i.e. 45 percent farmers applied recommended protective irrigation yet still 55 percent were partial adopters. It also implies that their were no wide difference in awareness of farmers about the various cultural practices in reserve and free area of sugar mills.

TRANSGENIC BREEDING : AN EFFICIENT TOOL FOR CROP IMPROVEMENT

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Abstract

Climate change, population explosion, stagnant production coupled with biotic and abiotic stress resulted serious threat to mankind. It is estimated that the world population will reach 10 billion by 2025. To feed the growing population from limited land, water and other natural resources is a big challenge now. Thus, producing crop varieties having higher productivity and tolerant to biotic and abiotic stress is imperative to feed the growing population and that could be attained either by conventional selection and breeding or through genetic engineering. Conventional breeding programme is time taking and slow process.But due to advances in the field of plant biotechnology, these limitations can be overcome by gene revolution. The gene revolution involves a direct transfer of desired genes from one species to another by using biotechnological tools of genetic engineering technology. The gene of interest to be transferred may come from either closely or distantly related species or even unrelated kind of organism such as fungi, bacteria and viruses.The plants developed by this technique are referred as transgenic plants or genetically engineered (GE) plants, or genetically modified (GM) plants.In the past few years, breeding possibilities have been broadened by GE and gene transfer technologies, as well as by gene mapping and identification of the genome sequences of model plants and crops which resulted in efficient transformation and generation of large number of different transgenic plants. Now transgenic technology has emerged as a principal avenue for crop researchers to modify traits of economic importance in crops. Redesigning crops to ameliorate biotic (pathogen and insect pests) and abiotic stresses (herbicide, drought, salinity, salt, etc.) by using genetic transformation is a better way for developing new plant varieties for enhancing agricultural production under adverse conditions. Moreover, the powerful combination of transgenic technologyand conventional breeding permits exploration andutilization of valuable traits encoded by transgene(s) to be introduced into commercial crops within an economically viable time frame. Thus, transgenic crops can help us to (i) ensure enhanced food production, (ii) provide nutritional security, (iii) operate sustainable agricultural technologies, (iv) develop climate resilient varieties (v) reduce regional imbalances in growth. It ultimately provides solutions to solve the global problem of hunger and malnutrition.

YIELD AND GAP ANALYSIS OF CLUSTER BEAN THROUGH FRONT LINE DEMONSTRATION

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Abstract

Cluster bean (*Cyamposis tetragonoloba* L.) commonly known as cluster bean, is a drought and high temperature tolerant deep rooted summer annual legume of high social and economic significance. India is the largest producer of cluster bean and contributes 80 percent of total cluster bean production in the world. Cluster bean crop is cultivated mainly during kharif season. Cluster bean crop has experienced a remarkable journey from a traditional crop grown on marginal lands mainly for food, animal feed and fodder to a crop with various industrial usages ranging from food, cosmetics, printing, pharma textile etc. The unique binding, thickening and emulsifying property of guar gum obtained from cluster bean seed has made it a much sought after product in the international market. The United States of America is the largest importer of cluster bean and its derivatives from India. Cluster bean has also witnessed price volatility and uncertainty owing to limited area of production, increasing demand, speculation, lack of reliable market information system etc. The analysis of historical data and of relative share of different states in the total production and area shows that Rajasthan is the leading producer but suffers from high fluctuation in production. On the other hand, Haryana has significant contribution in terms of production based on high productivity. Low yield cluster bean has been reported mainly due to lack of knowledge of high yielding varieties, sowing without proper seed treatment, low rainfall and heavy infestation of insect-pest and diseases. Keeping in view, farmers' participatory front line demonstrations on varietal performance of cluster bean were conducted at ten locations during *kharif*, 2013 and 2014 under CCS, HAU, Krishi Vigyan Kendra, Fatehabad, Haryana. The pooled data of two years reveals that on an

average 12.17 q/ha yield of cluster bean (var. H.G 2-20) was recorded in demonstration plot as compare to 10.52 q/ha in local check (var. H.G 365) which was 15.7 percent higher over that of the local check with an extension gap of 1.65 q/ha. The data on economic parameters reveals that a net return of Rs. 8874 per ha was in demonstration compare to Rs. 2231 per ha in local check. The benefit-cost (B:C) ratio was 1.19 and 1.05 in demonstration and local check, respectively. The basic objective of FLD was to speedy spread of the newly introduced high yielding varieties of cluster bean and acquaint extension functionaries local farmers with front line varietals and management technologies.

SOIL HEALTH MANAGEMENT FOR SUSTAINABLE PRODUCTION

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Abstract

Soil health is anintegral property that reflects the ability of soil to respond to agricultural intervention so that it continues to sustain the agricultural production. Soil health is majorly dependent on four factors: soil structure, nutrient cycles, pest and disease regulation and carbon transformation. In agriculture, we generally pay attention to plant and animal productivity but lesser to soil quality or health as these would be of greatest importance for satisfying the basic needs of present population. There are evidences of degradation of agricultural soils in form of erosion, contamination, salinity and soil compaction due to intensive agricultural systems and faulty practices. A number of major studies comparing intensive tillage and zero tillage have been made since 90's. Intensive tillage practices cause disruption of spatial integrity of soil as well as reduced activities of soil microbes. On the other hand, no tillage changes the water regime; enhance activity at macrofaunal scale that helps in soil structure modification. Presence of soil organic matter and soil microbial population are the key indicators of soil health and production. It is wellknown that high soil organic matter means high potential productivity and health of soil.Healthy soils are basic requirement of sustaining food security and livelihood for present as well as future generation. Sustainable management of soil health necessitates setting of criteria at satisfactory levels of soil based ecosystem functions and particularly in sustaining balance between the food production, soil and water conservation, water quality. Therefore, for achieving sustainable agriculture production, primary requirement is the maintenance of soil health and fertility.

STUDYING THE EFFECT OF GERMINATION ON PHENOLIC COMPOUNDS, FLAVONOID CONTENT AND ANTIOXIDANT ACTIVITY OF BARNYARD MILLET FLOUR BY RESPONSE SURFACE METHODOLOGY

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Abstract

The present study was aimed at to optimize the germination condition for barnyard millet using response surface methodology (RSM) in order to enhance the availability and activity of bioactive compounds (total phenolics, total flavonoid). Statistical analysis revealed that independent variables like (soaking time, germination time, germination temperature) significantly ($p<0.05$) affected all responses. The best optimum conditions for barnyard millet were: soaking time12 h at 33º C for 30h germination time with the highest AoxA (66.32 to 90.6%), TPC (27.45 to 43.96 mg gallic acid equivalent (GAE)/ 100 g sample) and TFC (30.52–43.96 mg RU/g sample). The result shows that germination improved the AoxA, TPC and TPC of foxtail millet flours. Values predicted at optimum conditions by the response surface model for all responses were experimentally tested and close agreement between experimental and predicted values was observed. Small deviations were found between the experimental values and the predicted ones and the values were within the acceptable limits, indicating the efficiency of the model in predicting the quality attributes of barnyard millet flour.

DIVERSIFICATION OF TRADITIONAL FISHING GEARS IN TO MECHANIZED GEARS ALONG THE WULAR LAKE, JAMMU AND KASHMIR

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Abstract

All of the advancements in fishing gear and equipment were designed to make the practice of fishing more efficient and result in higher catch rates. Unfortunately, with better gear and technology also came some disadvantages. After the 1950s, increased fishing efforts with more sophisticated gears led to significant increases of bycatch and habitat degradation.Over the past few decades, extreme changes have occurred in the characters of exploited fish populations at Wular lake. The majority of these changes have affected the growth traits of fish life history, which include a smaller size-at-age, an earlier age-at-maturation and among others unstained environmental and fishing pressure will change the life history traits of most fish species, so the fish individual's traits are still in small size-at-age and at earlier age-at-maturation in exploited fish populations.

EVALUATING THE SUSTAINABILITY OF COMPLEX SOCIO-ENVIRONMENTAL SYSTEMS: MESMIS FRAMEWORK

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Abstract

Sustainable development has become a leading target of scientific research and policy agenda. In the context of natural resource management, understanding and evaluating the performance of complex socio-environmental systems has become a challenge, and the design of more sustainable alternatives is a driving need. In addition, there is a need to translate the general principles of sustainability into operational definitions and practices. The present study examines key methodological issues in the selection, transformation and aggregation of economic, environmental and social indicators for sustainability analysis. Specific reference is given to the MESMIS approach, a systemic, participatory, interdisciplinary and flexible framework for sustainability evaluation. The MESMIS operative structure is a six step cycle. The first three steps are devoted to the characterization of the systems, the identification of critical points and the selection of specific indicators for the environmental, social and economic dimensions of sustainability. In the last three steps, the information obtained by means of the indicators is integrated through mixed (qualitative and quantitative) techniques and multi criteria analysis, so as to obtain a value judgment about the resource management systems and to provide suggestions and insights aimed at improving their socio-environmental profile. MESMIS attempts to generate a cyclic process which, by effectively integrating the evaluation into the decision making process, improves the likelihood of success in the design of alternatives and the implementation of development projects.

CASCADING IMPACTS OF CLIMATE CHANGE ON AGRICULTURE

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Abstract

In every region of the world, plants and ecosystems are adapted to the prevailing climatic conditions. When these conditions change, even slightly, even in a direction that could seem more favourable, the plants will be impacted, some will become less productive, or even disappear. Some of these impacts can be easily predicted, like the direct impact of a heat wave on a specific plant at a specific moment. Others are more complex to predict, like the effect of a certain climatic change on a whole ecosystem, because each element will react differently and interact with the other. For instance, many cultivated plants react favourably, in controlled conditions, to an increase of CO_2 in the atmosphere. The result, in the field, can be an increase or decrease in yield of the cultivated plant depending on weeds competing for nutrients and water and on remedial agricultural

practices. Pests and diseases are likely to move, following climate change, thus arriving in areas less prepared to them, biologically and institutionally. A cascade of risks from climate changes to agro-ecosystems, to agricultural production, to economic and social consequences and finally to food security and nutrition. These additional risks on agricultural production directly translate into additional risks for the food security and nutrition of the people who directly depend on agriculture for their food and livelihood. They can also have an impact on the food security and nutrition of distant populations through price volatility and disrupted trade.

STUDIES ON PHYSICOCHEMICAL QUALITY OF HERBAL BASED FLAVOURED BEVERAGE BY USING WHEAT GRASS POWDER AND HONEY

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Abstract

At present time, people of all age groups required different types of vitamin, mineral, protein etc. which are sufficiently available in flavoured beverage. Flavoured beverage is one of the most popular beverage options all over the globe and liked by people of all age groups. Flavoured beverage resolves health problem and provides enough nutrition at a low cost to a large population. The present study was conduct for estimating, physicochemical quality of flavoured beverage blended with wheat grass powder extract and honey. Flavoured beverage was prepared from toned milk. In treatment T0, T1, T2 and T3, honey was added at the rate 0%, 9%, 10% and 11% of milk and wheat grass powder at the rate 1% of milk. The flavoured milk prepared under different treatment combinations were tested for carbohydrate, protein fat, ash acidity, moisture and total solids content for the quality of the product.

SOIL HEALTH MANAGEMENT PRACTICES

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Abstract

Soil health refers to the ability of the soil to sustain agricultural productivity and protect environmental resources. Different type of practices which manage the soil health that is, incorporation of cover crops and judicious additions of animal and green manure and compost can also be used to increase or maintain soil organic matter. Reduce the inversion tillage because, it increase the soil erosion. Cover crops keep the soil covered and reducing the risk of erosion, fibrous-rooted cover crops can promote aggregation and stabilize the soil. Farmscaping is a whole-farm, ecological approach to increase and manage biodiversity with the goal of increasing the presence of beneficial organisms. It can also be used as a filter strip to prevent water runoff and soil erosion. Carefully planning the timing, application method, and quantity of manure, compost, and other fertilizers will allow minimize nutrient excesses.

COMPARATIVE ASSESSMENT OF POPULAR BRANDS OF CORN STARCH FOR CUSTARD PREPARATION AND ITS EVALUATION FOR VISCOSITY AND SENSORY PARAMETERS

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Abstract

Weikfield industry one of the manufacturer of custard powder from last 56 years have reported that they are receiving some market complaints like custard doesn't get thick, custard becomes watery, improper setting, one lot made up of same starch have different viscosity or gel strength than other one etc. They are using corn starch as major ingredient for the manufacturing of custard along with artificial colours and flavor. In the present study corn starch of '*Weikfield*' and '*Tops*' brands were

analyzed for their physico-chemical, functional, characterization, pasting, textural properties and custard of different quantities were prepared to evaluate their viscosity and sensory parameters. The *Weikfield* corn starch had significantly (P<0.05) higher swelling power and solubility, pH, moisture, ash, starch, amylose, phosphorus, iron and zinc contents than those of *Tops* corn starch. On the other hand, the *Tops* corn starch had significantly (P<0.05) higher sediment volume, total blue value, sodium content than *Weikfield* corn starch. The mean particle size and apparent blue value of *Tops* and *Weikfield* did not differ significantly. The turbidity and syneresis of both the corn starches increased with storage period but, *Tops* corn starch had significantly (P<0.05) lower turbidity and syneresis than *Weikfield* corn starch. Among pasting properties of corn starches, the trough viscosity of *Weikfield* corn starch and set back viscosity of *Tops* corn starch were significantly (P<0.05) higher. The peak viscosity, breakdown viscosity and final viscosity of *Tops* while, peak time, pasting temperature and gelatinization temperature of *Weikfield* corn starch were slightly higher to each other but, did not differ significantly. The *Tops* corn starch gel had maximum hardness, cohesiveness, gumminess, whereas, lower springiness, chewiness and adhesiveness as compared to *Weikfield* corn starch. Both *Tops* and *Weikfield* corn starches exhibited polyhedral starch granules with mean size of 12.5 and 12.1 mm, respectively. *Tops* corn starch had significantly the lowest value of chroma and hue and similar values of L as that of *Weikfield* corn starch. The *Tops* corn starch had significantly higher Falling no. which indicates low á-amylase activity. The *Tops* corn starch had higher viscosity (2.56 cP) than *Weikfield* corn starch (2.38 cP). The *Weikfield* corn starch had significantly (P<0.05) lower water binding capacity, gel consistency and higher oil absorption capacity than *Tops* corn starch. The *Tops* corn starch had Least gelation concentration, the highest rapidly digestible starch, slowly digestible starch and resistant starch than *Weikfield* corn starch. The viscosity of *Tops* custard product was higher than *Weikfield* custard at different quantities (15 to 30 g). The overall acceptability of both *Tops* and *Weikfield* custard prepared with 20 g custard powder was 'desirable'. The mean scores of all the sensory attributes of *Weikfield* custard were higher than *Tops* custard except texture.

STUDY ON EFFECT OF PLANT GROWTH REGULATORS AND BORON ON QUALITY ATTRIBUTES OF TOMATO (*SOLANUM LYCOPERSICUM* MILL.)

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Abstract

The field experiment was conducted during *Rabi* season of 2017-18 at the Horticulture Research cum Instructional farm, BTC CARS, Bilaspur (C.G.). The experiment was laid out in Randomized Block Design (RBD) replicated thrice including ten treatments viz., treatments T_1 (control), T_2 (GA_3 @ 50 ppm), T_3 (GA_3 @ 75 ppm), T_4 (NAA @ 75 ppm), T_5 (NAA @ 100 ppm) T_6 (Boron @ 75 ppm), T_7 (GA_3 @ 50 ppm + Boron @ 75 ppm), T_8 (GA_3 @ 75 ppm + Boron @ 75 ppm), T_9 (NAA @ 75 ppm + Boron @ 75 ppm) and T_{10} (NAA @ 100 ppm + Boron @ 75 ppm). The significantly Maximum total soluble solid (5.06 %) was recorded in (T_{10}), while, the minimum total soluble solid (3.53 %) was observed in (T_1). The highest ascorbic acid recorded (30.00 mg/100 g) in (T_8), whereas, lowest ascorbic acid observed by (T_1). And Lowest percentage of acidity (0.45 %) was recorded in (T_{10}) and highest percentage of acidity (0.60 %) was observed in (T_1).

ACHIEVING AGRICULTURAL SUSTAINABILITY THROUGH REVIVAL OF INDIGENOUS TECHNICAL KNOWLEDGE

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Abstract

India being the land of diversity has a rich tradition of various settlements like Harappan and Mohenjodaro.Fertile land has given birth to numerous cultures till date. Though the development of modern agricultural technologies, substantially increased the crops and livestock production, but gradually decreased the farms income due to heavy investment on costly external resources of uncertain future availability hence it is need of the hour to minimize this exploitation for safe hand over the agricultural resources to the next generations keeping healthy agriculture for wealthy nation.With the advent of the concept

of sustainable agricultural development, ITK has attracted the focus of the scientists, extension workers, project coordinators etc IndigenousTechnical Knowledge (ITK) is an integral part of the culture and history of a local community. Indigenous knowledge is systematic body of knowledge acquired by local people through the accumulation of experiences, informal experiments and intimate understanding of the environment in a given culture. It encompasses the element use of natural products to solve problems pertaining to agriculture and allied sector. This study is based on the fact of eliciting the importance of documentation and validation of different ITKs selected through the secondary source of literature. The study will help the policy makers scientists, agriculturalists, project initiators in their endeavour to strive for achieving sustainability in all aspects of life.

EFFECT OF POPLAR BASED AGROFORESTRY SYSTEM ON GROWTH AND YIELD OF FODDER CROPS IN NORTH-WESTERN HARYANA

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Abstract

The fast agricultural development in the Haryana has deteriorated the agro-ecosystem through excessive use of natural resources. Heavy depletion of soil health, lowering of water table and high rate of environmental pollution are the matters of great concern for the future of the state. Diversification in agriculture in general and a rice-wheat rotation in particular has strongly been advocated in irrigated agro-ecosystems to conserve the natural resources. Poplar (*Populus deltoides*) based agroforestry systems are one of the viable alternative land use systems to diversify the rice-wheat rotation, prevent further degradation and obtain biological production on a sustainable basis. Hence, the present study was conducted to assess the effect of poplar based agroforestry system on growth and yield of fodder crops during kharif season. An already established two year old poplar plantation was used as the basic agroforestry model under which sorghum and cowpea were sown to determine their growth, yield attributing parameters and yield for fodder purpose. It was observed that the closer spacing of poplar based agroforestry system had a negative effect on the growth and yield of both the underneath crops as compared to the wider spacing. Further, it was observed that higher moisture content was recorded under closer spacing i.e. 3x3m as compared to the wider spacing which further effects the growth and yield of the fodder crops.

SELECTION OF BEST CROSS COMBINATIONS ON THE BASIS OF HETEROTIC PARAMETER ANALYSIS IN RICE (*ORYZA SATIVA* L.) UNDER NORMAL SOWN CONDITION

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Abstract

The present investigation was carried out at the Research Farm of Department of Genetics and Plant Breeding, N.D. University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad. The crosses were made during *Kharif*, 2012 and the hybrids along with parental lines and check varieties were evaluated during *Kharif*, 2013. The material for present investigation was derived by crossing 4 CMS line with 15 testers in a line x tester mating design. A set of 82 genotypes involving 60 hybrids (F_1's) and their 19 parents along with three checks were planted in randomized block design with three replications during *Kharif*, 2013. Observations were recorded for twelve characters *viz*., days to 50% flowering, days to maturity, plant height (cm), panicle bearing tillers per plant, panicle length (cm), spikelets per panicle, spikelet fertility (%), 1000-grain weight (g), biological yield per plant (g), harvest index (%), L/B ratio and grain yield per plant (g). Out of 60 crosses, the most desirable five crosses showing high significant positive heterosis over better parent for grain yield per plant were IR 79156A X NDR 370132 (72.19%), IR 68888A X NDR 370132 (66.69%), IR 68897A X NDR 370131 (43.33%), IR 58025A X CR 2499 (40.71%) and IR 79156A X NDR 2701 (35.80%). Eighteen crosses showed positive and significant heterosis over standard variety and the best five crosses among them were IR 58025A X NDR 1127 (20.78%), IR 79156A X IR 27723 (14.87%), IR 68888A X IR 27723 (14.81%), IR 58025A X Sugandha 5 (12.84%) and IR 68897A X NDR 2701 (12.46%). The cross, IR 58025A X NDR 1127, showed highest mean performance (28.70g), heterobeltiosis (22.48%) and standard heterosis (20.78%) for grain yield per plant while highest yielding parent, NDR-359, produced mean grain yield 23.78 g.

PREVENTION OF CHRONIC LIVER DISEASE BY APPLYING THERAPEUTIC DIET

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Abstract

Chronic liver disease (CLD) in the clinical context is a disease process of the liver that involves a process of progressive destruction and regeneration of the liver parenchyma leading to fibrosis and cirrhosis. It refers to disease of the liver which lasts over a period of six months. It consists of a wide range of liver pathologies which include inflammation (chronic hepatitis), liver cirrhosis, and hepato-cellular carcinoma. Portal hypertension is the earliest and most important consequence of cirrhosis and underlies most of the clinical complications of the disease. This study was carried out at AMRI hospital, Bhubaneswar to find the prevention of CLD by applying therapeutic diet. About 30 patients were chosen as a subject and analyzed in respect to their anthropometric, nutritional and bio-chemical parameters. In the study of anthropometric assessment it was found that CLD patients had lower BMI and MUAC level than standard level. The BMI and MUAC of CLD patient was found 19.66 ±0.202 and 21± 0.967 respectively. The values were found significantly differ from the reference standard value with F-value for BMI is 1.69 and for MUAC is 0.033 at $p<0.001$, where as in biochemical assessment it was found that CLD patients had lower level of albumin and higher level of bilirubin, SGOT and SGPT than normal level. The SGOT and SGPT of CLD patient was found 46.4 ±0.008 and 51.7± 0.031 respectively. The values were found is not significantly differ from the reference standard value with F-value for SGOT is 3.97 and for SGPT is 5.813 at $p<0.001$. During the analysis of nutritional assessment it was found that CLD patients consume low amount of protein, fat and carbohydrate and high amount of fat rich food and therapeutic diet was designed according to the condition of severity of disease. The patients were generally recommended for high protein, low fat, moderate amount of carbohydrate, moderate amount of energy, and low sodium diet.

EFFICACY OF PRE AND POST EMERGENCE HERBICIDES ON WEED FLORA AND PRODUCTIVITY OF GREEN GRAM

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Abstract

An investigation on "Efficacy of pre and post emergence herbicides on weed flora and productivity of green gram" was carried out during *Kharif* 2016 at Research Farm, College of Agriculture, Gwalior (M.P.). The experiment was laid out in randomized block design (R.B.D.) replicated three timed with 10 treatments, namely T_1 (Quizalofop-p-ethyl @ 50 g/ ha PoE), T_2 (Quizalofop-p-ethyl @ 75 g/ ha PoE), T_3 (Quizalofop-p-ethyl @ 100 g/ ha PoE), T_4 (Fenoxaprop-p-ethyl 100 g/ ha PoE), T_5 (Pendimethalin @ 1000 g/ ha PE), T_6 (Pendimethalin + imazethapyr (RM) @ 750 g/ ha PE), T_7 (Pendimethalin + imazethapyr (RM) @ 1000 g/ ha PE), T_8 (Imazethapyr + imazamox (RM) @ 80 g a .i./ ha PoE), T_9 (Two hand weeding at 20 and 40 DAS), T_{10} (Weedy check) green gram variety TJM-3 was grown up adopting recommended package of practices except weed control measures which were applied as per treatments. The magnitude of weed competition in green gram and weed control through different combination of herbicides had been critically in present investigation for evaluation of different combination of herbicides were growth, weed studies and economics of the treatments. Maximum number of nodules per plant was achieved in two hand weeding plot at 45 DAS of observation. However, it was statistically at par with T_8 (Imazethapyr + Imazamox (RM) @ 80g / ha PoE), T_5 (Pendimethalin 1000 g/ ha PE) and T_1 (Quizalofop-p-ethyl @ 50 g/ ha PoE. The lowest weed population was obtained from two hand weeding at 20 and 40 DAS (T_9) which was superior over other treatments except imazethapyr + imazamox (RM) @ 80 g a .i./ ha PoE (T_8) this treatment gave better control of *Cyperus rotundus, Echinochloa colona, Digra arvensis, Commelina benghalensis and Phylenthus niruri,* following by treatment Pendimethalin + imazethapyr (RM) @ 1000 g a .i./ ha PE (T_7). Among all treatment, Imazethapyr + imazamox (RM) @ 80 g a .i./ ha PoE gave the maximum net return (Rs. 42490/ ha) and B:C ratio (3.18) also.

DIFFERENT CHEMICAL WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF WHEAT CROP [*TRITICUM AESTIVUM* (L.)]

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Abstract

The study of "Different Chemical Weed Management Practices on Growth and Yield of Wheat Crop [*Triticum aestivum* (L.)]" under adoptic and climatic condition of northern part of Madhya Pradesh was carried out during Rabi season 2015-16 at the Research Farm, Directorate of Weed Science Research (DWSR), Centre for College of Agriculture(RVSKVV), Gwalior (M.P.). The experiment was laid out in randomized block design replicated three timed with 12 treatments, namely T1 (Pendimethalin 0.75 kg/ha), T_2 (Sulfosulfuron 0.025 kg/ha), T_3 (Metribuzin 0.21 kg/ha), T_4 (Clodinafop 0.06 kg/ha), T_5 (Pendimethalin 1.0 kg/ha + Metribuzin 0.175 kg/ha), T_6 (Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha), T_7 (Sulfosulfuron 0.03 kg/ha + Metsulfuron 0.002 kg/ha), T_8 (Pinoxaden 0.06 kg/ha + Metsulfuron 0.004 kg/ha), T_9 (Mesosulfuron 0.012 kg/ha + Iodosulfuron + 0.0024 kg/ha), T_{10} (Clodinafop 0.06 kg/ha + Metsulfuron 0.004 kg/ha), T_{11} (Two hand weeding at 30 and 60 DAS), T_{12} (Weedy check) wheat variety MP4010 was grown up adopting recommended package of practices except weed control measures which were applied as per treatments. Weed competition in wheat and weed control through different combination of herbicides in present investigation for evaluation of were growth, yield and yield attributing characters. Plant population recorded at both initial and harvest stages are not affected significantly due to different weed control treatments. The maximum plant height, yield attributing characters *viz.* number of effective tillers/m^2, ear length, number of grains per ear, test weight significantly influenced was recorded in two HW at 30 and 60 DAS at harvest. It was followed by T_6 (Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha) and T_8 (Pinoxaden 0.06 kg/ha + Metsulfuron 0.004 kg/ha). Among all treatment, Pendimethalin 1.0 kg/ha + Sulfosulfuron 0.018 kg/ha gave the maximum net return (? 64921/ha) and B:C ratio (3.02) also.

PREPARATION OF CARROT LASSI

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Abstract

Lassi is a popular and traditional fermented milk beverage of the Indian Subcontinent. In the present study treatment T0, T1, T2 and T3 were formulated in which lassi was prepared by blending Standardized Milk : Carrot Juice (SM : CJ) in the ratio of (100:00, 90:10, 80:20, 70:30) before fermentation. In lassi samples of different treatments and control, the chemical analysis (fat, protein, carbohydrate, ash, total solids, acidity, anti-oxidant, curd tension and curd synersis) was done for estimating its nutritional content and also the organoleptic characteristic like colour and appearance, body and texture, flavor and taste and overall acceptability was evaluated by trained panelist using 9 point hedonic scale. On the basis of findings, it was concluded that T1 was found to be highly acceptable among the other combinations by sensory evaluation and therefore it was considered as optimised product. Fat, protein, carbohydrate, ash, total solids, acidity and anti-oxidant of lassi samples of T1 treatment was found to be 3.31, 3.23, 14.48, 0.71, 21.73, 0.86 and 0.82 per cent respectively. Curd tension (g) of curd and curd syneresis (ml/100 ml) of curd was found to be 18.75 and 6.40 respectively.

SEQUESTRATION OF CARBON IN SOILS: PROCESSES AND POTENTIAL

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Abstract

The concentration of soil organic carbon, which is an important component (approx. 58% on weight basis) of soil organic

matteris among numerous controls or determinants of soil quality. Being highly reactive SOM is in a dynamic equilibrium under a specific land use and farming system. Its concentration increases with input of crop residues and root biomass; input of manure, compost and sludge; and aeolian and alluvial/fluvial deposits. Carbon sequestration capacity in a soil can be viewed from three levels-potential, attainable and actual. The potential carbon sequestration capacity for soils of managed ecosystems can be approximately equated to the initial value observed under historic land use prior to any change in the site management. The attainable soil carbon sink capacity refers to the amount which can be achieved following the best management practice over a long period of time and would hardly approach more than 50% of the potential capacity. The actual soil C sink under common land use will be usually low. Soil carbon sequestration are controlled by interactions of chemical, physical and biological factors. Land-use change (LUC) is widely considered a major factor that affects soil organic carbon (SOC) sequestration. It significantly alters soil organic carbon through alterations to the physical environment (e.g. moisture, temperature, etc.), physical (aggregation) and chemical (clay) protection, and biota. Each soil has a carbon carrying capacity, and an equilibrium carbon content depending on the nature of vegetation, precipitation and temperature. The equilibrium between carbon inflows and outflows in soil is disturbed by land use change until a new equilibrium is eventually reached in the new ecosystem. Soil Carbon stocks significantly increased after the conversion from farmland to grassland (19%), tree plantation (18%) and secondary forest (53%), they uses a relative percentage change. There are certain strategies that can be used to increase the soil carbon sequestration in soil like soil restoration and woodland generation, no-till farming, cover crops, nutrient management, manuring and sludge application, green manuring, water conservation and harvesting, efficient irrigation, agroforestry practices, and growing energy crops on spare land. These provides a better balance between input and output of carbon through respiration during decomposition of organic matter. To obtain a higher precision predictive capabilities of detecting changes in SOC, additional empirical studies are needed combined with a better understanding of biological and physical processes involved.

FOOD PROCESSING SECTOR : A SCENARIO OF INDIA

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Abstract

Food processing is the one of the important sector for the Indian agriculture, economy and development. India is the second largest producer of the world after China in the food processing. Currently food processing is account for almost one third of the total market of India. Food processing is the transformation of the raw ingredients into food, or of food into other forms so that food can be used for the longer times and save the wastage. There are different techniques are used in this sector to improve the food quality and shelf life. Many challenges are present in this sector in despite of it gives lots of opportunities in the overall development of the country and boost up the Indian economy.

DEVELOPMENT OF PROBIOTIC FERMENTED VALUE ADDED PRODUCTS ENRICHED WITH *OKARA*

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Abstract

Okara, the byproduct of soybean milk usually discarded as waste or animal feed possesses high levels of dietary fiber and good quality protein and can be a useful source of food for probiotic microorganisms. In the last few decades, lactic acid bacteria have attracted enormous attention of food manufacturers due to their potential health-promoting effects. Fermented foods are of great significance because they provide and preserve vast quantities of nutritious foods in a wide diversity of flavors, aromas and textures, which enrich the human diet. In the present study various value added food products incorporated with 10, 20 and 30 per cent *okara* powder and fermented with *Lactobacillus acidophilus* (10^8cells/ml) have been developed. The developed fermented food products were analyzed for sensory characteristics and most acceptable products were analyzed for nutrient composition. Among the various fermented food products developed *idli* and *dhokla* prepared by

incorporating 10 per cent *okara* powder and *wadi* and *rabadi* containing 20 per cent *okara* powder were found to be organoleptically most acceptable. Results of nutritional analysis indicated that supplementation of 10 per cent *okara* powder in *idli* and *dhokla* and 20 per cent *okara* powder in *rabadi* and *wadi* improved the protein, fat, crude fibre, dietary fibre and minerals content. Probiotic fermentation increased the availability of minerals, *in vitro* protein digestibility and antioxidants, while, decreased the phytic acid content in all the developed products. Thus, utilization of waste *okara* in food products not only improved their nutritional value but also helps in solving its disposal problem. Moreover, addition of probiotic microorganism will provide therapeutic properties to these food products.

MOLECULAR TILLING AND ECOTILLING : EFFECTIVE TOOLS FOR MUTANT GENE DETECTION IN PLANTS

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Abstract

With the fairly recent advent of inexpensive, rapid sequencing technologies that continue to improve sequencing efficiency and accuracy. Annotated genomic information of many species of animals, plants, and microbes are publicly available. The focus on genomics has thus been shifted from the collection of whole sequenced genomes to the study of functional genomics. Reverse genetic approaches have been used for many years 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 or animal species. TILLING is a non-transgenic reverse genetics approach that is applicable to all animal and 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 and animal species. EcoTILLING, which is a variant of TILLING, examines natural genetic variation in populations and has been successfully utilized in animals and plants to discover SNPs including rare ones.

ORGANIC PLANT BREEDING : TOOLS AND TECHNIQUES

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Abstract

Organic farming is based on the concept of working 'with nature' instead of against it; however, compared with conventional farming, organic farming reportedly has lower productivity. Ideally, the goal should be to narrow this yield gap. In this review, we specifically discuss the feasibility of new breeding techniques for rewilding, a process involving the reintroduction of properties from the wild relatives of crops, as a method to close the productivity gap. In this review, we describe the development of a set of guiding principles for the evaluation of breeding techniques by the organic sector over time. The worldwide standards of organic agriculture (OA) do not allow genetic engineering (GE) or any products derived from genetic engineering. The standards in OA are an expression of the underlying principles of health, ecology, fairness and care. The derived norms are process and not product oriented. As breeding is considered part of the process in agriculture, GE is not a neutral tool for the organic sector. The incompatibility between OA and GE is analyzed, including the "novel breeding techniques". Instead, alternative breeding approaches are pursued based on the norms and values of organic agriculture not only on the technical level but also on the social and organizational level by including other value chain players and consumers. The status and future perspectives of the alternative directions for organic breeding are described and discussed.

CLIMATE CHANGE, GREENHOUSE EFFECT AND ITS IMPACTS

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Abstract

Climate change has become a widespread topic in recent years. This is a problem that resulted from the emission of greenhouse gases that affect our environment. Therefore, it raises questions on whether the problem is caused by human activities or it's just a part of nature's cycle. Climate change is a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer (IPCC, 2007). An abrupt climate change occurs throughout the world. The levels of greenhouse gas CO_2 are increasing in different parts of the world. The other greenhouse gases are water vapors, methane, ozone, nitrous oxide, fluorinated gases. The greenhouse effect is a process that keeps the earth warm enough for people, plants and animals to live on. Impacts of climate change : 1.Global warming : Early decades of the twenty-first century will see a moderate warming of 1-2 ^oC, resulting in reduced crop yields in seasonally dry and tropical regions, while crop and pasture yields in temperate regions may benefit. Further warming in the second half of the century will negatively affect all regions, although agriculture in many developing countries in semi-tropical and tropical regions will bear the brunt of the effects. 2. Extreme climate events: Increased frequency and severity of extreme climate events, such as more heat stress, droughts and flooding, is expected in coming decades due to climate change. It will increase negative impacts on agriculture, forestry and fisheries in all regions. In particular, it will modify the risks of fires, and pest and pathogen outbreaks, with negative consequences for food, fiber and forestry. 3. Undernourishment: The number of undernourished is likely to increase by 5-170 million people by 2080, with respect to a baseline with no climate change. Even small amounts of warming will increase risk of hunger in poor developing countries, due to negative impacts on food production and availability. 4. Food stability, utilization and access: Additional negative impacts of climate change on food security, with the potential of reducing access to and utilization of food in many regions already vulnerable today, are expected but have not been quantified. In particular, stability of food supply is likely to be disrupted by more frequent and severe climate extremes.

DETECTION OF DELTAMETHRIN RESISTANCE BY FAO RECOMMENDED AIT-DD IN *RHIPICEPHALUS (BOOPHILUS) MICROPLUS* TICKS FROM 4 DISTRICTS OF HARYANA

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Abstract

Regular monitoring of status of acaricides resistance in field ticks and use of suitable managemental practices is essential for control of tick population in animals. With the continuously increasing acaricides use, it is indispensable to be aware of efficacy of currently available drugs. During the regular acaricides resistance carried out in Haryana, *Rhipicephalus (Boophilus) microplus* ticks collected from 15 places in 4 district of Haryana (Mahendergarh, Bhiwani, Sirsa and Hisar) were subjected to FAO recommended adult immersion test with discriminating dose (AIT-DD) against deltamethrin. The country specific discriminating dose based on data generated using IVRI-I line was taken as discriminating dose for deltamethrin (59.20 ppm) and standard FAO protocol was followed. Results revealed a high degree of resistance against deltamethrin in ticks collected from Agroha, Talwandi Rukka, Kamri Road, Sanipura village of district Hisar (86.67%,46.67%; 100%; 100%); Barwa, Siwani and of Nakipur district Bhiwani (86.67%, 66.67%, 66.67%, respectively); Jadwa of district Mahendergarh(60%); Badopal, Dhankad and Fatehbad city of district Fatehbad (40%, 40% and 53.3%, respectively) and Sirsa city (53.3%), respectively. The development of high degree of resistance is attributed to the fact that synthetic pyrethroids have been most widely and arbitrarily used in Haryana for the tick control in the last two decades. It also indicates an urgent need for adopting alternative tick control strategies.

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Abstract

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ENHANCED PRODUCTION OF LIGNOCELLULOLYTIC ENZYMES BY A SOIL FUNGUS *ASPERGILLUS DENTATUS* UNDER DIVERSE CULTURE CONDITIONS

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Abstract

The aim of this study was to optimize cultural conditions for optimum growth and enhanced lignocellulolytic enzyme production by *Aspergillus dentatus* for better digestion of lignocellulosic wastes to produce compost. The fungus was isolated from the leaf and litter waste. The effect of different temperature, pH, incubation period, aeration condition, addition of metal ions and various carbon and nitrogen sources on the lignocellulolytic enzyme production under submerged condition was studied. *Aspergillus dentatus* grew well and produced optimum enzymes at 30°C on the 7th day of the incubation at stationary conditions and at pH 6. Overall enzyme activities however decreased after addition of metal salts. Carboxymethyl cellulose (300 mg/l) and alkali lignin (200 mg/l) were the best carbon source for cellulolytic and ligninolytic activity, respectively. The best nitrogen source was ammonium sulfate. At optimum conditions different enzyme activities observed were 0.011 IU/ml FPase, 0.015 IU/ml CMCase, 6.5 IU/ml Lac, 57.5 IU/ml LiP and 4 IU/ml MnP.

ASSESSMENT THE KISAN MOBILE ADVISORY (KMA) SERVICES AS AN EFFECTIVE TOOL FOR PROMOTION OF BACKYARD POULTRY FARMING IN MORENA (M.P)

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Abstract

Information and communications Technology (ICT) has become a very Important Feature of the Indian Agriculture Sector in Present time .the strengthening of extension system in India, the technology has been playing a crucial and consistent role. As Extension involves the conscious use of communication of Information with variable tools for various backgrounds of beneficiaries. Agriculture extension continues to be in transition and now a day it also involves use of modern communication tools like Kisan Mobile Advisory (KMA) service, e- mails, WhatsApp, and Hike messenger system for effective Tranfer of Technology (TOT) in order rich the targeted beneficiaries. Under KVK- ATMA convergence programme backyard poultry

small unit (150 Adults) has been establishment at Mungawali, Morena farm with objective of promotion of Backyard poultry in the district with view of empowerment of rural youth and woman, conservation of desi bread of poultry, Eradication of malnutrition in the children as well as women by mean of high quality chicken meat, and eggs, Initially Farmers Home & KVK Faced the major constraint of how to reach larger population of farmers and how to provide the fertile eggs to larger farmers group so that they would hatch the eggs naturally using spent hen. But with the advent of KMA services things are going to be simpler for outreach to farmers. The responses of the group were variable, nearly 710 Phone calls were received by KVK Manny farmers enquired about specialty special breed.

INFLUENCE OF GROWTH REGULATORS ON FRUIT DROP, YIELD AND QUALITY OF SWEET ORANGE (*CITRUS SINENSIS* OSBECK.) CV. JAFFA

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Abstract

Citrus is the leading group of fruit crops in area and production in the world. It is grown under tropical, subtropical and Mediterranean climatic conditions. It is considered to be one of the most remunerative fruit crops that have a lasting niche in the international trade and world finance. Jaffa is an important commercial cultivar of sweet orange. The present investigations entitled "Influence of growth regulators on fruit drop, yield and quality of sweet orange (*citrus sinensis* Osbeck.) cv. Jaffa'', was carried out on the sixteen years old sweet orange trees planted at a spacing of 6 m x 6 m in sandy laom soil at Research Orchard of Department of Horticulture, Chaudhary Charan Singh Haryana Agricultural University, Hisar during the year 2015-16. The treatments comprising of GA_3 10, 20 and 30 ppm, 2,4-D 5, 10 and 15 ppm and NAA 20, 30 and 40 ppm along with control were laid out in randomized block design with three replications. The GA_3, 2,4-D and NAA was sprayed twice, *i.e.*, in last week of March and first week of July. For recording data on these parameters, the thirty plants were randomly selected in the orchard. The maximum reduction of fruit drop from May to harvesting and percent fruit retention was recorded with the treatment NAA 20 ppm. The fruit yield parameters, *i.e.*, number of fruits per plant and fruit yield per plant, were obtained highest with NAA 20 ppm, while the other parameters of yield like fruit weight and fruit size were obtained highest with foliar application of GA_3 30 ppm. Quality parameters like TSS, acidity, ascorbic acid content and TSS to acid ratio were recorded better with foliar application of 2,4-D 15 ppm and juice content found better with foliar application of NAA 20 ppm. Trees sprayed with GA_3 20 ppm showed minimum rind thickness in their fruits. The number of seeds per fruit was recorded minimum with foliar application of GA_3 30 ppm.

UNDERUTILIZED LEAFY VEGETABLE PLANTS FOR NUTRITION AND HEALTHFROM BAHRAICH (UP) INDIA

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Abstract

Humans have used leaves as food since time immemorial. Different types of leaves, depending from the place and the season, were part of the human diet since prehistoric times. With the passing of the centuries many of those traditional leaf vegetables have been replaced by leaves that are more tender, have a more neutral taste or that are considered more refined. The leaves that were part of ancient traditional diets are still to be found in the wild, sometimes at the edge of cultivated fields, or near abandoned homesteads. Generally, they are found not far from inhabited places, indicating that they are the vestiges of ancient cultivated plants. Leaf vegetables, also called leafy greens, salad greens, pot herbs, vegetable greens, or simply greens, are plant leaves eaten as a vegetable, sometimes accompanied by tender petioles and shoots. Although they come from a very wide variety of plants, most share a great deal with other leaf vegetables in nutritionand cooking methods.

Nearly one thousand species of plants with edible leaves are known. Leaf vegetables most often come from short-lived herbaceous plants, such as lettuce and spinach. Woody plants of various species also provide edible leaves. The leaves of many fodder crops are also edible for humans, but usually only eaten under famine conditions. Examples include; alfalfa,

clover, most grasses, including wheat and barley. These plants are often much more prolific than traditional leaf vegetables, but exploitation of their rich nutrition is difficult, due to their high fibre content. Leaf vegetables contain many typical plant nutrients. This causes leaf vegetables to be the primary food class that interacts significantly with the anticoagulant warfarin. In Bahraich there are 95 plant species representing 69 genera belonging to 39 families. Fabaceae (Papilionoideae) is the biggest family being represented by 12 plant species whereas Fabaceae (Caesalpiniaceae)with 10 plant species followed by Brassicaceae with 8; Amaranthaceae with 7; Asteraceae with 6; Malvaceae with 4; Chenopodiaceae, Apiaceae, Cucurbitaceae, Lamiaceae and Portulacaceae with 3 plant species each; Cleimaceae, Araceae, Covolvulaceae and Boraginaceae with 2 plant species; rest 24 families viz., Mimosaceae, Plantigenaceae, Basellaceae, Nyctaginaceae, Capparaceae, Molluginaceae, Acanthaceae, Rubiaceae, Moringaceae, Menyanthaceae, Bignoniaceae, Poaceae, Oxalidaceae, Polygonaceae, Phyllanthaceae, Sapindaceae, Padillaceae, Caryophyllaceae, Urticaceae, Meliaceeae, Verbenaceae, Marsileaceae, Solanaceae and Apocynaceaeis being represented with single plant species each.

WILD NUTRIMENTALFRUIT PLANTS FOR HEALTH FROM BAHRAICH (UP) INDIA

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Abstract

Collection of fruits from wild for food and domesticating food plants for multipurpose use is an age-old practice in Indian subcontinent. Mango, bael, aonla, banana, palmyra palm, coconut and such others are intimately associated with the culture, traditions, festivals and rituals of Indian communities. Medicinal uses of fruits like bael, emblic myrobalan, jackfruit, wild dates, wild fig, monkey jack, jamun, ber, mango, wood apple and many others find place in Indian Ayurvedic literature starting from the century BC to date.The rich diversity of wild fruits in Indian tropics and Himalayan belt not only provide nutritious food, but also income to tribal and poor people living close to forests and rural areas. Quite often, besides providing timber, firewood, fodder, they serve as famine insurance in periods of food scarcity. Many of the wild fruits are nutritionally very rich and of great medicinal value. Agricultural research and development however have not given due emphasis to these plant groups resulting limited literature on diversity, distribution, taxonomy, phenology and uses of wild edible fruit plants of India. An inadequate understanding concerning taxonomy, biology and local knowledge of these taxa has contributed to suboptimal utilisation of these valuable resources. It is essential therefore, to identify, evaluate, improve, propagate and cultivate these under-utilized species for its sustainable use which can broaden our choice of food and enrich the livelihoods of rural poor.

In Bahraich there are 76 wild edible plant species representing 63 genera of 40 families. Moraceae and Anacardiaceae are found to be the biggest family represented by 5 plant species each whereas Malvaceae and Rhamnaceae with 4 plant species each; Rutaceae, Annonaceae, Euphorbiaceae, Sapotaceae, Solanaceae and Myrtaceae with 3 plant species each; Amaranthaceae, Vitaceae, Caesalpiniaceae, Lameaceae, Capparidaceae, Apocyanaceae, Boraginaceae, Dilleniaceae, Sapindaceae, Rubiaceae and Combretaceae with 2 plant species each. The rest 19 families viz., Cornaceae, Phyllanthaceae, Averrhoaceae, Nyctaginaceae, Bombacaceae,Lecythidaceae, Cucurbitaceae, Ebenaceae, Asteraceae, Flacourtiaceae,Molluginaceae, Acanthaceae, Verbinaceae, Lauraceae, Passifloraceae, Arecaceae, Portulacaceae, Aizoaceae, and Papilionoideaeare being representing by single plant species each.

FOOD PACKAGING PERMEABILITY INTERAACTIONS

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Abstract

The use of polymer materials in food packaging field is one of the largest growing market area. Actually the optimization behaviour of packaging permeability is of crucial importance, in order to extend the food shelf-life and to reach the best engineering solution. Studying the permeability characterization of the di?erent polymer material (homogeneous and heterogeneous polymer system) to the di?erent packaging gases, in di?erent environmental condition, is crucial to understand if the selected material is adapted to the chosen food contact ?eld. Temperature and humidity parameters are of crucial importance for food quality preservation, especially in real life situations, like food market, and house long-life use. The aim

of this report was to collect information about the state of the art on the permeability characteristics of the polymer packages used on food ?eld.

ENHANCED PRODUCTION OF LIGNOCELLULOLYTIC ENZYMES BY A SOIL FUNGUS *ASPERGILLUS DENTATUS* UNDER DIVERSE CULTURE CONDITIONS

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Abstract

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ROLE OF LECTIN GENES IN TRANSGENIC CROPS FOR RESISTANCE TO INSECTS

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Abstract

Plant lectins are a heterogenous group of sugar binding proteins, which have a protective function against a range of insect pest. Plant lectin proteins possessing at least one non-catalytic domain, which binds reversibly to a specific mono or oligosaccharide carbohydrate. Plant lectins are classified mainly on the basis of their sugar binding properties. Lectins from snowdrop, pea, wheat, rice, castor, soybean, mungbean, garlic, sweet potato, tobacco, chickpea and groundnut have been isolated and characterized. Lectins produce chronic effects on survival and development of sucking insect pests. The major pests for rice are Homopteran, the brown plant hopper and green rice leafhopper; transgenic rice plants demonstrating tissue-specific expression of GNA were constructed and evaluated for control of the brown plant hopper. Transgenic tobacco expressing pea lectin has shown adverse effects against *H. virescens.* Wheat germ agglutinin (WGA) and phaetohaemogluttinin (PHA), lectins have low mammalian toxicity. Greater insecticidal activity has been observed in chitin binding lectins from wheat germ and common bean. Transgenic maize expressing WGA has shown moderate activity against *O. nubilalis* and *Diabrotica* sp. Insects fed on transformed plants exhibited a significant decrease in survival and fecundity, which retarded their development However, mammalian toxicity of this lectin is high and it may not be therefore a good candidate for use in genetic transformation of crops.

STANDARDISATION OF PRODUCTION TECHNOLOGY IN VEGETABLE CROPS

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Abstract

An investigation was performed at the experimental field of SKUAST-K during different years was carried out to find out the

effect of different levels of zinc and boron, different sources of organic manures on growth, yield and quality of vegetables. The experiments was laid out in RCBD with three replications. Treatment combination Z_3B_3 (7.500 kg Zn + 1.500 kg B ha^{-1}) has recorded maximum values for plant height (69.18 cm), number of leaves $plant^{-1}$ (11.64) and leaf length (42.32 cm), total bulb yield (287.29 q ha^{-1}), marketable yield percent (96.34)**,** marketable bulb yield (276.76 q ha^{-1}) respectively in onion while in case of tomato Z_3B_2 (9.500 kg Zn + .500 kg B ha^{-1}) resulted highest plant height (88.54 cm), leaf area index (2.63), and highest yield (243.43 q ha^{-1}). In case of organic manures through vermicompost (S_2) resulted in maximum plant height (117.18 cm) and leaf area index, fruit number $plant^{-1}$, fruit yield $plant^{-1}$ (2.44 kg) and total fruit yield (8.92 kg m^{-2}) in capsicum. While in case of lettuce Treatment T9, (60 kg N ha^{-1} + 45 kg P ha^{-1}+ 30 kg K ha^{-1}+ Vermicompost (4 t ha^{-1}) + Biofertilizers @ 7.5 *l* ha^{-1}) recorded higher values for plant height (37.84 cm), plant spread (39.91 cm), minimum no. of days to first harvest (40), leaf area (280.42 cm^2), no. of leaves $plant^{-1}$ (48.15), average leaf weight (13.95 g), leaf weight plant-1 (518.25 g), leaf yield $plot^{-1}$ (9.81 kg) and leaf yield ha^{-1} (23.83 t).

HETEROSIS STUDIES IN OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH) FOR GREEN FRUIT YIELD AND QUALITY PARAMETERS OVER THE ENVIRONMENTS

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Abstract

The experiments were comprised of 90 genotypes of okra including 8 lines (females), 9 testers (males) and their 72 hybrids alongwith commercial check GJOH-3 were sown at Distant Hybridization Farm and Agronomy Farm, Anand Agricultural University, Anand during K*harif* 2016 (E_1), late *Kharif* 2016 (E_2) and *Rabi* 2016-17 to study the magnitude of heterosis over better parents and standard check over the environments. Significant differences were observed among parents and hybrids indicating considerable genetic variation among these genotypes. Maximum heterosis over better parent was observed for green fruit yield per plant followed by number of fruits per plant, fruit length, primary branches per plant, total chlorophyll content and plant height. While maximum standard heterosis was observed for total chlorophyll content, crude fiber content, green fruit yield per plant, fruit length and internode length. The range of heterobeltiosis and standard heterosis for green fruit yield per plant was 43.91 to -13.45 % and 27.84 to -22.70 % over pooled basis respectively. As regards the quality parameters the estimates of heterosis was low to moderate in desired direction for total chlorophyll content, mucilage content, carbohydrate content and ash content and moderately higher in desired negative direction for crude fiber content. The Hybrids DHOK-153 x Kashi Kranti, JF 108-2 x Kashi Kranti , DHOK-153 x GJO 3, DHOK-153 x Kashi Pragati, JF 108-2 x GAO 5 and AOL 9-2 x Phule Utkarsha were found to be high yielding and heterotic over the environments and pooled basis. The per cent disease incidence (PDI %) for yellow vein mosaic virus indicated that these hybrids recorded no incidence of YVMV reaction. The yield levels in *Rabi* season (E_3) were low due poor environment i.e. off season, despite of this these hybrids displayed consistent performance. Hence, these hybrids were identified as potential for commercial cultivation after sufficient evaluation.

LENGTH WEIGHT RELATIONSHIP AND CONDITION FACTOR OF SELECTED FRESHWATER FISHES OF GOVARDHAN SAGAR LAKE, UDAIPUR, RAJASTHAN

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Abstract

The present study was carried out to estimate the length-weight relationship and condition factor of selected freshwater fishes of Goverdhan Sager Lake, Udaipur, Rajasthan during January- June, 2018. The relationship between length and weight of *Catla catla* and *Labeo rohita* from fish catch was calculated by establishing correlation and regression between the two parameters. The exponent values of total length and weight varied from 0.676 to 1.495 and 0.336 to 6.046 for different length

groups of *Catla catla* and *Labeo rohita.* The higher value of 'n' could be attributed to high rate of weight increase with per unit increase in length. The correlation co-efficient 'r' between total length and weight were found to be significant for all the length groups of both the species. The values of condition factor (K) of both the species were also computed and found that both the species performed well in Lake Environment. The maximum 'K' value was found 1.251 in *catla catla* (group A) and 1.210 in *labeo rohita* (group B). On the basis of length-weight data, the regression equations of body-weight on total body length were calculated.

MANIFESTATION OF CORRELATION COEFFICIENTS AND PATH COEFFICIENT EFFECTS ON SEED YIELD IN BLACKGRAM (*VIGNA MUNGO*)

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Abstract

A field experiment involving 15 genotypes of blackgram was carried out at Agricultural Research Station, Madhira during rabi 2016-17 to study the association of yield contributing characters among themselves along with direct and indirect effects on seed yield. The results of the study revealed that days to 50% flowering showed positive significant association with days to maturity indicating that genotypes with more number of days to 50% flowering tend to mature later. Days to maturity does not have any significant effect with any of the yield attributes. Plant height showed positive significant association with number of clusters per plant, number of pods per cluster and ultimately seed yield. This indicates that genotypes with longer plant type could accommodate more number of clusters per plant along with more number of pods per cluster. Positive significant association of number of clusters per plant, number of pods per cluster and test weight with seed yield was observed in the material under study. Path analysis indicated negative direct effects of days to 50% flowering and days to maturity resulting in negative association with seed yield. Plant height showed positive direct effect and positive indirect effects were manifested through number of clusters per plant, number of pods per cluster and test weight resulting in positive significant association with seed yield. Number of clusters per plant and test weight showed positive direct effects and positive indirect effects through other yield attributes resulting in positive significant association with seed yield. For improvement of seed yield, attention should be given for traits number of clusters per plant, number of pods per cluster and test weight which showed high positive correlation coefficients with a considerable direct and indirect effect on seed yield.

EFFECT OF LIME TREATMENT ON NUTRITIONAL QUALITY OF QUALITY PROTEIN MAIZE

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Abstract

Maize (*Zea mays*) is the third important food crop after rice and wheat and is a good source of carbohydrate, fat, protein and some of the important vitamins and minerals. Since it is cheaper than wheat and rice, maize acquired a well deserved reputation as a poor man's nutri-cereal. Inspite of its rich nutritional value, it has not been considered as complete food due to lack of two essential amino acids *viz.* lysine and tryptophan. However, this problem has been overcome by the development of quality protein maize (QPM) by International Maize and Wheat Improvement Centre (CIMMYT).QPM is considered a bio-fortified food because its nutritional profile has been improved using conventional breeding techniques. The grain of QPM contains nearly twice as much as lysine and tryptophan compared to traditional maize varieties. The nutritional quality of QPM (Vivek QPM-9) with and without lime treatment was studied. For alkaline treatment or nixtamalization the maize grains after cleaning were soaked in 1% lime water (Calcium hydroxide) and then cooked for 30 minutes at 85^{0}C. The nixtamal was steeped overnight followed by washing to remove lime. The grains were spread in tray and dried in dryer at 60^{0}C till moisture level reached 10-11% with occasional mixing. The dried grains were ground in milling machine and prepared flour was stored in air tight container for further analysis. Results of proximate composition showed that untreated and lime treated maize grains contain moisture content (%) 10.5 and 10.83, total ash (%) 1.47 and 1.92, crude protein (%) 10.07 and 9.78, crude fat (%) 3.53 and 2.93, crude fiber (%) 2.80 and 2.25, carbohydrate by difference (%) 71.64 and 72.29 and energy (kcal/100g) 358.57 and 354.65, respectively. Non significant difference was observed ($p>0.05$) in the moisture, protein and carbohydrate values of untreated and lime treated QPM grains while the fat, fiber content and energy value of untreated QPM

grains were significantly higher ($p<0.05$) than treated QPM grains and ash content of treated QPM grains was significantly higher ($p<0.05$) than untreated QPM grains.

NEED FOR CONSERVATION OF FOREST GENETIC RESOURCES OF HIMALAYAN REGION

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Abstract

The magnificent Himalaya is well known for its bio-physical diversity and socio-cultural heritage. It is one of the Global Biodiversity Hotspot (Himalayan Biodiversity Hotspot) and covers ten states of India including Uttarakhand and other Himalayan states. The total geographical area of Indian Himalaya is about 5, 94,427 sq. km., which is about 18% of the total area of the country. The wide altitudinal range and diverse climatic as well as edaphic variability range from alluvial grasslands and subtropical broad leaf forests to alpine meadows above the tree line make these mountain ranges very rich and diverse biodiversity region. The forest resources are one of the important livelihood options for the people of this region and provide wild edibles, medicine, fodder, fuel wood, agricultural implements, timber, industrial raw materials and several other non-timber forest products. But due to overexploitation, shrinking forest land and their climate vulnerability threaten the sustainability of these forest genetic resources. Thus, the conservation and sustainable management of these forest resources is needed. The conservation of forest genetic resources (FGR) has huge potential to ensure food and livelihood security to the local communities. The important forestry species of Himalayan region will be prioritized on the basis of their status in Red data book, economic importance and their role in the livelihood support to the local people. The seeds of important FGR species would be collected from phenotypically good trees. To maintain diversity in germplasm collection we will have to select distinct populations separated by natural barrier and within seed source five trees at least 100 meter apart from each other. Collected seed should be preserved and maintained for further analysis in future research work. We should also focus on chemical characterization of precious forest genotypes (i.e, *Taxus buccata, Quercus semecarpifolia, Betula utilis, Rhododendron arboreum, Myrica esculenta, Diploknema butyracea* population etc.) which are naturally distributed in different part of Himalayan region. The chemical characterization of collected forest genotypes using various methods would be done for their chemical markers like total saponin content, total tannin content, total phenolic content, total flavanoid content with use of various instruments like UV Spectrophotometer, GCMS, HPLC, HPTLC etc. With the help of chemical characterization we could assume that which population of a specific forest genotype is superior from other populations. So we have to make a conservation strategy to conserve those chemically superior genotypes. So making the FGR we will be able to generate knowledge about seed germplasm, their storage and chemical characterization of forest genotypes. Also in this we could add genetic constituents, forest pathology survey data, geo co-ordinates of precious germplasm. This will be very beneficial for present conservation scenario and to develop future conservation strategy for the sustainable management of forest genetic resources.

OPINION OF FARMERS TOWARD IMPROVED GINGER PRODUCTION TECHNOLOGY IN UDAIPUR DISTRICT OF RAJASTHAN, INDIA

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Abstract

Ginger is an important spice and medicinal crop. The present study was conducted in Udaipur district of Rajasthan. There are total eleven tehsils in Udaipur district, out of which two tehsils namely, Jhadol and Gogunda were selected on the basis of maximum area under ginger cultivation. Five villages from each identified tehsil were selected on the basis of maximum area under ginger cultivation. For selection of respondents, 100 ginger growers were randomly selected from identified villages (10

from each village) for data collection. The study reveals that, majority of respondents 65.00 per cent have favourable opinion whereas, 20.00 per cent ginger growers have least favourable and remaining 15.00 per cent respondents had more favourable opinion about improved ginger production technology. There was significant difference between the respondents of selected tehsils about opinion farmers toward improved ginger production technology.

IMPACT OF CLIMATE CHANGE ON RAINFED AGRICULTURE

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Abstract

Rainfed agriculture is one of the most vulnerable sectors to climate change, as the available water and land resources are limited and most of the country's land is arid. The impact of climate change is high on agriculture compared to any other sector in the country. The climatic variations such as drought occurrence have high level impact on the rainfed crops yield. Improving agricultural productivity, under rainfed or irrigated conditions hold significant scope for addressing climate change vulnerability. It also offers adaptation capacity needs as well as water and food security in the country. The potential for improving soil water productivity and improved water harvesting have been explored as ways of climate change mitigation and adaptation practices in similar agro-ecological environments and create opportunities for outscaling for much wider areas.

STUDIES ON DIVERSE GERMPLASM OF PEA (*PISUM STIVUM* L) WITH SELECTION PARAMETER OF GENETIC VARIABILITY

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Abstract

Pulses are one of the most important crops worldwide, having major impact on agriculture, environment, animal, human nutrition. Pulses are included many crop like Gram, pea and other crop. Pea (*Pisum sativum* L.) is a temperate crop.Pea crop have their ability to develop a symbiotic relationship in their root nodules with the nitrogen fixing bacteria enriching the soil fertility Pea crop several qualities rich in proteins, energy, minerals and certain vitamins.. The success of breeding programme is essentially a manifestation of efficiency of selection and largely depends upon the magnitude of significant variability present in the plant population. This experiment was carried out at the Research Farm of Institute of Agriculture Sciences, Banaras Hindu University, Experimental design was Randomized Block Design with each treatment was replicated three times and sixty four lines/germplasm of pea. The development of an effective plant breeding programme is dependent upon the existence of genetic variability. The objective was assessment of direct selection parameters Genetic variability with nine characters studied were days to flowering, days to maturity, plant height, number of primary branches, pods per plant, seed per pod, pod length, seed weight (g) and seed yield per plant (g). Analysis of variance revealed significant differences among genotypes for all the characters under study. A wide range of variation was found for all the characters. The seed yield per plant, the ultimate trait of improvement ranged from 4.06 gm in EC 322745 to 12.99 gm in HFP-14. Estimates of phenotypic variance ($ó^2p$) were higher than genotypic variance ($ó^2g$). A wide range of phenotypic variance ($ó^2p$) were observed for days to flowering, days to maturity, plant height, pods per plant, seed weight and yield per plant while narrow range of variance showed by the traits number of primary branches, pod length and seeds per pod. The result of phenotypic coefficient of variation revealed that seed yield per plant exhibited highest phenotypic coefficient of variation (31.94)The maximum value of genotypic coefficient of variation was found for seed yield per plant (31.60) In general, the values of genotypes coefficient of

variation (GCV) were lower than the respective phenotypic coefficient of variation (PCV).The coefficient of variation was less than 10 percent for all the characters. This shows lower influence of environment for the characters under study.Significant difference among genotypes for all characters performance out of 64 genotypes 10 genotypes (IPF-9981, KPMR-557, HFP-14, EC324108II, EC324112, HUP-5, EC328747, EC31363II, Rachana and JP-4) were found to be best genotypes for multiple traits, so these can be used as parent for future breeding programme and ample scope for selection of promising line from present gene pool for improvement.

ARTIFICIAL GENETIC VARIABILITY CREATION FOR PIGEONPEA IMPROVEMEN

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Abstract

Pulses exist pioneering in akeyrole Indian agriculture. Within this protein-rich group of crops, red gram or pigeonpea occupies an important role between rainfed resource and poor farmers because it provides quality food, fuel wood fodder and broom.Hybrids are plants that result from controlled cross-breeding of two different but specific varieties or breeding lines of the same species of plant.One common feature of domesticated plants is condensed genetic diversity paralleled to their wild families. Two key forces that basis the drop in genetic diversity are lesser population sizes (''Bottleneck effect'') that happen during the primary formation of a domesticated lineage, and selective sweeps and/or directional selection for genes related with domestication traits. Domestication is a human social-ambitiousprocess; it can also be predisposed by random gene flow from wild relatives. Constricted genetic base coupled with low levels of resistance against important biotic/abiotic stresses in cultivated pigeonpea is the major constraint affecting its production and productivity globally. Wild species are important birthplaces of resistance to biotic and abiotic stresses as they have evolved to survive droughts, floods, extremes of temperature (heat/cold), and have the ability to tolerate damage by insect pests and diseases. Wild *Cajanus* species are the reservoir of many important genes and can be utilized to improve the crop cultivars, enrich variability, and increase the genetic base. Pre-breeding populations involving wild *Cajanus* species from the secondary and tertiary genepools as Donors. In wild *Cajanus* species, new and diverse sources of resistance/tolerance to various biotic stresses, such as alternaria blight, phytophthora blight, sterility mosaic disease, pod borer, cyst nematode, and abiotic stresses, such as salinity, as well as accessions with agronomically desirable traits, such as early flowering, high seed number per pod, high seed protein content and photoperiod insensitivity have been identified. Ten alleles reported exclusive to inter-specific derivatives of *Cajanus cajan*x *C. scarabaeoides*. The presence of alleles unique to specific population or group shows an incomparable genetic variability at confident loci. This material is valuable to classify interspecific hybrids with exclusive genetic variability, whose selection can increase the allele abundance of breeding population.

High levels of resistance is presented in wild *Cajanus* species, these are not being exploitedsufficiently in pigeonpea breeding programs. The major restriction is due to the linkage drag and different incompatibility barriers between cultivated and wild species. Under such situations, prebreeding provides anexceptionalprospect to increase primary gene pool by exploiting genetic variability present in wild species and cultivated germplasm, and will ensure continuous supply of new and useful genetic variability into the breeding pipelines to develop new cultivars having high levels of resistance and broad genetic base. Exploitation of wild *Cajanus* species has also subsidizedexpressivelyin the direction of improvement of nutritional quality of cultivated pigeonpea. Some wild *Cajanus* species namely *C. scarabaeoides, C. sericeus, C.albicans, C. crassus, C. platycarpus,* and *C. cajanifolius* have higher seed protein content (average 28.3%) compared to pigeonpea cultivars (24.6%). The major limitation in well using *Cajanus platycarpus*for the enhancement of cultivated pigeonpeais embryo abortion in the BC_1 generation from the cross *C. platycarpus*× *C. cajan*. *Cajanus platycarpus,* although placed in the tertiary gene poolof pigeonpea, is now amenable to gene transfer withthe development of suitable embryo rescue techniques.

CROP GROWTH OF WHEAT (*TRITICUMAESTIVUM*L.) UNDER LAND CONFIGURATION AND IRRIGATION SCHEDULES

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Abstract

Ideal planting geometry is important for better and efficient utilization of plant growth resources get the optimum productivity of wheat. Proper scheduling of irrigation (amount and timing) to crops is an important component of water saving technologies. Water is the fundamental basis of life. Growth of plant is controlled by rates of cell division, their enlargement and by the supply of organic and inorganic compounds required for the synthesis of new protoplasm and cell wall. Cell enlargement is particularly dependent on least minimum degree of cell turgor. The share of water to agriculture will further reduce to about 72 to 75% by 2050. About 75 to 85% water requirement of wheat in the north-western plain zone is met through irrigation. Crop establishment method and irrigation schedule are major causes of growth and yield reduction in wheat, which also affect its water-use efficiency.Six land configuration systems, 75 cm bed, 2 rows (B_{75-2}); 75 cm bed, 3 rows (B_{75-3}); 90 cm bed, 2 rows (B_{90-2}) ; 90 cm bed, 3 rows (B_{90-3}), 90 cm bed, 4 rows (B_{90-4}); Flat planting, rows 22.5 cm apart and three irrigation schedule practices such as I_1- 4 cm irrigation at IW/CPE 0.8; I_2- 5 cm irrigation at IW/CPE 1.0; I_3- 6 cm irrigation at IW/CPE 1.2.The objective of the study was to examine the treatment effects on crop growth, of wheat crop. The crop growth rate displayed significantly higher with land configuration of 90 cm bed, 2 rows (B_{90-2}). Among the yield attributes increased significantly in B_{75-2} and B_{90-2}plots, respectively.The yield and harvest index was significantly higher in B_{90-4})land configuration and 4 cm irrigation at 0.8 IW/CPE.The interaction, irrigation schedules × land configuration was significant for crop growth and yield was significantly higher in 4 cm irrigation at 0.8 IW/CPE at 90 cm bed, 2 rows (B_{90-2})and 90 cm bed, 3 rows (B_{90-3})as compared to rest treatment combination. Farmers can easily respond to this technology if efforts are diverted to demonstrate yield differences between flat and bed planting systems either by modifying bed configuration or crop rows planted on the top of the bed or proper irrigation schedules.

EFFECT OF NITROGEN LEVELS ON YIELD AND QUALITY PARAMETERS OF WHEAT VARIETIES UNDER AGRI-SILVI-HORTICULTURAL SYSTEM

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Abstract

The present investigation was carried out during 2015-16 and 2016-17 to study the effect of nutrient levels on yield attributes, yield and quality parameters of different wheat varieties (WH-1105, HD-2967, WH-711 and DPW-621-50) in already established five year old agri-horti and agri-silvi-horti systems. The growth of eucalyptus and kinnow under both agri-silvi-horti and agri-horti system increased sharply with the advancement of age. Eucalyptus attained maximum (7.2 cm) CAI for basal diameter followed by DBH (5.1 cm) during the age of six year which shows that the eucalyptus achieved sufficient biomass during 6th year of growth. The additional dose of nitrogen (10, 20 and 30 per cent) to the recommended dose of fertilizer (RDF) in both the agroforestry based systems increased the growth, yield attributes and yield of different wheat varieties however; the difference between further additional doses of N to the RDF was non-significant. Among different wheat varieties, HD-2967 was found the most shade tolerant and exhibited higher plant height, number of tillers, number of spikes, spike length, number of grains per spike, grain and straw yield etc under both the agroforestry based systems. Whereas, the variety WH-711 was found be the most sensitive to shade and exhibited poor growth, yield attributes traits and yield. However, grain, straw and biological yield of different wheat varieties was found higher in agri-horti system over agri-silvi-horti system due to more competition among the annuals and perennials in agri-silvi-horti system. Different quality parameters *viz.* protein content, gluten content, sedimentation value, grain hardness etc. in different wheat varieties was observed higher in agri-horti and agri-silvi-horti system over sole cropping system. Higher protein content, grain hardness and grain luster were recorded in HD-2967 while, variety WH-711 exhibited higher gluten content and sedimentation values under

both the agroforestry based systems. Therefore, agroforestry based systems are eco-friendly, helps to provide nutrient security and a way to increase the farmer's income.

GENETIC ANALYSIS FOR YIELD AND ITS COMPONENT TRAITS IN WHEAT (*TITICUMAESTIVUM* L.) UNDER TIMELY SOWN IRRIGATED CONDITION

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Abstract

The present investigation entitled "Genetic analysis for yield and its component traits in wheat (*Triticumaestivum*L.) under timely sown irrigated condition" was carried out during *Rabi* 2015-16 and 2016-17 at the All India Co-ordinated Wheat & Barley improvement project, B.T.C. College of Agriculture and Research Station, Bilaspur (C.G.). The experiment was conducted in RBD involving ten lines, four testers and 40 F_1s hybrids of wheat with two replications. Analysis of variance for combining ability revealated that mean square due to females were highly significant for all the character. Where for male it was highly significant for all the character except for number of grains per spike. A perusal of variance ratio suggested the preponderance of non- additive genetic variance for all the character except harvest index. Based on estimates of GCA effect parents *viz.,* .MP 1202, Chhattisgarh genhu 03 and HW 2045 were found good general combiner for yield and must of its contributing traits, therefor, were noted as good source of favourable genes for increasing yield through various contributing characters. The estimation of SCA effects revealed that none of the hybrid was consistently significantly superior for all the traits. Out of 40 hybrids evaluated, 13 hybrids registered significantly positive SCA for grain yields per plant. The highest non additive gene action for seed yield per plant, harvest index, 1000 seed weight and spike length are found in crosses of MP 1202 X GW 2013-507.

WEATHER ELEMENTS OF CONCERN : GREENHOUSE GASES, GLOBAL WARMING AND THEIR IMPACTS ON AQUATIC LIFE

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Abstract

Nowadays, nearly all climatologists have agreed that the climate change results from the increase in the greenhouse gas emissions in the atmosphere and this comes on account of numerous human activities. Weather elements are highly concerned in oceans and seas as they are typically influenced by the process of change in weather caused by global warming since they constitute a large portion of our planet and feature rich biodiversity. A temperature rise of few degrees does not only caused by an increase in the temperature of large water masses but also by the hydrological actions that cause to alter in the physical and chemical characteristics of water. Water temperature is the most important environmental parameter that affects the lifestyles cycle, physiology and behaviors of aquatic living beings. The dissolution of carbon dioxide, which has the main share amongst greenhouse gases in term of contribution in global warming and climate change have caused decline in surface waters, a rise in the sea level, alteration in streams and precipitation models. Consequently this has started to show harmful effect on all aquatic organisms from planktons to mammals. Typically krills have reduced by 80% on an average in the past 30 years. Coral bleaching has multiplied dramatically. Reproduction area of sea turtles has diminished as coastal habitat is destroyed by rise in sea level. Melting of the sea ice has caused many of marine mammals to face extinction. As stated by mathematical computer models evolved recently, it's been calculated that if the CO_2 density is doubled, the global temperature will increase by 3°C. For this reason, a lot many precautions to be taken towards global warming, reducing of the carbon dioxide emission comes first and research has to be executed at the war foot for this purpose on international stage.

BIOCHAR : A SOIL AMENDMENT TOOL FOR MAINTAINING SOIL PRODUCTIVITY IN AGRICULTURE

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Abstract

Food Security in the country for the last 50 years can be credited to intensive agriculture. However, as a consequence has become a major contributor to greenhouse gas emissions, biodiversity loss and degradation of land and fresh water. It leads to an increase of Carbon (C) to atmosphere in the form of carbon dioxide (CO_2), thereby reducing ecosystem C pools. Diminishing increased levels of CO_2 in the atmosphere is the use of pyrolysis to convert biomass into biochar, which stabilizes the carbon (C) that is then applied to soil. Biochar is a black carbonaceous recalcitrant product produced through the process of pyrolysis i.e. by heating in an oxygen-free or low oxygen environment such that it does not or only partially combusts. Improving the soil with biochar is estimated at the international level as a way to enhance soil productiveness, fertility and also to mitigate climate change. Biochar can stabilize carbon belowground and potentially increase agricultural and forest productivity. Biochar as a soil amendment have various advantages such as carbon sequestration, increase drought resiliency, improves nutrient use efficiency, increases pH, conduct remediation at brown fields and with respect to economic view increases energy security and community food and construct local jobs. The possible mechanisms behind improvements in soil properties by biochar application are: as it exhibits highly porous structure, adsorptive nature, a large reactive surface area, high CEC (Cation Exchange Capacity), size of pore, volume, distribution and element composition, affect its recognized influences, particularly on microbial communities by providing habitat to microorganisms and increase in total soil organic carbon contents. Biochar, due to its aromatic structure and long mean residence time in soil (more than 100 years) has the potential for long-term carbon sequestration in the soil. Biochar is a new product, and it can be very hard for farmers or peasants to find it in larger quantities, at an affordable price. Extensive study is needed on the impacts of biochar has to be carried out in the upcoming years. It is suggested and recommended that you get as much information as possible.

EFFICIENT NUTRIENT MANAGEMENT FOR HIGH CROP YIELD AND QUALITY IN WHEAT CROP

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Abstract

A field experiment on maize crop was conducted in the Crop Research Farm of Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur during 2015-16 (Indo-Gangetic plain of Central UP, Entisol). The treatments were Control, 100% NPK (120:60:60 kg ha^{-1}), 100% NPK+S_{40} (Sulphur 40 kg ha^{-1}), 100% NPK+Zn_5 (Zinc 5 kg ha^{-1}), 100%NPK+S_{40}+Zn_5, 125% NPK, 125% NPK+S_{40}, 125% NPK+Zn_5, 125%NPK+S_{40}+Zn_5 and 150% NPK. There were 10 treatments and 4 replications in Randomized Block Design. The variety was Azad Uttam for maize. The results showed that 125% NPK+S_{40}+Zn_5 gave 30.78 q ha^{-1} in maize as against the respective controls of 14.33 q ha^{-1}. The treatment effects were significant for both NPK levels and their combination with S, Zn and S+Zn. Significant increases was observed in plant height, number of cobs $plant^{-1}$, cob length and grain test weight of maize. Concentration and uptake of NPK, S and Zn were also increased significantly due to different treatments. In maize 125% NPK gave 20% higher yield of grain over 100% NPK. Similarly 150% NPK gave 7% higher grain yield over 125% NPK. 100% NPK+S and 125% NPK+S resulted in 19 % and 11% increase in grain yield over 100% NPK and 125% NPK, respectively. Addition of 5 kg ha^{-1} Zn to 100% and 125% NPK resulted in an increase of grain yield by15% and 7%, respectively. Addition of S+Zn to above levels of NPK increased the yield by 30% and 23% in that order.

ISOLATION, SCREENING AND CHARACTERIZATION OF POTASSIUM SOLUBILIZING BACTERIA FROM DIFFERENT PLANT RHIZOSPHERIC SOILSOF KASHMIR VALLEY

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Abstract

Eighty five potassium solubilizing bacteria (KSB) were isolated from rhizospheric soils of apple, pear, almond, walnut, cherry, apricot, peach, Kashmir iris, vegetables etc collected from five districts of Kashmir Valley *viz* Anantnag, Kulgam, Shopian, Srinagar and Baramulla. The bacterial isolates were morphologically and biochemically characterized and identified up to genus level which included gram positive belonging to *Bacillus, Micrococcus* and gram negative belonging to *Pseudomonas*, *Rhizobium, Azotobacter* and *Serratia*. The solubilization index of KSB isolates ranged from 2.25 to 10, 72 hours after incubation. The amount of potassium released ranged from 12.88 to 40.01ug/ml, 15 days after inoculation. Out of all the KSB isolates the highest K release was observed in KSBA2 and KSBB69 which was 40.01ug/ml. The highest enzymatic activities and polysaccharide production was observed in KSBA2, KSBA12, KSBK27, KSBS57 and KSBB72.

IN VITRO EVALUATION OF SELECTED FUNGICIDES FOR THEIR EFFICACY AGAINST *BIPOLARIS MAYDIS* INCITANT OF MAYDIS LEAF BLIGHT OF MAIZE

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Abstract

Maize (*Zea mays* L.) is one of the most important cereal crops in the world and is popularly known as queen of cereals. Maize is the third most important food grain in India next to wheat and rice. About 65 pathogens infect maize and out of these, maydis leaf blight (MLB) caused by *Bipolaris maydis* (Nisikado and Miyake) Shoemaker is considered as one of the most serious diseases. The disease is widely distributed in India during *kharif* season. During the recent past, the spread of different maize hybrids has increased the incidence of foliar diseases. Maydis leaf blight appears every year with incidence ranging from 20-85 per cent in Haryana. The disease has the potential to reduce the grain yield up to 41 per cent in susceptible cultivars. Eight fungicides (chlorothalonil, propiconazole, hexaconazole, difenconazole, tebuconazole, captan, mancozeb and carbendazim + mancozeb) were evaluated at 100, 200, 500 and 1000 µg ml^{-1} concentration against mycelial growth of *Bipolaris maydis* by using poison food technique under *in vitro* conditions. Mycelial growth of *Bipolaris maydis* decrease with increase the concentration of fungicides. Among fungicides tested, propiconazole was found most effective as it showed 100 per cent growth inhibition of *B. maydis* at 100 µg ml^{-1} followed by tebuconazole (200 µg ml^{-1}), difenconazole (500 µg ml^{-1}) and hexaconazole (1000 µg ml^{-1}). However, carbendazim + mancozeb (84.31% inhibition), mancozeb (79.44% inhibition) and captan (66.81 % inhibition) showed maximum inhibition at 1000 µg ml^{-1}. Chlorothalonil (53.19 % inhibition) was found least effective at all the four concentrations. The percentage growth inhibition by different fungicides ranged from 53.19 to 100 per cent at 1000 µg ml^{-1} concentrations. These finding will be helpful in developing integrated disease management strategies for the management of maydis leaf blight of maize.

DEVELOPMENT OF SUITABLE IDM APPROACH FOR MANAGEMENT OF LATE BLIGHT OF POTATO AND THEIR EFFECT ON GROWTH PARAMETERS AND YIELD OF POTATO

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Abstract

Potato (*Solanum tubersom* L) ranks third in importance as a food crop, following wheat and ricegrown in about 150 countries

of the world covering an area and total area about 19.33 million hectares with a total production of about 321 million tons which is consumed by over a billion of peoples across the globe, of which half are in the developing countries. Its production is limited by several biotic constraints among those late blight caused by *Phytophthora infestans* (Mont) de Bary is an important and devastating disease which can be overcome by an integrated disease management approach. Integrated approaches have ability to increased tuber germination and plant height of potato with the maximum in treatment T 1 (Soil application of FYM @ 125gm/pot + waste of mushroom cultivation with *T. viridae* @ 5gm/kg + tuber treatment with *Azotobacter* @ 5% + foliar spray with Ridomil @ 0.25%), representing the value 100 per cent and 41.5 cm at 30 days age of plant. As per concerned on pathogenic infection, the minimum disease severity (8.16%) was reported from treatment where treatments were given as treatment T 1 (Soil application of FYM @ 125gm/pot + mushroom waste with *T. viridae* @ 5gm/kg + tuber treatment with *Azotobacter* @ 5% + foliar spray with Ridomil @ 0.25%) treated plants against 74.40 % disease severity in case of control. The integrated effect of FYM + mushroom waste as soil application + bio formulation as tuber treatment + fungicides as foliar spray efficiently increased tuber size and yield of potato. The highest yield with 630.6gm was recorded from treatment T1 (Soil application of FYM @ 125gm/pot + mushroom waste with *T. viridae* @5gm/kg + tuber treatment with *Azotobacter* @ 5% + foliar spray with Ridomil @0.25%).

EFFECT OF DIFFERENT MOISTURE CONSERVATION AND INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON GROWTH, YIELD ATTRIBUTES AND YIELDS OF GREEN GRAM

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Abstract

A field experiment was conducted at Student Instructional Farm, C. S. Azad University of Agriculture and Technology, Kanpur during *Kharif* season of 2015 and 2016, to find out the effect of various moisture conservation and integrated nutrient management (INM) practices on growth, yield and quality parameters of green gram under green gram + sesame intercropping system. The experiment comprised of twenty four treatments *i.e.* four levels of moisture conservation and six levels of INM practices under split plot design with tillage practices as main plots and nutrient management practices as sub plots with three replications. Among different tillage and moisture conservation treatments, growth parameters were found higher under the treatment M_4 (Deep tillage + Vegetative mulch) and F_6 (30:60:40 NPK+ *Rhizobium* + PSB application), respectively. The highest value of biological yield, grain yield, straw yield and protein yield during 2015 was recorded 24.04 and 25.43 q ha^{-1}, 8.96 and 9.09 q ha^{-1}, 15.08 and 16.34 q ha^{-1} and 22.42 and 23.94 kg ha^{-1} while during 2016 highest recorded values were 23.88 and 25.46 q ha^{-1}, 9.09 and 9.19 q ha^{-1}, 14.79 and 16.27 q ha^{-1} and 22.82 and 24.30 kg ha^{-1} under treatment M_4 and F_6, respectively.

EVALUATION OF CROP DIVERSIFICATION AND INTENSIFICATION IN RICE AND MAIZE BASED CROPPING SEQUENCES IN CENTRAL PLAIN ZONE OF UTTAR PRADESH

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Abstract

An experiment was executed with ten crop sequences during 2010-17 at C.S. Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh under All India Coordinating Research Project on Cropping Systems. All these sequences were evaluated for yield, economics, profitability and to identify the remunerative cropping sequence among rice and maize based cropping sequences. Results revealed that Hyb. Rice-Wheat and Maize-Mustard-Onion cropping sequences were most economically efficient among rice and maize based cropping sequences respectively. Hyb. Rice-Wheat fetched highest B:C ratio of 3.24 followed by Maize-Mustard-Onion (3.21) while lowest B:C ratio (1.86) was recorded by Maize+Green gram-Potato-Wheat. Highest crop profitability (Rs. 774.79 /ha/day) and system profitability (Rs. 1075.28 /ha/day) were recorded by Maize+Black gram-Potato-Onion cropping sequence followed by Maize+Garlic-Green gram(G+R) (Rs. 758.34 /ha/day and Rs. 890.04 /ha/day, respectively).

STUDIES ON MANAGEMENT OF DRY ROOT ROT (*MACROPHOMINA PHASEOLINA)* OF BLACK GRAM (*VIGNA MUNGO)*

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Abstract

Black gram (*Vigna mungo* (L.) Hepper) also known as urdbean or urd grown in the Indian subcontinent. The urdbean crop is affected by various fungal as well as bacterial disease. Among them *Macrophomina phaseolina* is a destructive soil borne fungus which causes root rot disease on urdbean. The first symptoms of disease is yellowing of the leaves, dark lesionmay be seen on the bark at the ground level, the basel stem & main root show dry rot symptoms. The fungus produced white, dense, radial growth in initial stage which turns brown to black coloured at advance stage. Integrated disease management is the most suitable and eco-friendly method of disease management. Aqueous extracts of nine plants were evaluated at 5, 10, 15 % concentration. Among them Azwain seed extract was most effective which suppressed pathogen growth 11.11%, 16.66% , 3333% followed by Garlic bulb extract 8.14%, 12.58% and 28.15% at 5, 10 and 15% concentration while other plant extract viz Tulsi leaf, Heena leaf, Lemon leaf, Turmeric leaf, and Methi seed extract were ineffective in controlling the mycelial growth of pathogen. The inhibitory effect of eight fungicides Viz Mancozeb 75 % WP, Carbendazim 50% WP, Carbendazim 12 % + Mancozeb 63 % WP, Thiophanate – Methyl 70 % WP, Tebuconazole 25.9 % EC, Hexaconazole 5% SC, Propiconazole 25 % EC and Chlorothalonil was tested at 50, 75, and 100ppm concentration by poisoned food technique, after 24 hrs of inoculation the complete inhibition (100 %) of mycelial growth was found with all fungicides at all concentration. A combination of organic amendments, oilcakes, biological control agents and foliar spray of fungicides were applied. Among which the lowest disease incidence 3.4 % was recorded in treatment T2 (Propiconazole @ 0.05% as foliar spray) followed by 7.14% in T^1 (Carbendazim @ 0.2% as seed treatment). Soil application of *T.harzianum* 10 gm per pot + press mud 100 gm per pot also reduced the disease incidence. The improvement ingermination and controlling the disease might be due to multiplication of antagonists on seed surface which prevented the fungal entry into seeds by instantly colonizing the roots.

MOLECULAR SCREENING AND TRANSFER OF Â-CAROTENE & OPAQUE 2 GENES IN MAIZE

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Abstract

Maize is the third most important cereal, after rice and wheat, for human food. In India 24% of total maize produce is used for human food, 52%, as poultry feed, 11% as animal feed, 11% as wet milling, 1% as brewery and 1% as seed. Maize plays an important role in food and nutritional security, but its protein is deficient in essential amino acids (lysine and tryptophan). The Local White and Local Red maize cultivars of sirmour region of H.P are high yielding genotypes with better adaptability and palatability, but poor in protein qualities (lysine, tryptophan amino acid and beta-carotene). The objective of this study to improve the protein quality of these two cultivars, by transferring *opaque2* gene form APQH9 inbred lines using MAS, validation of molecular markers for the donor and recipient parent, screening of F1 plants for *opaque 2* and â-carotene hydroxylase using linked molecular markers and development of BC_1F_1 populations from selected F_1 hybrids and recurrent parent. For this we used two maize traditional cultivars of Himachal Pradesh, local white (LW) and Local red (LR) as recipient parent and hybrid APQH-9, as donor parent. We successfully demonstrated the introgression of the *opaque 2* and *crtRB1* alleles from APQH 9 using three SSR polymorphic markers *(phi11*2, phi057, and *umc1066),* in which *umc1066* showed polymorphism between recipient and donors parent. 36 rows of cross LW × APQH 9 and 30 rows in cross LR × APQH 9, were subjected to PCR amplification using molecular marker umc 1066 and crtRB1 linked to opaque 2 and â-carotene. In Cross LW × APQH 9, out of 36 rows, 29 were heterozygous for opaque *2* allele and umc 1066 molecular marker amplified both the allele of 180 and 169 bp while 7 rows were showed only 180 bp allele indicated the null for *opaque 2* allele. However, crtRB1 allele, out of 36 rows, 22 was heterozygous for crtRB1 molecular marker and amplified both the alleles of 543 and 296 bp. In crosses $_{LW}$ × APQH 9 and LR × APQH 9, half the genome was contributed from donor parent and half from the recurrent parent. In both the crosses 42 rows were heterozygous for umc1066 and crtRB1 allele and used for the backcrossing with recurrent parent local white and local red to develop BC_1F_1 population, which will be used for the molecular screening or foreground selection for the umc1066 and crtRB1 allele in next season.

MOLECULAR OF GENETIC DIVERSITY ANALYSISTHROUGH MICROSATELLITE MARKERS IN CARP SPECIES FROM TWO RESERVOIRS OF UTTARAKHAND

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Abstract

The present study deals with the assessment of genetic diversity using microsatellite marker in the fish *Labeogonius* from Nanak Sagar and Dhaura reservoirs of Uttarakhand having different morpho-edhaphic features and self-recruiting populations of this fish. These reservoirs are distantly located and distinctly separated without any connection having negligible possibility of gene exchange with each other. Total 12 microsatellite primers were selected and by using software Primer-BLAST and Primer-3 and all the designed microsatellite primers were screened in all 100 DNA samples of fish collected from both the reservoirs. Screened 12 microsatellite loci were successfully amplified. After PCR amplification of microsatellite loci and performing native PAGE using amplified DNA samples as above, POP GENE Version 1.32 was used to calculate Nei's observed heterozygosity, expected heterozygosity, Nei's genetic diversity, Fixation index (Fis) and Shannon's information index (SI) and genetic variability indices viz. Gene flow(Nm), the coefficients of genetic differentiation (Fst & Gst) and Nei's genetic distance.Genetic diversity and level of heterozygosity in *L. gonius* were found to be maximum (Hi=0.6770 and Ho=0.5046)) from Nanak Sagar reservoir followed by genetic diversity in *L.gonius* from Dhaura reservoir (Hi=0.5732andHo=0.4901) and genetic diversity in *L. rohita* (Hi=0.561 and Ho=0.4894) from Nanak Sagar reservoir. *L. rohita* from Dhaura reservoir shows minimum genetic diversity value (Hi=0.4894and Ho=0.4226). Genetic diversity values are lower in Dhaura reservoir which might be due to its reduced effective population size associated with the small size of reservoir, extensive fishing pressure and drying up of major portion in summer season. These reservoirs are distantly located and have no connection with each other indicating negligible gene exchange with each other which is responsible for weak sub structuring of *L. rohita* and *L. gonius* stocks. Overall GST value (0.1601) recorded for *L. gonius* suggested the possibility of less gene exchange among the two stocks and indicated that 16.01% variation was attributable to inter stock divergence, while 83.99% to individual differences within the stocks.

BIOTECHNOLOGICAL IMPROVEMENT OF SOYBEAN (*GLYCINE MAX* (L.) MERRILL) AGAINST YMV & DROUGHT

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Abstract

Soybean [*Glycine max* (L.) Merrill] is one of the major legume crops in the world, providing an abundant source of oil, protein, macronutrients and minerals.Globally, area under soybean cultivation is around 121 million hectares and five major producing countries (USA, Brazil, Argentina, India and China) account for more than 85% of global soybean area and 88.5% of production. India ranks 5th in soybean production (8.00 Million metric tons) with covering 11.65 Million hectares with 0.69 Metric tons per hectare of productivity during 2015-16. In India, Madhya Pradesh ranks first as soybean producing state with 44 Lac tons of production from 56.127 Lac hectares of area with 784 Kilos per hectare productivity. The growth and productivity of soybean are adversely affected by an array of biotic factors such as diseases: Yellow vein mosaic viruses, Rust, *Rhizoctonia* root rot, *Myrothecium* leaf spot, Bacterial pustule and Anthracnose; pests such as girdle beetle (*Oberia brebis*) and stem fly (*Melanagromyza phaseoli)* and abiotic stresses like drought and salt. Soybean appears to show less genetic diversity than the other major crops. Since current commercial soybean cultivars in India are only a few steps ahead from the original plant introductions, some of this yield increase is probably due to the result of selection for environmental adaptation and mixing of narrow gene pool. Adding to the variability available to soybean breeding through unconventional techniques will likely progress in yield improvement. Resistance to most major insect pests and diseases has been found within the soybean gene pool. However, additional genes for disease and pest resistance resulting from *in vitro* selection or transfer from unrelated species *via* molecular techniques would be an imperative addition to the soybean breeder's arsenal. In present investigation, an effort have been made for selection against drought at cell level by using Polyethylene glycol as selection

agent with two susceptible genotypes *namely*: JS335 and RVS 2001-4. Moreover 53 genotypes have been screened tolerant/resistant against YMV and drought on the basis of physio-morphological parameters and linked SSR molecular markers twenty for each that may be used as parents in crossing programmes to breed varieties tolerant/resistant against YMV and drought in future by using conventional or molecular breeding approaches.

ROOT-MICROBE INTERACTIONS : MICROBIOME EXPLOITATION

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Abstract

The research related to belowground ecology is a fascinating field and gaining immense attention currently. A multitude of interactions operating in the rhizosphere has been revealed by recent boom in the studies exploring the underlying mechanism of the communications between plant and microbial communities. These interactions are mediated by plant exudates controlling numerous ecological processes. The ecological functions based on root-microbe interactions include bioremediation, biomass production, decomposition, disease suppression, nutrient cycling, and maintenance of soil structure, soil carbon sequestration and regulation of microbial communities. These mutually beneficial processes are extremely important from agricultural perspective. Thus novel approaches elucidating the molecular basis of rhizospheric interactions can be the basis of exploitation of these communications for agronomical perspectives. The new discoveries provide new opportunities to have insights into root-microbe interactions and their important role in shaping microbiome in the rhizosphere. A greater understanding of these root-microbe interactions is strongly required to exploit the soil microbiota for plant development from applied perspective.

BIOTECHNOLOGICAL ENHANCEMENT OF SOYBEAN(*GLYCINE MAX* (L.) MERRILL) AGAINST *MACROPHOMINA PHASEOLINA & RHIZOCTONIA SOLANI* THROUGH MOLECULAR AND *IN VITRO* SELECTION APPROACHES

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Abstract

Soybean *Glycine max* (L.) Merill. (2n=40) is an economically important dicot legume a protein rich oilseed crop of the world. On account of its multifarious uses and limitless benefits, soybean is rightly called as “golden bean”, “miracle bean” or “wonder crop” of the 20th century. Soybean plays a very vital role in the economy and foreign earnings of our country as it contributes 42% and 25% to the national oilseeds and edible oil production. Soybean is number one oil seed crop in terms of both area and production as India occupied 4th in terms of global soybean production area and 5th in production after united state, Brazil, Argentina and China. In India Major soybean growing states include Madhya Pradesh, Maharashtra, Rajasthan, Karnataka and Chhattisgarh is contributed 96% of production 99% area under soybean is rainfed. Initially the soybean was free from diseases but as continuous cultivation with simultaneous increase in area has lead to increase in disease ultimately yield losses upto 77% due to Charcoal rot and 35% with Rhizoctonia root rot in epidemic conditions. Soybean somatic chromosomes are symmetrical and only one pair of satellite chromosomes can be identi?ed. The soybean breeders, worldwide, are con?ned to crossing with in the primary gene pool; thus, genetic base of soybean is very narrow. Wild perennial *Glycine species* of the tertiary gene pool have been recently exploited to broaden the genetic base of modern soybean cultivars. Conventional breeding have been made to enhance crop productivity and releasing new varsities, however as we know these crop will need more integrated pest and disease management which is tidies job. So as to safe time with reducing cultural practices and introducing resistance variety in short span of time is present aim of soybean breeder. *In vitro* selection offers an immense potential for the quick and comprehensive generation of useful somaclones or mutants for resistance against various biotic and abiotic factors. These plants may serve as an excellent donor of the resistance gene(s) in breeding programmes. Marker assisted selection is an indirect selection process where a trait of interest is selected based on a marker (morphological, biochemicalor DNA/RNA variation) linked to a trait of interest (*e.g.* productivity, disease resistance, abiotic stress tolerance,

and quality), rather than on the trait itself. An effort was made to screen53 soybean genotypes tolerant/resistantgenotypes against charcoal rot and rhizoctonia root rot diseases on the basis of physio-morphological parameters and gene- linked SSR molecular markers five for each that may be used as parents in crossing programmes to breed varieties tolerant/resistant against these diseases in future by using conventional or molecular breeding approaches. Moreover *in vitro* selection approaches also have been tried to develop tolerant/ resistant lines with two susceptible genotypes *viz*::JS335 and JS-95-60 against charcoal rot.

CURRENT STATUS AND FUTURE PROSPECTS OF MARKER ASSISTED BREEDING FOR GENETIC IMPROVEMENT OF MINOR MILLETS

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Abstract

Millets, a powerhouse of nutrients, hold great potential in contributing substantially to food and nutritional security of the developing country. They are climate resilient crops and due to their unique nutritional characteristics, they contribute significantly in increasing demand for nutritious food and feed.Recently the government has renamed jowar, bajra, ragi and other millets as “Nutri Cereals”, instead of “coarse cereals”. These Nutri Cereals includes Sorghum (Jowar), Pearl Millet (Bajra), Finger Millet (Ragi/Mandua), Minor Millets: Foxtail Millet (Kangani/Kakun), Proso Millet (Cheena), Kodo Millet (Kodo), Barnyard Millet (Sawa/Sanwa/ Jhangora), Little Millet (Kutki) and two Pseudo Millets (Black-wheat (Kuttu) and Ameranthus (Chaulai) which have high nutritive value for production, consumption and trade point of view. 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, association 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.

BIOCHEMICAL STUDIES IN *BRASSICA JUNCEA* FOR FATTY ACID CONTENTS

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Abstract

Brassica juncea commonly known as Indian mustard is an amphidiploid with chromosome number 18 which belongs to genus *Brassica* of *Brassicaceae* family. In India, oil is used for human consumption and cake as livestock feed. However, presence of high erusic acids, glucosinolates, saturated fatty acids and narrowed genetic base of existing varieties confines its use. Keeping these facts in mind an experiment was conducted at Research farm of RVSKVV, Gwalior during 2015-2016 to study the fatty acid contents in 188 genotypes of *Brassica juncea*. Significant differences were observed among the genotypes for different fatty acids contents. Palmitic acid content was recorded in the range of 3.94-13.27%. The minimum Palmitic acid content was recorded in genotype MRNJ-21 and was found significantly *at par* with genotypes MRNJ-22, Rohini, MRNJ-30, MRNJ-28 and MRNJ-18 whereas maximum Palmitic acid content was recorded in genotype IDM-67 followed by genotypes ISC-12, PM28, ISC-17, L-4 and MRNJ-122. Oleic acid content was observed in the range of 6.07-37.10%. The minimum Oleic acid content was recorded in RVM-1 followed by genotypes Maya, MRNJ-12, MRNJ-16, RVM2 and MRNJ-23, whereas maximum oleic acid content were recorded in ISC-18 and was found significantly *at par* with MRNJ-30, MRNJ-25, PM30, Karishma and PM24. Significant variation was also observed for Linoleic acid content and linolenic acid. Linoleic acid content varied in range of 14.97 to 37.34 % and linolenic acid content ranging between 8.29-16.75%. The Erucic acid, another important trait also differed in range of 0.93-51.44 %. The minimum Erucic acid content was recorded in genotype PM-29 (0.93%) followed by genotypes PM25, PM21, PM30, PM22 and PM28, whereas maximum Erucic acid content was recorded in Maya (51.44%) intimately followed by genotypes JM-1, RVM-2, IDM-41, IDM-25 and RH790. Significant variability in

fatty acid contents were noted in Indian mustard. The present study can be utilized in the breeding programme to develop qualitative genotypes with higher oil content and yield.

SYNTHETIC SEED METHOD FOR CONSERVATION AND PROPAGATION OF *TINOSPORA CORDIFOLIA*

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Abstract

Several medicinal plants have been assessed as endangered, vulnerable and threatened due to over harvesting or unskilful harvesting. Conservation strategies need to be adopted for continuous supply to meet the ever-increasing demands and sustainable utilization of resources. Guduchi (*Tinospora cordifolia*) is an immune boosting herb used in Ayurveda belongs to the family Menispermaceae It is widely used in Indian Ayurvedic medicine. The stem is harvested for therapeutic uses. Tissue culture technology is potent and has opened extensive areas of research for micropropogation, secondary metabolite production and biodiversity conservation. Plant *in vitro* regeneration is a biotechnological tool that offers a tremendous potential solution for the propagation of endangered and superior genotypes of medicinal plants which could be released to their natural habitat or cultivated on a large scale for the pharmaceutical product of interest .Nowadays, artificial seed technology is one of the most important tools to scientists in plant tissue culture. It has offered powerful advantages for large scale mass propagation of elite plant species. These tools provide methods for production of synthetic seeds for conversion into plantlets under *in vitro* as well as *in vivo* conditions. A protocol was developed for regeneration from encapsulated nodal segment collected from *in vitro* propagated shootlets of *Tinospora cordifolia.*The best gel composition was achieved by using 3% sodium alginate and 100mM $CaCl_2.2H_2O$. The regeneration ability was affected by the concentration of sodium alginate and calcium chloride. It provides a simple and rapid system for conservation of natural populations for germplasm conservation. The aim and scope for switching towards artificial seed technology was for the fact that the cost-effective mass propagation of elite plant genotypes could be promoted.

GENETIC IMPROVEMENT OF GRAIN QUALITY FOR HIGHER YIELD AND RUST RESISTANCE USING GENE BASED MARKER IN WHEAT (*TRITICUM AESTIVUM L.*)

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Abstract

Wheat (*Triticum aestivum* L.) belonging to the family praceae and most important cereal crop in the world. India is the second largest producer of wheat in the world. Increasing wheat production can be achieved by developing and adopting high yielding varieties and application of improved breeding techniques. Major emphasis, in breeding programme, is put on the development of improved varieties with superior qualitative traits and resilience to different biotic and abiotic stresses. For the improvement of grain quality in wheat screening of rust resistance genotypes for the higher yield is necessary because wheat rust, a devastating disease known as the “polio of agriculture". There is mounting concern at the dangers posed to global food security due to rust disease destroying up to 40 per cent of the crop. There are three types of rust majorly affect wheat production in India leaf rust caused by *Puccinia recondite,* stem rust by *Puccinia graminis triticii* and stripe rust by *Puccinia striformis*. Development of resistance variety is environment friendly approach and cost effective also. Resistance variety can be developed by using conventional, transgenic or molecular breeding approaches. Marker assisted breeding as compared to conventional method is cost effective, reliable, environmental free and takes less time to develop variety. There are several classes of molecular markers available, which can be used for marker assisted selection. In wheat rust resistance breeding several gene based markers has been reported *i.e*., SCAR, RAPD, SSR, STS *etc.*). In present investigation gene based markers has been validated against leaf rust and stem rust resistance genes Lr26 and Sr31 which can effectively be employed to find line(s) resistance against disease and higher yield. Molecular markers especially gene based markers may be proved better for identification of donors parents resistant against rust and mapping populations can be developed smoothly and in short span of

time with higher accuracy to get improved line (s). In present study molecular and morphological characterization will be used to identify better performing line(s) with higher yield and resistance against rust(s).

ENHANCEMENT IN GROUNDNUT BREEDING PROGRAMME FOR FOLIAR DISEASE AND OLEIC ACID CONTENT USING GENE BASED SSR MARKERS

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Abstract

Groundnut (*Arachis hypogeal* L), is one of the major source for human consumption worldwide. It is an important oilseed crop with an allotetraploid genome (AABB, 2n=4x=40), which is being cultivated and practiced widely. Its kernels contain approximately 50% oil. Enhancement of oil content and quality traits (high oleic and low linoleic acid) in groundnut could be accelerated by exploiting linked markers through molecular breeding.In present study, genetic diversity was studied in ninety germplasm lines and six cultivars of diverse groundnut set using 13 morphological traits including initial plant stand/ row, final plant stand/ row, days to 50% flowering, days to maturity, fresh weight/plant, dry weight/ plant, number(s) of pods/ plant, 100 pod weight, kernel yield, 100 kernel weight, shelling percentage and sound mature kernel and Simple Sequence Repeat (SSR) molecular markers. In this study morphological analysis has been conducted with 13 parameters and genetic distance was measured by using NTSYS2.0 and SPSS softwares to determine diversity. Gene based markers were used for screening of oleic acid and foliar disease in germplasm lines in all 9 germplasm lines were found foliar disease resistance and 32 germplasms have been identified with higher oleic acid content. Molecular characterization along with morphological analysis showed an incredible result and identified highly diversified lines of groundnut along with germplasm lines having foliar disease resistance with higher oleic acid content that may be proved remarkable contribution for groundnut breeding in future.

MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION OF INDIAN MUSTARD [*BRASSICA JUNCEA (L.) CZERN&COSS.*]GERMPLASM LINES USING SSR MARKERS

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Abstract

Brassica juncea is a major oilseed crop grown in India on approximately 6-7 million hectares of land during the winter season under rain-fed cropping system. Forty-three mustard genotypes were evaluated for 12 physio-morphological traits in complete randomized block design during the *Rabi* season of 2017-18. Molecular analysis was carried out using 50 SSR markers. The analysis of variance revealed that variances due to replication were highly significant for plant height, main raceme length and number of siliqua per plant; variances due to varieties were highly significant for all the characters except number of primary branches per plant, siliqua length, number of seeds/ siliqua and 1000 seed weight. The coefficient of correlation between seed yield and morphological characters ranged between 0.328 to 0.518.UPGMA clustering enabled the identification of two major clusters. Cluster-I consisted of further two sub groups including 40 genotypes another major cluster, Cluster-II consisted of only 3 genotypes which included two cultivated varieties *namely*: Rohini and JM-3 and MRNJ-54. All differed from the group C-I. The population structure was obtained using the software "Power-marker v.3.25". Major three clusters were obtained *i.e.*, C-I, C-II and C-III, in which cluster C-I consisted of germplasm lines: MRNJ-62, MRNJ-65, MRNJ-63 andMRNJ-54 separated from the majority.PIC values revealed that the grouping of genotypes based on SSR marker data is more convincing than phenotypic data. PIC value of the markers varied from minimum 0.6219 of primer SR_94102 to a maximum of 0.8768 of SR_9222 with a mean value of 0.7326, representing high genetic diversity of these markers. The major allele frequency of the markers varied from 0.1628 of SR_9222 to 0.4884 SSR_Na10-D09 with an average of 0.3359. A total of 65 alleles were identified with an average of 7.2 alleles per locus, the genotype and allele number per locus varied from maximum 16 & 12 of SR_9222 to minimum 4 of SR_94102 with mean value of 7 and 6.5556 respectively. Genetic diversity varied from minimum 0.6782 of SR_94102 to maximum 0.8875 of SR_9222 with value of 0.7666. The result obtained in the study extended useful information that SSR marker are informative which could be utilized for characterization of germplasm and have greater reliability than quantitative traits for characterization of *B. juncea* genotypes.

IN VITRO MICRO TUBER FORMATION TO ESTABLISH RAPID DISEASE FREE SEED SYSTEM IN POTATO

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Abstract

The potato plant (*Solanum tuberosum* L.) belonging to Solanaceae family is cultivated and consumed in many countries. The production of potato plant is usually made by asexual routes, especially with tubers and micro tubers. The uses of healthy and certified high quality seeds are very significant for potato production and for high yield. Tissue culture techniques are utilized in speedy propagation and breeding trials in addition to protecting gene sources in potato. These procedures are also used to obtain disease and virus free planting materials. In this mode, irrespective of climatic conditions, diseases and virus-free starting materials can be obtained and studies with controlled conditions may bring increased yield with higher reproduction rate. There are two simple and reliable methods among micropropagation techniques in potato. The first method is the development of offshoots by cultivating single or multiple nodes, called single or multiple node cultures, particularly designated for artificial nutrient media. The second and possibly more interesting micropropagation technique is producing micro tubers from potato offshoots. Micro tubers are produced *in vitro* in embarrassment of different growing systems with varying environment, media constituents, and storage intervals. Many of the interactions between growth parameters *in vitro* and subsequent productivity appear to be genotype-specific. Accordingly, micro tubers come in different sizes, have different dormancy requirements and differ widely in relative growth potential and productivity. Despite these differences, there is confirmation for strong analogies in growth responses between field-grown tubers and micro tubers. The application of micro tubers in germplasm conservation is widely accepted. This technology may be used in seed tuber production, breeding programmes and in research in future.

APPLICATION OF PROTEOMICS AND METABOLOMICS IN IMPROVEMENT OF LENTIL [*LENS CULINARIS*]

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Abstract

Lentil (*Lens culinaris or Lens esculenta*) or massur in hindi, belongs to the family fabaceae, is self- pollinated, diploid (2n=14) crop. It is one of the good source of protein (25%). It also contain carotenoids, dietary minerals, lutein, zeaxanthin, polysaturated fatty acid and vitamins B. There are numerous biotic and abiotic factors which affect crop and leads in reduction of crop yield. Several abiotic stresses are important to lentil yields including drought, heat, salt susceptibility and iron deficiency. The biotic stresses are numerous which affect crop production heavily *i.e.*, *Ascochyta blight*, *Anthracnose*, *Fusarium wilt*, *rust*, *collar rot* and *root rot*. Genes for several traits have been genetically mapped and shown to be linked to molecular markers. It is now feasible to use the linked markers in a marker assisted selection breeding programmes. Proteomics and metabolomics are emerging technologies that can be used to understand response in lentil crop, these approaches can be integrated with information obtained from genomic data to identify candidate gene and can be used to better utilize the functional mechanisms behind breeding targets in future.

GROUNDNUT IMPROVEMENT : CURRENT STATUS AND FUTURE PROSPECTS

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Abstract

Peanut (*Arachis hypogaea* L.) is an important oilseed crop being cultivated mostly for edible oil and food uses. The kernels are

high source of oil (48–50%) and protein (25–28%) and contain several vitamins, minerals, antioxidants *etc*. Groundnut breeding generally done by selection of plants from segregating populations derived from crossing two diverse parents. Conventional methods has been successfully utilized for release of several higher yielding varieties of groundnut with desirable traits. However molecular breeding approaches enhance the efficiency of overall breeding programmes. Appropriate phenotyping plays crucial role in crop improvement programme and in combination with genomics tools more efficient selection can be done. For the introgression of wild gene in to elite material for a specific trait, generally the backcross method of plant breeding is used. In backcross generation, plant with the wild target phenotype introgression are selected while the background of the cultivated parents is recovered through many generation. Without the help of molecular markers, this process results in the introgression of a large portion of the donor genome which carries undesirable gene associated to the allele of interest (due to linkage). Molecular markers ordered on a genetic map, provide a tool to monitor the size and distribution of wild introgression throughout the breeding process. Due to availability of genome sequence of groundnut more advance genomic tools can be utilized to get advance breeding line with appropriate trait and higher yield.

VALIDATION OF MOLECULAR MARKER AND SCREENING OF CHICKPEA GENOTYPE USING GENE BASED MARKERS FOR *FUSARIUM* WILT DISEASE

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Abstract

Chickpea (*Cicer arietinum* L.) is one of the most important grain legumes in many countries of semi-arid tropics and warm temperate zones.Chickpea is the third most important pulse crop in the world, after dry bean and pea and ranks first in Indian subcontinent. It is a good source of protein in developing countries (~17-22% protein content with increased value after dehulling) and known as poor man's meat.In addition to its importance as a food crop, it is valued for sustainability and profitability of production systems due to medicinal and health values. *Fusarium wilt* (*F.oxysporum*f.sp*ciceris*) is one of the major yield limiting factors of chickpea.It is difficult to manage the disease either through crop rotation or application of chemicals because of soil nature persistence and its capacity to survive for long time, even in the absence of host and cost of management. For the resistance development in chickpea against *Fusarium oxysporum,* markers assisted selection (MAS) can speed up conventional breeding approaches. An effort was made on validation of most appropriate molecular marker against *Fusarium* wilt and screening of popular chickpea varieties (Desi Chana: 25 and Kabuli Chana: 15) using validated polymerase chain reaction (PCR) based marker. Marker for the targeted trait was done using two types of PCR based markers i.e., Sequenced Tagged Microsatellite (STMS) TA-59,TA-96, TR-19, TA194, TR29, TR31; and Inter simple sequence repeats (ISSR) markers, UBC-811, UBC-841, UBC-864,UBC-880.Two check varieties were used for validation of markers *i.e*., Tolerant variety JG-218 and susceptible variety JG-62. Out of 6 markers of STMS, TA 96 and four markers of ISSR, UBC-811 and UBC-841 amplified in resistant and susceptible genotypes of chickpea. These markers would be used for screening of desi and kabuli chickpea genotypes for *Fusarium wilt* disease. Identified genotypes with disease resistance and higher yield would be used in further crop improvement programme of chickpea through marker assisted breeding.

MOLECULAR CHARACTERIZATION FOR HIGH OLEIC ACID CONTENT USING ALLELE SPECIFIC MARKERS IN GROUNDNUT

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Abstract

The cultivated groundnut or peanut (*Arachis hypogaea* L.), is self-pollinated, allotetraploid (2n=4x=40) with a genome size of 2891 Mbp. Groundnuts are important protein crops in India grown mostly under rain-fed conditions. Groundnut kernels contain 40-60% oil, 20-40% protein, 10-20% carbohydrates and 567 kcal of energy can be gained from 100 g of kernels. Fatty acid composition of groundnut oil is an important trait from human nutrition point of view as well as oil stability during the storage. Groundnut oil comprises about 80 % unsaturated fatty acids (UFA) and 20% saturated fatty acid. Consuming oils with

higher levels of oleic acid is beneficial to human health because it reduces low-density lipoproteins, maintain high-density lipoprotein, slow down atherosclerosis and reversing the inhibitory effect of insulin production. Fatty acid desaturase (FAD) enzyme facilitate the conversion of oleic acid to linoleic acid by adding double bond to oleic acid. This enzyme is coded by two homologous genes (ahFAD2A and ahFAD2B) located on A and B sub genomes. High oleated peanut increases the shelf life by reducing oxidation that degrade the shelf life in peanut. During preset investigation the FAD2B gene has been identified and validated in check varieties of groundnut (Sunoleic 95R and Gangapuri) by applying three allele specific primers *i.e*., FAD2B-F, FAD2B-A & FAD2-R. The primers are being used in validation of advance breeding lines and germplasm lines of groundnut with FAD2B allele. The approach of marker assisted breeding to identify advance line with high oleic acid content will further be utilized in genetic improvement of popular groundnut genotypes.

IN VITRO SELECTION FOR DEVELOPMENT OF TOLERANT/RESISTANT LINES AGAINST *FUSARIUM* WILT DISEASE IN CHICKPEA

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Abstract

Chickpea (*Cicer arietinum* L.) is the most important pulse crop of India after pigeon pea. It is an important source of human food and animal feed that also helps in the management of soil fertility particularly in dry lands. It can be a promising alternative crop for rotation with barley, peas and wheat in dry land areas. The productivity of chickpea in India is below world average and has been uncertain, erratic and low. Wilt disease is one of the factors responsible for its low yield. Wilt caused by *Fusarium oxysporum* Schlechtend.Fr. f. *sp*. ciceris is a devastating disease of chickpea in India. *In vitro* selection is a feasible method for developing wilt resistant or tolerant genotypes of chickpea. Unlike other crops, this approach has not been well established so for in chickpea. *In vitro* selection system against *Fusarium* wilt was employed with the aim to establish a recurrent selection system in chickpea. *In vitro* somatic embryogenesis derived plantlet were screened against *Fusarium* species toxic culture filtrate at various concentrations of (50 and 100%v/v) supplemented in Murashige and Skoog (MS) basal liquid medium following four selection cycles. The effect of *Fusarium* culture filtrate on plantlet survival and proliferation were observed to be directly related to the concentration in the selection media. Present study revealed that *Fusarium spp*. culture filtrate can be potentially employed as a potent selection agent for carrying out *in vitro* selection approach against wilt disease of chickpea. The successful recurrent selection system developed *in vitro* on the basis of current research can probably help in future breeding programmes.

BIOTECHNOLOGICAL INTERVENTIONS FOR ENHANCEMENT OF OIL AND PROTEIN CONTENT IN SOYBEAN

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Abstract

Soybean [*Glycine max* (L.) Merrill] contain about 20% oil and 42% protein which is used as source of high quality protein, edible oil and livestock feed. Soybean account 50% total population of oil seed crop in world. Protein and oil percentages in soybean, while influenced by both genotype and environmental cues, average approximately 40% and 20%, respectively. A strong indirect phenotypic correlation exists between these traits. In addition, variation in soybean germplasm lines for protein content is significantly greater than that observed for total oil content. Historically, soybean breeders have used total protein content as a selection criterion for germplasm development. However, recently, both oil content and quality have drawn much attention in soybean genetics and breeding programs, due to the increased demand for vegetable oils and increased consumer awareness of health issues around dietary fats. To this end, significant efforts have been made to increase oxidative stability of soybean oil as a means to avoid trans-fats generated through the hydrogenation process and to enhance *ù*-3 fatty acid content of the oil for use in both food and feed applications and increase the total oil content of seeds. For many previous decades, soybean breeders working on improving the oil quality and protein content for human & animal as food and feed. But it all

breeding process not much successful so nowadays using molecular markers and biotechnological methods and techniques which develop a new area of research and understanding of genetic code and genes. Markers and biotechnological methods and techniques enhance good chemical compounds like isoflavones that result in superior quality and quantity of oil and protein which develop a new cultivar of soybean and improving healthy properties.

STRATEGIES, CHALLENGE AND FUTURE PROSPECTIVE FOR SOYBEAN CROP PRODUCTION UNDER BIOTIC AND ABIOTIC STRESSES

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Abstract

Soybean (*Glycine max* L. Merril) is the world's most important seed legume, which contributes to more than 20% of the global edible oil. Soybean is a significant and cheap source of protein (42%) and oil (20%) and edible crop that have been genetically modified and used for making a many products in food industry. The major soybean growing states are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Andhra Pradesh, and Chattisgarh. Soybean plant are subjected to different biotic and abiotic stresses under different conditions such as salinity, pathogen, drought, flooding, osmatic, heavy metal, subtropimal root zone, heat, cold and ultraviolet-B. However strategies concern, soybean crop are not naturally tolerant to biotic and abiotic stress so we need to improve their tolerate power under stress at different conditions using molecular technique and plant genetic engineering methods. However, there are many challenges to get resistant lines against these stresses due to expensive, require time and natural or environmental factors. Further improvements in the yield of soybean grain along with desirable traits and quality of soybean oil are possible by use of new research methodologies and exploitation of recent advances in biotechnology. Conventional breeding methods along with appropriate application of molecular markers for marker assisted breeding, gene pyramiding, marker assisted foreground and background selections and recent techniques of genotyping by sequencing can accelerate the process of achieving advance varieties of soybean in upcoming days.

ROLE OF PULSES IN MITIGATING THE PROTEIN MALNUTRITION AND SOIL HEALTH MANAGEMENT

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Abstract

Pulses play an important role in our daily diet. It is an important source of vegetarian protein and many important amino acids required by our body. Due to their nutritional fact and easy availability, it is also known as poor man's meat. In the year 2017-18 India produced 22.950 million tones of pulses (DES, DAC and DOC, 2018). Although India ranks first in world in term of pulse production but its more production is urgently needed to feed the protein hunger people and to mitigate the protein malnutrition from the society. Apart from protein demand fulfillment, pulses also plays an key role in conserving the soil health diversity. As the world population is fastest growing and available agricultural soil resource is decreasing rapidly though it buildup a pressure on soil to grow more and more food in per unit area. This harassed the soil nutritional and fertility status badly. Soil health can be maintained and conserve by cultivating pulses in regular manner. Pulses boost soil fertility and reduce the need for industrial nitrogen fertilizers because they fix nitrogen from the atmosphere and provide organic matter to soils. Pulse-cereal rotation helps to control weeds and reduce disease and pest infections. Pulses extract water and nutrients from deep soil through their deep roots that minimize the impact of water stress. When grown as cover crops, pulses are effective in controlling soil erosion. Pulses reduce nitrous oxide emission because of minimal nitrogen inputs *via* chemical and organic fertilizers. Pulses support a large and diverse population of soil organisms (including microbial populations) and therefore promote biodiversity in soil. Pulses can play an important role in addressing hunger, food insecurity, malnutrition, environmental degradation, climate change impacts and human health.

MORPHO-PHYSIOLOGICAL AND MOLECULAR ASSESSMENT FOR FOLIAR FUNGAL DISEASES USING GENE BASEDSSR MARKERS IN GROUNDNUT (*ARACHIS HYPOGEA* L.)

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Abstract

Cultivable groundnut (*Arachis hypogea* L.) is an important oilseed crop with an allotetraploid genome (AABB, 2n=4x=40), which is being cultivated and practiced widely. Significant progress in the area of molecular breeding increased the output of breeding approaches, especially where phenotypic selection is difficult, expensive and more importantly lack of accuracy. In current study, genetic diversity was studied in Forty- two germplasm lines and four cultivars of diverse groundnut set using 7 morphological traits and Simple Sequence Repeat (SSR) markers. Morphological characters for yield related traits were observed *i.e*., days to maturity, number(s) of pod(s)/ plant, 100 pod weight (gm), karnel yield (gm/plant), 100 karnel weight (gm), shelling percentage and sound mature karnel. In this study morphological analysis has been conducted with 7 parameters and genetic distance was measured by NTSYS2.0 to analyze diversity. Gene based allele specific molecular markers were used for screening of two foliar diseases *i.e*., rust and late leaf spot. Total 15 groundnut germplasm lines were identified having foliar disease resistance using gene based markers. Molecular characterization along with morphological analysis showed an authentic result and identified highly diversified lines of groundnut along with foliar disease resistance and higher yield.

ROLE OF SILVER NANO PARTICLES ON GROWTH PARAMETER OF WHEAT CROP

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Abstract

The word "Nanotechnology" has originated from a Greek word "Nanos" which means "Dwarf". The term "Nanotechnology" was first used by Norio Taniguchi in 1947. It is the revolutionary field, where the particle size ranges between 1 and 100 nm at least in one dimension. Due to their high surface area and high reactivity better penetration into the cell these can activate plant and microbial activities resulting in more nutrient use efficiency. The present study demonstrated that by the application of silver nano particles, most of the parameters of growth and development improved. It is suggest that release silver nano particles into the environment could have only positive effects on the plant community. Enhanced seed germination as well as early plant growth is vital to achieve crop productivity. Application of silver nano particles enhanced seed germination percentage, grain weight, Biological yield and grain yield**.** It was observed that accumulation and uptake of silver nano particles was quiet beneficial for Wheat plants. Ultimately, it can be inferred that Silver nano particles play a crucial role for enhancing Wheat growth. Application of 2mM Silver nano particles seems to be the most appropriate concentration for this purpose.

POTENTIOMETRIC DETERMINATION OF FIXED CHARGE DENSITY FOR BARIUM MOLYBDATE MEMBRANE

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Abstract

Membrane Potential and Bi-ionic Potential across the parchment supported Barium Molybdate Membrane bathed in different concentration of 1:1 electrolyte (KNO_3, $NaNO_3$, NH_4NO_3) have been measured. The methods used for the estimation of fixed charge density were: The Teorell - Meyer - Sievers method (TMS). The value derived from different theories were almost the same , confirming there by the validity of the recently developed theories of membrane potential for the evaluation of effective fixed charge density of the system under investigation. The membrane has been characterized on the basic of SEM , TEM, TGA, DSC and FTIR analysis.

ELECTOCHEMICAL STUDIES OF BIOMEMBRANE BASED ON IRREVERSIBLE THERMO-DYNAMICS

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Abstract

Membrane Potential, Bi-ionic Potential and Electrical Conductivity across Biomembrane bathed in different concentration of 1:1 electrolyte (NaCl, KCl, LiCl) have been reported. The irreversible thermodynamic equation originally meant for understanding the behavior for artificial membrane have been found to be equally applicable to those of the biological membrane. The Biomembrane has been characterized on the basic of SEM, TEM, XRD and FTIR analysis.

PREPARATION, CHARACTERIZATION AND ELECTROCHEMICAL STUDIES OF IRON TUNGSTATE SYNTHETIC MEMBRANE

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Abstract

The parchment supported inorganic precipitate iron tungstate synthetic membrane was prepared by the ion intraction method. The membrane was characterized by using Thermogravimetry Analysis (TGA), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and X-Ray Diffraction (XRD). The order of charge effectiveness was found to be $Li^+<Na^+<K^+$. This synthetic membrane showed potential application in the area of separation of heavy metal ion from wastewater because of good stability. Long lifetime and cost effectiveness.

STUDIES OF MEMBRANE POTENTIAL AND SURFACE CHARGE DENSITY OF CERRIC TUNGSTATE MODEL MEMBRANE

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Abstract

Transference Number of Metal Ion across the parchment supported Cerric tungstate model membrane with various uni-univalent electrolytes have been evaluated from membrane potential measurement. The effective fixed charge densities of the membrane evaluated in contact with these univalent electrolytes using recently developed theories have been found to be low. Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Thermogravimetric Analysis (TGA) and Fourier Transform infrared (FTIR), images have also been presented.

EFFECT OF NPK APPLICATION ON SOIL NUTRIENT STATUS OF GUAVA ORCHARD CV. HISAR SAFEDA

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Abstract

Guava (*Psidium guajava* L.) is one of the commonly grown and an important commercial fruits in India. In Hisar district of Haryana about 83 per cent orchards were found deficient in nitrogen, 75 per cent in phosphorus and 91 per cent in case of

potassium.A field experiment was conducted at Experimental Orchard of the Department of Horticulture, CCS Haryana Agricultural University, Hisar during rainy season of 2015-16 and 2016-17 to assess the effect of different macronutrient application on nutrient status of guava orchard. There were five treatments RDF (60, 80 100, 120 and 140%) with four replications in Randomized Block Design. The NPK were applied in month of February and July. During the year 2015-16, the maximum available nitrogen (259.2 kg/ha) was recorded with the application of RDF 140% followed by RDF 120% at soil depth 0-15 cm while at same depth minimum available nitrogen (240.3 kg/ha) was observed in treatment RDF 60%. Similar pattern was observed at 15-30 cm and 30-60 cm depths. The treatment RDF 140% was significantly higher than lower three doses of RDF (60, 80 and RDF 100%). Similarly, at soil depth 0-15 cm, the maximum available phosphorus (16.78 kg/ha) was obtained with the application of RDF 140%, which was statistically similar with treatment RDF 120% but significantly different from lower three doses of RDF (60, 80 and 100%). The maximum available potassium (346.3 kg/ha) was achieved with the application of RDF 140%, which was statistically at par with RDF 120% at soil depth 0-15 cm during the year 2015-16. The minimum potassium (335.6 kg/ha) was recorded in the treatment RDF 60%. The similar trend with respective to available nitrogen, phosphorus and potassium was observed during in the year 2016-17.So, the treatment RDF 140% was significantly higher than lower three doses of RDF (60, 80 and RDF 100%) but at par with RDF 120%.

DEVELOPMENT OF POLYMER GEL BASED FORMALIZED COMBINED MASTITIS VACCINE

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Abstract

Mastitis is a major cause of economic loss in dairy cattle. The losses occur in actual and also due to loss of potential production, shortening of productive life, losses in milk quality, medicine costs, costs of veterinary care. The most frequent agents involved in mastitis in dairy cattle are *Staphylococcus aureus, Escherichia coli, Streptococcus agalactiae, Streptococcus uberis and Streptococcus dysagalactiae.* First two contribute almost 50% of total bacterial mastitis. There is no effective indigenous vaccine available for bovine mastitis in India. Thus in the present study mastitic milk samples were collected from bovines for the isolation of pathogenic *Staphylococcus aureus* and *Escherichia coli*. The virulence of all the isolates was also confirmed on blood agar and for the presence of drug resistance genes. The two most pathogenic isolates were selected for the development of formalized killed vaccine. These were characterized based on cultural, morphological, biochemical and molecular methods. The genus and species specific PCR was used to confirm the isolates. These PCR product were subjected to sequencing and the sequences have been submitted to NCBI gene sequencing data base to obtain accession number. The stability and safety of vaccine was tested. The vaccine was found stable at room temperature, at incubator (37ºC) and in refrigerator for 3, 6 and 12 months period, respectively. The stable vaccine was used to assess safety of vaccine in swiss albino mice and was found safe in mice. However, efficacy of the vaccine is to be established initially in mice model and subsequently in homologous host.

MORPHOMETRICS, FOOD AND FEEDING AND REPRODUCTIVE BIOLOGY OF WHITE SARDINE, *ESCUALOSATHORACATA* (VALENCIENNES, 1847) OF RATNAGIRI COAST

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Abstract

The white sardine, *Escualosathoracata* inhabiting shallow coastal waters, has been supporting to be an economically important fishery along Ratnagiri coast during recent years. Morphometric relationship, food and feeding, reproductive biology, length-weight relationship, growth and mortality parameters have been studied for the fish during the period February

2015 to January 2016. The regression coefficient (b) was found to be highest for fork (0.8092) and standard length (0.7656) and lowest for pupil and orbital diameter. The length-weight relationship was$W = 0.0174 L 2.7521$ for the males, $W = 0.0133 L 2.8567$ for females and $W = 0.0162 L 2.8537$ for total.Analysis by student's t-test showed allometric growth. The analysis of covariance indicated no significant difference in the slopes of both sexes ($P > 0.05$). This fish is found to be planktivorous in feeding habit, feeding mainly on copepods followed by cladocerans, crustacean's larvae, fish eggs, bivalve larvae, tintinnids and diatoms (*Ceratium* spp*., Coscinodiscus* spp., *Nitzschia* spp.,*Rhizosolenia* spp.). The studies on reproductive biology indicated prolonged spawning season from October to April with peak spawning from November to February. Highest GSI value for both sexes were observed during November (9.1487 for males and 5.4335 for females) and lowest during June (1.2772 for males and 0.8855 for females). The highest value of K was found in February for both sexes, male (2.06) and (1.86) in females. The overall male: female ratio was 1: 1.19 indicating slight dominance of females.The ova diameter for this species ranged from 0.02 to 0.64 mm, absolute fecundity ranged from 6156 to 9924 ova with an average of 7674 ova. Length at first maturity has been estimated to be 79 mm. The asymptotic length (L8), growth coefficient (K) and t_0 were estimated to be 135 mm, 1.2 year^{-1} and - 0.000012 year respectively by scattergram technique, whereas L8 andK obtained by ELEFAN-I were 114 mm and 1.0 year^{-1} respectively. This species attains a length of 65, 94 and 114 mm at the end of six, twelve and eighteen months respectively. The total mortality coefficient (Z), natural mortality coefficient (M) and fishing mortality (F) estimated were 3.56 year^{-1}, 1.25 year^{-1} and 2.31 year^{-1} respectively using FiSAT programme. Exploitation rate (U) and exploitation ratio (E) estimated were 0.63 and 0.64 respectively indicating overexploitation of resources from Ratnagiri coast suggesting reduction in fishing effort to ensure sustainability.

ROLE OF CRITICAL ENVIRONMENTAL PARAMETERS FAVOURING FOR INFECTION AND DEVELOPMENT OF PEARL MILLET BLAST

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Abstract

Blast incited by *Pyricularia grisea* (Cooke) Sacc. has become wide spread and destructive disease of pearl millet particularly in the crop cultivated for fodder purpose. Earlier it was considered a minor disease in the country but from last one decade it has become important in many of the high yielding hybrids. More than 50 species of grass family are infected by blast pathogen including rice, wheat, barley, oats, pearl millet, finger millet and foxtail millet. The pathogen is highly variable in nature but certain strains were specific in its host range. It produces highly palatable and nutritious forage. The crude protein content of green pearl millet forage varies from 6 to 20%. The fresh forage is fairly well digested by ruminants, with DMD being about 66-69%. In pearl millet silage, crude protein content is low (from 4% to 10%) due to protein losses, and the rumen degradable fiber fraction is low (Guimaraes *et. al.,* 2010). An experiment was laid out at experimental farm of College of Agriculture, Gwalior on five different dates of moderately blast susceptible cultivar JBV-2 was planted in five different dates at weekly interval starting from the last week of June during 2015-16 and 2016-17. The experiment was conducted in RBD design with four replications. Spacing was maintained as 30 cm row to row and 10 cm plant to plant. Fertilizers @ N 80 kg, P 40 kg and K 40 kg /ha were applied as basal dose before sowing. The progressive blast infection on the tagged plants will be recorded at weekly interval simultaneously. The meteorological parameters data on temperature, relative humidity (RH), rainfall and number of sunshine hrs were also recorded separately weekly interval during crop season in year 2015-16 and 2016-17 from the Meteorological Department of College of Agriculture Gwalior. Symptoms appeared after inoculation on plant. .Progressively development of symptoms on plant was recorded at weekly interval. There after correlation and regression studies will be carried out in between the leaf blast severity and individual metrological parameters. The role of meteorological parameters on the infection and development of blast was studied. The infection and development of blast positively and significantly influenced by maximum relative humidity ($r = 0.724^{**}$), minimum relative humidity ($r = 0.650^{**}$), rainfall ($r = 0.884^{**}$) while it was negatively and significantly influenced by maximum temperature ($r = -0.463^{*}$) and minimum temperature ($r = -0.638^{**}$). The evaporation and duration of sunshine hrs did not influenced it significantly. The average maximum and minimum relative humidity should be more than 65 and 30 percent respectively whereas the maximum temperature should be less than 34.5 c. In assessing the percentile contribution rainfall (62.201) had contributed the highest proportion followed by maximum relative humidity (43.138), minimum temperature (18.593) and maximum temperature (13.465). where as evaporation and sunshine hours did not influenced the disease significantly.

EFFECT OF FOLIAR APPLICATION OF NUTRIENTS AND PLANT GROWTH REGULATORS ON YIELD AND QUALITY OF GUAVA (*PSIDIUM GUAJAVA* L.) FRUIT C.V. LALIT

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Abstract

Guava (*Psidium guajava* L.) is one of the most important fruit crops grown well under tropical and sub-tropical condition. Popularly known as 'Apple of Tropics'. It's a member of family 'Myrtaceae' and sub family 'Myrtoideae'. The guava is now cultivated in more than 60 countries of the world, In India the major growing states are U.P, Bihar, M.P, and Maharashtra. The total area under guava cultivation and production of guava in India is about 261.72 thousand hectares and 3648.18 thousand MT respectively. The productivity of guava in India is 13.94 MT/ha (NHB 2016-2017). The experiment was laid out in R.B.D. with three replication and nine treatments and following treatment details, T_1 (Urea 1%), T_2 (Potassium sulphate 1%), T_3 (Zinc sulphate 1%), T_4 (GA_3 50ppm), T_5 (NAA 50ppm), T_6 (Urea 1%+ NAA 50ppm), T_7 (Urea 1%+ GA_3 50ppm), T_8 (Urea 1%+ Zinc sulphate 1%), T_9 (Urea 1%+ Potassium sulphate 1%) along with T_0 Water spray (control). Observations recorded to be fruit set, fruit retention, fruit length, fruit width, fruit weight, fruit volume, specific gravity, and fruit yield (kg/plant). The data so obtained were analysed statically. Based on the results obtained under investigation it can be concluded that among different treatments of nutrients and plant growth regulators applied as foliar spray single or in combination ; T_6 (Urea 1%+NAA 50 ppm) proved most effective and maximized fruit yield (kg/plant). Apart from acidity of the fruit reduced drastically, this ultimately enhanced the quality of fruit. The quality traits such as T.S.S, total sugar, ascorbic acid were also improved by the use of this treatment. Therefore, combined spray of T_6 (Urea 1%+NAA 50 ppm) can be advocated to guava growers for securing higher yield and better quality of guava fruits.

INTRA NASAL INOCULATION OF SODIUM ACRYLATE NANOPARTICLE BASED VACCINE INDUCED PROTECTION AGAINST *BRUCELLA MELITENSIS*

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Abstract

There is no effective indigenous vaccine available for human brucellosis caused by *Brucella melitensis* in India. The present study efficacy of sodium acrylate nanoparticle based formalized killed *Brucella melitensis* vaccine (NPV) against challenge with a virulent strain of *Brucella melitensis* biovar 3 IND1 in BALB/c mice. The efficacy of NPV was assessed in inbred adult female BALB/c mice. Mice were divided in three groups group A, B and C. Group A received I/N NPV($1.47X10^8$ CFU/mouse), Group B received adjuvant and Group C was sham immunized with PBS (pH 7.4). Half of the mice in each group were booster vaccinated on 21st day of primary vaccination. All the mice were challenged on 28th day post vaccination and booster vaccination. Mice were sacrificed one week after challenge to collect vital organs for organ weight, CFU Brucella count, Splenocyte proliferation assay, estimation of Th_1 and Th_2 cytokine expression by SYBR Green real-time along with assessment of serum antibodies by RBPT and ELISA and Th_1 and Th_2 cytokine plasma level. Vaccination with NPV showed significant reduced organs size and reduced CFU per gram of spleen and liver; significant difference in plasma cytokine levels; higher level of proliferation of spleen cells on exposure to *Brucella* LPS; highest increase in vaccinated group for INF-? and lower level expressions of all other cytokines than the adjuvant inoculated groups. The booster vaccination further reduced size of liver, spleen, CFU/gm in spleen and liver, higher splenocyte proliferation of stimulation with *Brucella* LPS, higher level of INF-? plasma level and expression in vaccinated mice spleen cells. The intra nasal administration of NPV showed a promising protective response against challenge of virulent *B. melitensis* in BALB/c mice.

HISTOPATHOLOGY BASED ASSESSMENT OF FORMALIZED KILLED COMBINED OIL ADJUVANT MASTITIS VACCINE IN MICE MASTITIS MODEL

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Abstract

The present study involved the formulation of a formalized killed combined oil adjuvant vaccine (OAV) with virulent local strains of *S. aureus* (Accession no. MH092071) and *E. coli* (Accession no. KY914488). To enhance the duration of protection Montanide™ ISA61VG {a specific enriched light mineral oil and an extremely refined emulsifier obtained from mannitol and purified oleic acid of vegetable origin ingredients based adjuvant prepared in water-in-oil (W/O) emulsion}was used an adjuvant. The vaccine consisted of load of 10^8bacterial cells of each strain suspended in PBS (pH 7.6). The adjuvant was added in 1:1 (V/V) with bacterial suspension. The sterile, stable and safe OAV was used in mice mastitis model. A total of 72 female lactating mice were divided in three groups. OAV (100µl) was inoculated in 24 lactating female albino mice through subcutaneous route A. Whereas remaining two groups (Group B, Group C) were inoculated equal volume of adjuvant and PBS (pH 7.6). On 28th day post vaccination these groups were challenged with combination of 100 virulent bacterial cells of *S. aureus* and *E. coli*. Seventh day post vaccination (35th day of initial vaccination), all the mice were sacrificed and mammary tissues were collected for histopathology. The microscopic examination revealed changes in cellular mass, inflammatory cells and infiltration of neutrophils in all the groups. The level of neutrophils accumulation and changes in cellular architect was highest in Group C followed by Group B and minimum in Group A, suggesting protective effect of vaccine.

EFFECT OF BORON AND ZINC APPLICATION ON GROWTH AND YIELD OF EARLY CAULIFLOWER

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Abstract

Cauliflower (*Brassica oleracea var. botrytis* L.) *is* one of the most important vegetable crops, belonging family- *Brassicaceae*, and occupies the largest area in India. Earlier, it was grown only as winter vegetable in India, but with the evolution of Indian cauliflower varieties it is being grown during summer and rainy season also. Different micronutrients have specific role in cauliflower production. Among them Boron & Zinc play more important role due to its availability in soil, mobility in plants and soil. The field experiment was conducted in the permanent experimental area of the Nalanda College of Horticulture, Noorsarai, Bihar Agricultural College, Sabour, and Bhagalpur. College Farm in the Rabi season 2016-17 in R.B.D. factorial design with three replicatations and 15 treatment combinations. The variety used in the experiment was- Sabour Agrium. From the results of the experiment it was found that application of bron @ 2.0 kg/ha + zinc 5.0 kg/ha exhibited significantly higher plant height (cm), Curd diameter (cm), curd depth (cm), net curd weight (kg) with yield of 152.22 q/ha. This treatment was at par the application of bron @ 3.0 kg/ha + zinc 7.5 kg/ha in respect to calculated yield 144.44 q/ha

AN ABOMASAL BLOAT IN NEONATAL RUMINANT: A CASE REPORT

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Abstract

Abomasal bloat in neonatal calf is a condition produced by the excessive fermentation of energy rich gastrointestinal contents

particularly milk in the abomasum along with the presence of fermentative enzymes (produced by bacteria). If the animal is not able to remove this excessive gas from the abomassum, then it will cause the abomassal bloat. A neonatal murrah buffalo calf (3-4 days old) in private dairy farm at Modipuram, Meerut was presented for the clinical examination and professional assistance. The clinical signs showed by the calf were pasty yellow and bloody diarrhea, excessively distended and painful abdomen. The cause of this disease is complex and multifactorial; the exact cause remains unknown but it may be either bacteria that lead to excessive fermentation or some factors such as volume, osmolality and caloric content of the ingested milk feed, as well as the abomasal and duodenal pH that slows the abomassal emptying. Among the various bacterial causes, infection of *Clostridium perfringens* type A are perhaps the most common cause of abomassal bloat in neonatal ruminants. The calf was treated with Marbofloxacin (Marbomet, Intas Pharmaceuticals Ltd., Ahmedabad) @ 8mg / kg body weight as a single injection intramuscularly along with pheniramine maleate and other symptomatic treatment. After 48 hrs of treatment, the condition of the animals was significantly improved. Then, the animal was supplemented with vitamin and mineral supplements along with liver stimulants. Additional studies are essential to clarify the predisposing factors and the interrelations between the clinical, pathological, and etiological factors of this condition for the development and application of prevention and control strategies.

AGRONOMIC MANIPULATION ON SUSTAINABLE PRODUCTION OF COTTON AND SOYBEAN INTERCROPPING SYSTEM

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Abstract

Two field experiments, namely "Evaluation of Bt cotton and Soybean genotypes in intercropping under different crop geometry" and "INM to sustain productivity of Bt cotton and Soybean intercropping system" were conducted on vertisols at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during 2015-16 and 2016-17. The experiment I was laid out in randomized complete block design in factorial concept with 12 + 4 (control) treatments and two replications. The experiment II was laid out in randomized complete block design with 20 treatments and three replications. Neeraja Bt cotton intercropped with JS 9305 soybean in 120 cm row spacing for cotton and 40 cm for soybean recorded significantly higher seed cotton yield and soybean seed yield. Higher LER, ATER, cotton equivalent yield (CEY), system productivity index (SPI), net returns and BC ratio were recorded in this treatment. In INM experiment, higher yield and yield attributes of cotton and soybean were observed in T_3 (150 % RDF for cotton and soybean) which was on par with T_2 (125 % RDF for cotton and soybean) and T_{17} (T_1 + Vermicompost 1.25 t ha^{-1} + Gliricidia 2.5 t ha^{-1}). Higher ginning percentage was observed in T_{18} (T_1 + Vermicompost 1.25 t ha^{-1} + Pongamia 2.5 t ha^{-1}) than application of 100 per cent RDF alone to both crops (T_1). Soybean quality parameters like oil content and oil yield were significantly higher in T_{17}. Higher LER, ATER, CEY, canopy index and SPI were observed in T_3, which was on par with T_2. Lower insect and disease incidence were observed in T_{17} and T_{18}. Higher net return was observed in T_2 and higher BC ratio was observed in T_{16} (T_1 + Gliricidia 2.5 t ha^{-1} + Pongamia 2.5 t ha^{-1}) than other treatments.

ASSESSMENT OF TECHNOLOGICAL GAP FOR ADOPTION OF WHEAT PRODUCTION TECHNOLOGY IN MADHUBANI DISTRICT OF BIHAR

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Abstract

Wheat (*Triticum aestivum* L.) is the second most important cereal crop after rice in India. It plays a vital role in stabilising national food supply and ensuring food-cum-nutritional security. Presently, India is the second largest wheat producing country in the world, next to China. Wheat is also the second most important cereal crop after rice (59.6%) in the Madhubani district of Bihar. The district occupies 26.05 per cent area under wheat followed by pulses (7.34%) and oil seed (4.25%) But

inspite of vast area and immense potentiality for boosting wheat production, Madhubani still remains one of the deficit districts due to its low productivity. This low production and productivity can be enhanced if the farmers are provided information related to latest wheat production technology including the new varieties.Thus realising the importance of problem, the study was designed to know the association of selected socio-psycho-economical and communicational variables with the technological gap in adoption of wheat production technology in Madhubani district of Bihar Out of thirteen independent variables under taken into consideration, five variables namely, education ,cropping intensity, risk orientation, contact with extension agency and level of knowledge about wheat production technology in case of highest productivity block were negatively significantly correlated with technological gap. However the variables age was positively and significantly correlated with technological gap. The remaining seven variables found to have non-significant association with technological gap. While in case of lowest productivity block, the finding reveals that the same set of variable (except cropping intensity) were negatively significantly correlated with technological gap. Likewise highest productivity block, the other remaining variables were found to have non- significantly associated with technological gap. Further multiple regression analysis indicated that, in case of highest productivity block the calculated 't' value in the case of level of knowledge was found to be negatively and significant about wheat production technology. Whereas in case of lowest productivity block, the variable education, size of family and level of knowledge about wheat production technology was found to be negatively and highly significant. The remaining variables in the both blocks were found to be non-significant contribution with technological gap.

GROWTH AND LEAF YIELD OF MAGAHI PAN AS INFLUENCE BY PLANT DENSITY

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Abstract

Magahi Paan (*Piper betle* L.) is one of the major well known betel vine variety in India specially grown in the Magadh region of Bihar for its leaves, so named Magahi paan. Due to its region specific quality like non-fibrous and softest nature of leaf, it was registered under GI act by Government of India. Yield components and leaf yield of betelvine crop are negatively affected by using a higher or lower plant density. Hence, determination of the optimal plant density is necessary for vigorous plant growth to obtain highest number of fresh leaf (economic part) of betelvine. Keeping in view of the fact, the present experiment was performed under AICRP on MAPs and Betel vine project during three consecutive years 2010-11, 2011-12 and 2012-13 at Betelvine Research Centre, Islampur, Nalanda under Agro-climatic Zone IIIB of Bihar. The experiment consisted of four plant density treatments (T_1-1.25, T_2-1.50, T_3-1.75 and T_4- 2.0 Lakh Vine ha^{-1}).The experiment was laid out in a randomized block design with three replicatations. The mean of the three years result showed that plant population density of 1.50 Lakh Vine /ha exhibited higher no. of branches per vine (14.70), maximum vine elongation (10.03 cm/month) and more fresh weight of leaves (219.79 g/100 leaves). Though more number of leaves per hectare was obtained with plant population of 1.75 and 2.0 Lakh vine /ha but fresh weight was reduced as a result of reduction in leaf size. However, plant density of 1.5 Lakh Vine/ha resulted significant effect on marketable leaf yield (22.05 Lakh/ha) with and lower incidence of *Phytophthora foot rot* disease (8.62 %) in comparison to higher plant density treatment (1.75 & 2.0 lakh Vine/ha) and lower pant density (1.25 lakh Vine/ha). Thus, based on mean of three years finding, it may concluded that the plant density of 1.5 Lakh Vine/ha was suitable for higher growth and leaf yield of Magahi Pan in agro-climatic zone III B of Bihar.

STUDY OF GENETIC DIVERSITY IN INDIGENOUS AND EXOTIC GERMPLASM OF LENTIL (*LENS CULINARIS* MEDIK.) FOR TIMELY SOWN CONDITION IN BIHAR

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Abstract

An investigation has been done on 49 indigenous and exotic lentil genotypes at Bihar Agricultural University, Sabour. Significant treatment differences were found for all the characters under study except number of primary branches per plant.

In general, phenotypic coefficients of variation (PCV%) were higher than genotypic coefficients of variation (GCV %). Highest PCV % and GCV % were noted for wilt incidence followed by harvest index, plot yield, grain yield per plant, number of pods per plant and biological yield per plant. High heritability (%) along with high genetic advance as percent of mean was noticed for plot yield, days to 1st flowering, days to fifty percent flowering, biological yield per plant, seed index, harvest index, grain yield per plant and number of pods per plant, indicating that these characters are governed by additive gene effects and directional selection for these traits would be more effective. Association of character among grain yield and component traits including direct and indirect effect in lentil, the phenotypic correlation revealed that number of pods per plant and biological yield per plant had positive and highly significant association with grain yield. Path analysis revealed that biological yield per plant had maximum and positive direct effect on grain yield whereas, days to first flowering, days to fifty percent flowering and days to harvest had negative direct effect on grain yield while, days to maturity had negative direct effect on grain yield only at phenotypic level. On the basis Mahalanobis D^2 statistics eight clusters were formed. Among the eight clusters, cluster VII consisted maximum number of genotypes (13) followed by cluster III (12), cluster IV (8), cluster V and VI (4 each) and cluster VIII (3) contributed maximum towards genetic divergence among the genotypes and supposed to play important role in the improvement of lentil. Plot yield contributed maximum towards genetic divergence followed by plant stand at harvest, number of pods per plant and biological yield per plant. The results indicated that the germplasm lines studied has a considerable level of variability that could be exploited in future breeding programs.

EFFECT OF HERBICIDE MIXTURES ON WEED DYNAMICS AND YIELD OF WET DIRECT SOWN RICE (*ORYZA SATIVA* L.)

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Abstract

Rice (*Oryza sativa* L.) is a principal source of food for more than half of the world population and for the people of Asia in particular. In coastal plain zone of Odisha transplanted puddle rice is the common method for rice establishment in wet season which is cost and labour intensive. Wet direct sown rice (W-DSR) is a viable alternative for transplanted rice. But, weed infestation is one of the major biotic stresses which reduces yield up to 65% in direct sown rice. So weeds must be controlled in the critical crop weed competition period. Use of herbicides is getting growing acceptance among the farmers as it saves cost, time and labour and controls weeds efficiently. Hence there should be continuous effort to study the effects of new herbicides and herbicide mixtures on weed dynamics of W-DSR. The present investigation was conducted at ICAR-National Rice Research Institute, Cuttack (Odisha) during wet season of 2016. The experiment was laid out in Randomized Complete Block Design with nine treatments viz. four herbicide mixtures (T_1-XR-848 Benzyl Ester + Cyhalofop Butyl 12% EC (w/v) @ 120 (20+100) g ha^{-1}, T_2- XR-848 Benzyl Ester + Cyhalofop Butyl 12% EC (w/v) @ 150 (25+125) g ha^{-1}, T_3- XR-848 Benzyl Ester + Cyhalofop Butyl 12% EC (w/v) @ 180 (30+150) g ha^{-1},T_4- XR-848 Benzyl Ester + Cyhalofop Butyl 12% EC (w/v) @ 360 (60+300) g ha^{-1}), three alone herbicides (T_5- XR-848 Benzyl Ester 2.5% EC (w/v) @ 25g ha^{-1}, T_6- XR-848 Benzyl Ester 2.5% EC (w/v) @ 30 g ha^{-1}, T_7- Bispyribac-Na 10% SC @ 30 g ha^{-1}), one weed free (T_8) and weedy check (T_9), replicated thrice. The test variety '*Naveen*' was sown at 20 cm apart rows on 13th June, 2016 and harvested on 6th October, 2016. The major weed species observed during the period were grasses (*Echinochloa colona* and *Leptochloa chinensis*), sedges (*Cyperus difformis, Cyperus iria* and *Fimbristylis miliacea*) and broadleaves (*Sphenoclea zeylanica* and *Marsilea quadrifolia*). Highest percentage of composition was of *Leptochloa chinensis* in all the stages followed by *Sphenoclea zeylanica* at 30 days after sowing (DAS) and *Cyperus iria* at 45, 60 DAS and at harvest. Among different herbicide treatments, broad-spectrum control of weeds was observed under the treatment, XR-848 Benzyl Ester + Cyhalofop Butyl 12% at 150 (25+125) g ha^{-1}, effectively with lowest weed density, dry matter, weed index and having the highest weed control efficiency (82% at harvest). Among the herbicide treated plots, the highest grain yield was recorded under XR-848 Benzyl Ester + Cyhalofop Butyl at 150 g ha^{-1} (4.91 t ha^{-1}) which was at par with the weed free plots (5.27 t ha^{-1}). The yield was negatively correlated to weed density, weed dry matter and weed index. All the herbicide mixtures recorded higher growth and yield parameters compared to sole application of herbicides. Thus, the herbicide mixture XR-848 Benzyl Ester + Cyhalofop Butyl at 150 g ha^{-1} is found to be potential option and may be recommended for better weed control in W-DSR.

STATUS AND PROSPECTS OF APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGY THROUGH EXTENSION FUNCTIONARIES IN BIKANER DISTRICT OF RAJASTHAN

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Abstract

The present study was conducted in Bikaner district of Rajasthan. State department of agriculture was selected purposively as Government Organisation (GO) and six Non-Government Organizations working in agriculture with more application of ICTs were also identified from Bikaner district. A total of 120 extension functionaries (60 from GO & 60 from NGOs) were included in the study. For the purpose of study five ICT tools namely Smart phone, Internet, Agricultural Websites, Kisan Call Centre and Information Kiosks were taken for the study. The major findings of the study are as follow: The study reveals that majority of extension functionaries (69.17%) had medium level of knowledge about ICTs. It was further noted that overall extent of knowledge of extension functionaries about Smart phone, Internet, Agricultural Websites, Kisan Call Centre and Information Kiosks was 76.10, 59.17, 78.66, 68.42 and 46.86 per cent respectively. The knowledge of NGOs extension functionaries was significantly higher then GO extension functionaries about ICTs. The finding reveals that majority (63.33%) of the total extension functionaries had medium level of ICT application. The extent of application of Smart phone, Internet, Agricultural Websites, Kisan Call Centre and Information Kiosks were noted to be 73.95, 71.12, 77.50, 66.63 and 63.21 per cent respectively by the extension functionaries. The study revealed that majority of the extension functionaries (77.50%) possessed medium level of training needs about ICTs. Findings further revealed that there was significant difference in training needs of GO and NGOs extension functionaries about various tools of Information and Communication Technology. The study also indicated that inadequate budget provision for purchasing of Smart phone by the department, poor ICT infrastructure and network for assessing Internet at village level, lack of awareness about Agricultural Websites, busy network of Kisan Call Centre, lack of agricultural information provided by Information Kiosks were important constraints perceived by GO and NGOs extension functionaries in application of ICT. The findings indicated that computer with internet facility be made available on free of cost to extension functionaries, the number of phone lines at KCC should be increased along with instant messaging, touch screen system with graphic technology be made available at Information Kiosks, call centre experts must be professional agriculture specialists and digital agricultural technological packages be made available in Hindi were most important possibilities viewed by the extension functionaries for better prospects of ICT application.

A STUDY ON FUTURE MILK YIELD FROM EARLY LACTATION TRAITS IN CROSSBRED CATTLE USING MULTIPLE LINEAR REGRESSION MODELS

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Abstract

The present study was conducted on G.B. Pant University of Agriculture and Technology, Pantnagar, based on the statistical analysis of data related to performance traits of crossbred cattle. Data pertaining to 326 crossbred cattle for a period of 16 years (2001 to 2016) were used for the present study. The data for the Age at First Calving (AFC), First Service Period (FSP), First Gestation Period (FGP), First Lactation Period (FLP), First Milk Yield (FLMY), First Dry Period (FDP), First Calving Interval (FCI), Second Lactation Milk Yield (SLMY), Third Lactation Milk Yield (TLMY) and Lifetime Milk Yield (LMY) were obtained from history sheets of animals maintained at Instructional Dairy Farm (IDF), G.B. Pant University of Agriculture and Technology, Pantnagar. To estimate Lifetime Milk Yield of crossbred cattle, several MLR models were developed using more than one predictors out of 9 predictors are (AFC, FLP, FCI, FGP, FDP, FLMY, SLMY, TLMY and FSP). However, 17 MLR models are included in our study for which R^2 value were more than 50%. On the basis of maximum value of R^2 (0.992**) and minimum value of RMSE (143.0), MLR model was found to be best model to estimate LMY of crossbred

cattle as : LMY = 1039.306 + 1.389** (FSP) + 0.615** (FGP) + 1.035** (FLMY) - 1.438** (FDP) - 0.246**(FCI) + 1.806** (SLMY) (R^2=0.992). It was concluded that, FSP, FGP, FDP, FCI, FLMY and SLMY are the best predictors to estimate LMY of crossbred cattle, as they jointly explained 99.2% variability in LMY.

FLORICULTURE : A SUNRISE INDUSTRY FOR THE FUTURE INDIAN AGRI-BUSINESS

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Abstract

Floriculture is a form of horticulture concerned with the cultivation of flowering and ornamental plants for gardens giving rise to floral industry. The development and production of new varieties is a major occupation of floriculturists. Floriculture in India viewed as a potential industry with 100% export-oriented status. India is a vast country with variance of climatic, soil and water resources which makes it suitable for commercial floriculture throughout the year in some or the other region of the country. Floriculture is the growing of cut flowers, foliage plants, ornamental or medicinal and cosmetic purposes and bedding plants in open fields and in polyhouses. A few decades back floriculture was considered a pass-time absorption of the rich and the elite and only the flower lovers but now it has assumed the status of agri-business i.e. commercial horticulture. The present life-style has increased the demand of ornamental flowers by leaps and bounds. Present times witness an enormous demand of ornamental flowers and foliage during wedding celebrations, conferences, summits, seminars bouquets in public functions and felicitations, formal and home décor the world over. Hence, flowers seem to be a 'wanted item'. They have become part of purchase at Super- markets. The two broad categories under floriculture could be termed as field-grown particularly cut flowers varieties such as daffodils, tulips, gladiolias, snapdragons, roses, frecsia etc. Flowers like the carnations, marigold, jasmine, aster, chrysanthemum and the greenhouse produce. Major buyers of Indian cut-flowers are the U.S.A., U.K., Germany, Netherlands, and U.A.E. in the year 2014-15 and for loose flowers like jasmine and marigold are Sri Lanka, Malaysia, Singapore and West Asian countries. India is likely to lead in the export of marigold flowers. The annual world trade in marigold is currently estimated to be around Rs. 500 crores and in the wake of rising cost of production in Kenya, which so far has been the largest exporter in the world, India stands a good prospect of becoming the largest exporter of marigold in the world.

YIELD GAP ANALYSIS IN KABULI CHICKPEA (*CICER ARIETINUM* L.) THROUGH FRONT LINE DEMONSTRATION

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Abstract

Kabuli Chickpea (*Cicer arietinum* L.) is a major pulse crop grown in Madhya Pradesh Particularly in Indore district. It was observed that, the productivity of chickpea (11.83 q/ha) at Indore district was far bellow than its potential yield (20 q/ha). Therefore to enhance the production and productivity of chick pea Front Line demonstration were carried out at three villages of Indore district covering 39 farmers during 2015-16, 2016-17 & 2017-18. The interventions imparted under Font Line demonstration were consisting Improve variety, {(Phule G 0517 (Kripa)}, integrated nutrient management (20:60:20 kg N: P: K /ha + Rhizobium + P.S.B.@ 5 ml per kg of seed), integrated pest management, Deep ploughing, seed treatment with Trichoderma viridi , Quinolphos @1.5 lt/ha+ Indoxacarb 3.3 lt/ha). Existing farmers practice was treated as control. Full gap was observed in case of variety, seed rate, seed treatment, seed inoculation, while partial gap was observed in use of inorganic fertilizer and plant protection measure followed by the farmers. 26.23 percent average yield enhancement was recorded with extension gap ranging between 3.1, 2.4 and 3.49 q/ha during the period of study. The trends of technology gap (ranging between 5.4, 6.93 and 4.39 q/ha) reflected the farmers co-operation in carrying out such demonstration with encouraging results in sequent year. Average technological index 14.8 % showed the feasibility of the evolved technology at the farmer's field. Net return under recommended practices was recorded Rs 70553,73220 and Rs 57847 while it was Rs 45593, 57228 and Rs 39525 under control i.e. existing farmers practice . Benefit: cost ratio was also calculated, it was ranged between 1: 3.47, 3.25 and 1:2.97. Consequently it was clearly showed that the Front line demonstration can paved the way of minimizing the gap between actual yield of chick pea and its yield potential.

BIOTECHNOLOGY IN PLANT PATHOLOGY

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Abstract

Biotechnology is the genetic manipulation of any living organism through novel techniques and technologies such as tissue culture and genetic engineering in order to produce new organisms that can be used in variety of ways. The potential for plant disease control has been greatly expanded by advances in biotechnology relating to plant cell and tissue culture, production of monoclonal antibodies and the manipulation of nucleic acids and genetic engineering. Genes pyramiding was made easier with molecular markers. Polymerase chain reaction (PCR) and ELISA techniques are used in the identification of viral and bacterial disease and also new formats using antibody based detection for very fast presumptive on-site diagnosis have become available. These do not require specialized equipment or skill. These biotechnologies have permitted new possibilities for production of pathogen-free plants, development of disease resistant plants, manufacture of microorganisms with specific uses such as biological control agents and pesticides degraded agents, production of serological products for identification and diagnosis of disease, and exploring the knowledge of host parasite interactions.

EFFECT OF DATES OF SOWING, VARIETIES, IRRIGATION SCHEDULE AND AGRO METEOROLOGICAL INDICES ON GROWTH AND YIELD ATTRIBUTES OF BARLEY VARIETIES UNDER ALLAHABAD CONDITIONS

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Abstract

A field experiment was conducted at the Forestry Nursery and Research Farm of Department of Environmental Sciences & NRM, College of forestry, SHUATS, Allahabad during Rabi 2016-17. The experiment was conducted in 33 factorial randomized complete block design with three dates of sowing (viz. 25 oct, 10 Nov and 25nov), 3 varieties (JYOTI, RD 2035 and BH-393) and 3 irrigation (5, 4 and 3 irrigation) with 3 replications. The interaction effects of date of sowing and irrigation schedule on yield attributes of barley varieties. The results revealed that spike length of barley crop was significantly influenced by different dates of sowing, varieties and irrigation schedules. The maximum number of spike and grain yield spike length were recorded with variety JYOTI, sowing of barley on 25thNov and 3 irrigations. Sowing of barley variety jyoti on 25th Nov along with 3 irrigations resulted in maximum spike length (15.27 cm), number of spike (29.16) and grain yield (55.31 q/ha).The lowest agro meteorology parameter was recorded in 25th Nov.

EFFICACY OF PENDIMETHALIN HERBICIDE ON PLANT GROWTH, YEILD AND ECONOMICS OF POTATO CROP (*SOLANUM TUBEROSUM* L.) IN WESTERN UTTAR PRADESH

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Abstract

An experiment was conducted in potato (*Solanum tuberosum* L.) crop with different methods of weed control during *Rabi* season of 2015-16 to find out the efficacy of pendimethalin herbicide and cost effective weed management practice. The field was laid out in Randomized Block Design with four replications and five treatments. The treatments were taken as follows T_1 - Control, T_2 - hand weeding twice at 35 DAP and 45 DAP, T_3 - Pendimethalin @ 0.75 kg ha^{-1} + one hand weeding, T_4 - Pendimethalin @ 1.0 kg ha^{-1}, T_5 – Pendimethalin @ 1.25 kg ha^{-1}. The variety 'Kufri Chipsona-1' was planted at seed rate of 25 q ha^{-1} in ridge and furrow manner on November 16, 2015 in standard plot size of 12 sq.m. The planting space was kept 40 cm between ridges and 20 cm between tubers planted. The fertilizer dose of NPK @ 100:80:80 was applied to the crop. Of which,

half dose of nitrogen with full dose of phosphorus and potassium was applied while land preparation; rest dose of nitrogen applied in two equal splits at 45 and 60 days after planting. Analysis of variance showed significant differences for plant height, plant width, number of tubers/plant, tuber size, tuber weight, tuber yield and weed index due to different weed management practices. Treatment T3 recorded maximum tuber yield (260.50 q ha^{-1}) which was found 147% higher than control. Economics of production revealed that highest net return (Rs. 104532/- ha^{-1}) was also obtained under same treatment.

MARKER ASSISTED SELECTION IN ORPHAN CROPS

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Abstract

Staple crops face major challenges in the near future and a diversification away from over-reliance on staples will be important as part of the progress towards the goal of achieving security of food production. Orphan or underutilized or neglected crops species are often indigenous ancient crop species which are still used at some level within the local, national or even international communities, but have the potential to contribute further to the mix of food sources than they currently do. Orphan crops are in general more adapted to the extreme soil and climatic conditions than the major crops of the world. The major bottlenecks affecting the productivity of orphan crops are low yield, poor in nutrition and production of toxic substances. Environmental factors such as drought, soil acidity and salinity, pests, diseases and weeds also contribute to large losses in yield.Some of the studies showed marker assisted selection (MAS) for crop improvement in underutilized crops. MAS forcassava, the use of multiple flanking markers for selection of a dominant gene, *CMD2* for cassava mosaic virus (CMV) resistance at CIAT. MAS for the same gene is important during introgression of cassava green mite (CGM) and cassava brown streak (CBS) resistance from a wild relative. Other potential targets of MAS such as beta carotene and dry matter content as well as lower cyanogenic potential.Use of MAS in pearl millet for development of drought tolerant and disease resistance variety.Terminal drought is one of the major constraints in chickpea (*Cicer arietinum* L.), causing more than 50%production loss. Marker-assisted recurrent selection and genomic selection are beingdeployed for enhancing drought tolerance in chickpea.

IMPACT ASSESSMENT OF SRI ON FARMER'S FILED AT BALODA BAZAR - BHATAPARA DISTRICT OF CHHATTISGARH

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Abstract

Area under Paddy of Baloda Bazar - Bhatapara District was 209820 ha (2016-17). Usually farmers were adopted conventional methods of sowing *viz.* broadcasting and transplanting. Area under broadcasting and transplanting was 180200 ha and 2962 ha respectively. State agriculture department have been imparted various front line demonstrations on SRI (System of Rice Intensification) in six blocks *Bhatapara*, *Baloda Bazaar, Palari, Bilaigarh, Simga* and *Kasdol* from 2012 to 2016. The impact assessments were calculated through pre tested interview schedule with the beneficiaries. Assessment revealed that the adoption of SRI technology was 4.22 % and rest of the beneficiaries could not adopt the same because lack of resources and technical knowledge. Though the training and some input were given to the beneficiaries but they could not continue for further crop season because beneficiaries land was not leveled and they could not grow the nursery as per required. 14.6% beneficiaries were successfully adopted the technology by following the principles of SRI. Average productivity of SRI was higher 62q/ha than conventional transplanting method 40 quintal/ha. Late duration varieties possesses high yield as compare with the early varieties.

PREDICTION OF TALL CROP REFERENCE EVAPOTRANSPIRATION (ETR) AND TREND ANALYSIS FOR BHILWARA STATION, INDIA

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Abstract

Evapotranspiration is simply a component of an energy budget of activities occurring at the crop surface. For effective management of water resource, better crop production, environmental assessment requires knowledge of evapotranspiration. Evapotranspiration, which includes evaporation of water from land and water surface and transpiration by vegetation continuous to be foremost important in water resource planning and management. In the present study the prediction of tall crop reference evapotranspiration (ETr) from meteorological parameters of Bhilwara station was done by FAO Penman-Monteith method (Allen *et al.,* 2005, ASCE 2008) standardized for tall crop i.e. reference crop, Alfa-Alfa. The tall crop reference evapotranspiration was computed by assuming a hypothetical reference crop with an assumed crop height of 0.50 m, a fixed surface resistance of 45 s m^{-1} and albedo of 0.3 for 20 years period (1991-2010). The analysis showed that the daily tall crop reference evapotranspiration was ranged from 3.75 mm/day to 5.89 mm/day with mean of 4.96 mm/day. The annual tall crop reference evapotranspiration was also estimated and found that it was maximum of 2148.72 mm during year 2010 and minimum of 1367.52 mm during year 1994. The lowest tall crop reference evapotranspiration observed during year 1994 due to lowest wind speed (1.30 m/s). Also, Trend analysis was done by Linear regression analysis, Mann-Kendall and Sen Slop Estimator. The linear regression analysis was carried out for tall crop reference evapotranspiration showed that the trend was increasing during annual (m = 0.0691), winter (m = 0.0678), pre monsoon (m = 0.1485), post monsoon (m = 0.0895), Rabi (m = 0.0736) and zaid (m = 0.1461) respectively. For assured the trend, Mann-Kendall test was carried out and trend was increasing found at 95 % level of significance. The evapotranspiration rate was more due to decreasing mean relative humidity (z = ± 1.96). The magnitude of trend was ranged from 0.0678 mm/year (winter season) to 0.170 mm/year (zaid season).

VARIATIONS IN BIOCHEMICAL CHARACTERS IN SOME IMPORTANCE VARIETIES OF MULBERRY

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Abstract

Mulberry (*Morus* spp.) is an cross pollinated plant with about 60 known species and numerous varieties. It' sprimarily being exploited for rearing of silkworm. Leaf variability is used to develop varieties with superior production traits. In the present study six mulberry varieties have been catalogued for the biochemical characters. The characters studied include Biomass, moisture content, and chlorophyll. Total carbohydrates, crude proteins and ash content. All of the characters differed significantly in between the varieties. On the basis of these biochemical characters varieties can be recommended for their suitability for rearing silkworm.

SUCCESSION OF MAJOR INSECT PESTS OF CABBAGE (*BRASSICA OLERACEA* L. VAR. *CAPITATA*)

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Abstract

The present investigation was carried out during *Rabi* season of 2017-2018 at the Horticulture complex, Maharajpur, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, and Jabalpur (M.P.). Studies on insect pest succession and field incidence revealed that 8 species of insects (7 pests and 1 natural enemy) and 1 species of non insect predatory spider were observed to be associated with various stages of the cabbage crop (after germination).The seasonal incidence and sequence of appearance of major insect pest species damaging cabbage under Jabalpur area showed that the order of seasonal appearance

was Painted bug, *Bargrada cruciferarum* (Hemiptera: Pentatomidae), Tobacco caterpillar, *Spodoptera litura* Fab. (Lepidoptera: Noctuidae), Gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae), Flea beetle, *Phyllotreta cruciferae* (Coleoptera: Chrysomelidae), Aphid, *Lipaphis erysimi* kalt. (Hemiptera: Aphididae), Diamond back moth, *Plutella xylostella* (Lepidoptera, Plutellidae) and cabbage Head borer, *Hellula undalis* (Lepidoptera: Crambidae) and two natural enemies Spider (Unidentified) and Lady bird beetle, *Coccinella septumpunctata* were also found. The first major group of insects to attack in early stage of the crop was was *B. cruciferarum S. litura, H. armigera and P.cruciferae*. The second major group of insect pest to attack in the Head formation stage was *L. erysimi, P. xylostella and Hellila undalis.*

PHYSIOLOGICAL TRAITS IN RELATION TO ZINC MANAGEMENT CHICKPEA VARIETIES UNDER RAINFED CONDITION

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Abstract

A study on Chickpea with three levels of Zinc viz. 0, 2.5, 5.0 and 7.5 kg Zn per ha applied as soil application and three Chickpea varieties viz. KGD 1168, KWR 108, K 850 and KPG 59 during rabi seasons of the 2015-16 under rainfed condition at department of Crop Physiology, C.S. Azad University of Agriculture and Technology, Kanpur. Results showed that at 50 % flowering leaf area/plant (cm^2) relative water content (RWC) % and chlorophyll content (mg/g of fresh weight) were maximum as compared to 50 % pod development stage. All the verities significantly improved their leaf area/plant (cm^2), RWC% and chlorophyll content (mg/g of fresh weight) in leaf with increase in concentration of Zn @ 5.0 kg/ha. At all the stages of plant growth, variety KGD 1168 and application of Zn @ 5.0 kg/ha was found more effective with excellent metabolism and enhanced regard to excellent growth, productivity production of Chickpea.

STUDIES ON MORPHOLOGICAL AND BIOCHEMICAL CHARACTERIZATION OF CUCUMBER (*CUCUMIS SATIVUS* L.) GERMPLASM

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Abstract

The present investigation was conduct during July-October, 2014 and February-June, 2015, at Vegetable Research Center and NAIP laboratory, Department of Vegetable Science in G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The field experiment was laid out in Randomized Block Design having with forty six genotypes along with two checks with 3 meters X 60 cm spacing. Observations were recorded on total 7 growth and 8 yield characters. Data were analyzed statistically for their mean, range, character association, path coefficient analysis, diversity analysis through principal component analysis, non-hierarchical euclidean analysis and protein profiling through SDS-PAGE. The results revealed significant differences among the genotypes observed for most of characters except number of fruits per plant, fruit weight, fruit length and fruit diameter. Genotypes, namely, PCPGR-7207, PCPGR-7027, PCPGR-4343, PCPGR-748, PCPGR-264, PCPGR-7557 and PCPGR-7176 recorded for maximum yield. Phenotypic coefficient of variation was higher than that of genotypic coefficient of variation for the characters. Heritability in broad sense was found maximum for fruit weight (88.85) and minimum for primary branches per plant (25.31). Pooled analysis of two season data revealed that Fruit length (52.15) had maximum genetic advance as percentage of mean. Yield quintal per hectare exhibited highly significant and positive phenotypic correlation withnumber of fruits per plant (0.860**) and fruit weight (0.517**). Path analysis revealed that number of fruits per plant (0.837) followed by fruit weight (0.491), test weight (0.013). So these are the important characters which showed be preferred while making selection for improvement of yield. Approximately 83.339 and 83.332 per cent of variation was recorded due to first five principle components on various genotypes in first season and second season respectively. The first four principle components recorded a per cent variation of 66.617 among various genotypes in pooled analysis. Protein profiling of genotypes resolved all forty six indigenous germplasm lines into different groups on the basis of presence and absence of fifteen protein bands distributed into A, B and C zone respectively.

ROLE OF BIOCHAR IN SOIL HEALTH

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Abstract

Biochar is charcoal used as a soil amendment. Biochar is a stable solid, rich in carbon, and can endure in soil for thousands of years. It can increase soil aeration and reduce soil emissions of N_2O, a greenhouse gas. In current years, biochar has been shown as one promising mean of reducing the atmospheric CO_2 concentration because biochar slows the rate at which photo synthetically fixed carbon (C) is returned to the atmosphere. In addition biochar can improve agricultural productivity, particularly in low-fertility and degraded soils, where it can be especially useful to the world's poorest farmers. It reduces the losses of nutrients and agricultural chemicals in run-off, it can improve the water holding capacity of soils and it is producible from biomass waste. Biochar can influence CO_2 emission by affecting on the quality and quantity of residue returned to the soil, Increased above and below ground biomass production can increase the amount of residue returned to the soil, thereby increasing CO_2 flux. The CO_2 emission from the soil to the atmosphere is the primary mechanism of C loss from the soil. Soil carbon plays a role in regulating climate, water supplies and biodiversity, and provides the ecosystem services that are essential to human well-being. On the other hand, maintenance of a threshold level of organic matter in the soil is crucial for maintaining physical, chemical and biological integrity of the soil and also for the soil to perform its agricultural production and environmental functions. Hence, conversion of organic waste to produce biochar using the pyrolysis process is one viable option that can enhance natural rates of carbon sequestration in the soil, reduce farm waste and improve the soil quality.

ESTIMATION OF VARIABILITY PARAMETERS FOR QUANTITATIVE CHARACTERS IN BOTTLE GOURD [*LAGENARIA SICERARIA* (MOL.) STANDL.]

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Abstract

An experiment was conducted to evaluate 50 genotypes of bottle gourd for genetic variability, heritability and genetic advance. Analysis of variance revealed that mean squares due to genotypes were highly significant for all the characters. The high values of GCV and PCV were recorded for number of fruits per vine followed by number of primary branches per vine, vine length and ratio of male to female flowers. This indicated the presence of wide genetic variation for these characters. The high heritability (broad sense) values were observed for number of fruits per vine followed by vine length, number of primary branches per vine, fruit yield per vine, ratio of male to female flowers, average fruit weight, number of male flowers, fruit length, days to opening first male flowers, days to first picking, number of female flowers and internodal length, indicated that heritability may be due to higher contribution of genotypic component in these traits. The genetic advance expressed as percentage of mean were found high for number of fruits per vine followed by number of primary branches per vine, vine length, ratio of male to female flowers, average fruit weight, fruit yield per vine, internodal length and fruit length. Moderate to high estimates of heritability coupled with high genetic advance expressed as percentage of mean were observed for number of fruits per vine followed by number of primary branches per vine, vine length, ratio of male to female flowers, average fruit weight, fruit yield per vine, internodal length and fruit length, which may be attributed to the preponderance of additive gene action and possessed high selective value and thus, selection pressure could profitably be applied on these characters for their rationale improvement.

CHANGES IN PHYSICAL PARAMETERS OF CASHEW (*ANACARDIUM OCCIDENTALE* L.) APPLES DURING STORAGE

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Abstract

An experiment entitled "Changes in physical parameters of Cashew (*Anacardiumoccidentale* L.) Apples during storage" was

conducted in Factorial completely randomized design (FCRD) with five treatments of different cashew apple varieties*viz* ., T_1-Vengurla-1, T_2-Vengurla-4, T_3-Vengurla-6, T_4- Vengurla-7, T_5-Vengurla-8 and two storage conditions, *viz*., ambient temperature (S_1) and cold storage (S_2). Among different interactions, T_1S_2 recorded minimum increase in PLW (6.15%) and it was at par with three parameters (volume, specific gravity and spoilage). Minimum increase in spoilage (13.00%) was recorded by the interaction T_2S_2 (Vengurla-4 at cold storage) and it was at par with two parameters (volume and PLW). Interaction T_5S_2 (Vengurla-8 at cold storage) recorded minimum decrease in weight (3.87%), volume (4.08%) and minimum increase in specific gravity (0.00%) and it was at par withtwo parameters (PLW and spoilage). Hence, among the different interactions under study, interaction T_5S_2, T_1S_2 and T_2S_2 were found to be equally good with respect to physical parameters.

VALUE ADDITION IN FLORICULTURE

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Abstract

Value added Floriculture is a process of increasing the economic value and consumer appeal of a floricultural commodity. Floriculture is presently considered as the most lucrative agro-enterprise in terms of profit making. While increased productivity is an essential component of the vibrant agricultural sector, improved post harvest handling and processing is essential to insure high quality products reach the markets. 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 utilisation of fresh ornamentals in either garden-fresh or processed form. Value-addition addition ensures ensures high premium premium to the grower while providing more accept bl a e quality quality products products for the domestic domestic and export market. The value-addition for mark ti e ng flowers includes includes adoption adoption of post-harvest harvest technology technology and improved improved logistics logistics. Different kinds of value-added products are in market which include essential oils, flavours, fragrance, pharmaceutical and nutraceutical compounds, insecticidal and nematicidal compounds, pigments and natural dye, vanilla-based products, gulkand, rose water, etc. Besides floristry items, flower arrangements and floral ornaments are important value addition with the fresh flowers and other ornamentals. Another important arena is the production of dry/dehydrated flowers in which India has achieved a considerable success regarding in-house production and worldwide marketing.

TRAINING NEED ASSESSMENT OF TRIBAL FARMERS FOR APPLE CULTIVATION

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Abstract

Kinnaur is a predominated tribal district of Himachal Pradesh, which is well known for apple production. Despite tremendous increase in the area and production of apple during the last three decades or so, the productivity as compared to other developed nations was found to be less. Lack of need based and training on scientific productivity of apple might be one of the main reasons for this low productivity. Keeping in view, the study was conducted on a random sample of 100 apple growers selected from five villages of Pooh Block of District Kinnaur, in order to assess their training need so that an appropriate training module can be prepared to enhance their income. The study revealed that the respondents lacked knowledge in weed control(43%), insect-pest control (22 to 36%), fruit dropping (35%), fruit setting (55%) and early ripening of apple (53%). The overall knowledge was found to be medium. The respondents needed training on Post-harvest Technology, control of fruit dropping, fruit settings, weed control, application of irrigation and marketing of apple. Unprecedented weather conditions, road blockage particularly at the time of marketing, lack of storage and transportation facilities, lack of marketing knowledge and technical guidance etc. were perceived to be the main constraints/ problems faced by them. Hence, the study implies that by providing need based practical training on the above aspects at a convenient place particularly in the off-season, the productivity of apple and hence, the income of the apple growers can be enhanced.

IMPROVING FARMERS' SOCIO-ECONOMIC STATUS THROUGH RECENT EXTENSION APPROACH

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Abstract

Despite concerted efforts by the extension system, still a wide gap exists between the technology generated at the research station and its adoption by the farmers. In order to reach the farmers particularly small and marginal which constitute a large chunk of farming community, an extension workers needs to update his/her knowledge about the improved/ modern extension methods so that the same can be properly utilized in the task of transfer of farm technology. Most of our farmers have limited and fragmented land holding. How to enhance production and income from this limited land holding is a challenging question before our scientists. Diversification of agriculture and generating additional income from the allied enterprises like, floriculture,sericulture,poultry apiculture, dairy, piggery, fishery, sheep & goat rearing, mushroom cultivation, horticulture, agro-forestry etc. is the only solution for doubling the income of farmers-a cherished dream of our Prime Minister. But, the farmers need scientific information/ technical guidance with motivation to initiate these enterprises which can be possible only through well planned extension approach. Today's farmer is just like an entrepreneur who needs recent information on various aspects of agriculture and allied fields. In the present era of globalization, the farmers will have to transform themselves from mere producers in domestic markets to sellers/exporters in the global markets with focus on high productivity, high quality produce and low cost of production. The revolution in information and communication technology has made this task very easy and hence, the technical information can now be provided quickly by the extension workers in a cost effective manner even without visiting the farmers personally. Various cost effective and extension methods like Expert System, E-mail, Internet Browsing, Audio-Video Conferencing, Kisan Call Centres, Agri-clinics, Agri-business centres, Community Radio, SATCOM Networks etc. have been discussed along with a **conceptual model** which may act as a catalyst for motivating the farming community to adopt these enterprises to improve their socio-economic status.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON QUALITY AND YIELD PARAMETERS OF GUAVA (*PSIDIUM GUAJAVA* L.) CV.1-49

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Abstract

An investigation entitled "Effect of Integrated Nutrient Management on quality and yield parameters of Guava (*Psidium guajava* L.) cv. L-49" was carried out at the Instructional cum research fruit orchard, College of Horticulture, Mandsaur, during 2015-16.The present result revealed that the application of 100% NPK+5 kg vermicompost + 150 gm Azatobactor (T_6) recorded minimum acidity (0.23%) and maximum TSS (12.67^{o}Brix), TSS/acid ratio(56.39), ascorbic acid (206.07mg/100g pulp),pectin (0.75%),total sugars (8.21%),reducing sugars(4.15%) and non reducing sugars (4.06%). Where as, the maximum number of fruits per tree (286.91),fruit weight (209.88g) and yield per tree (60.20 kg) were recorded with the application of 100% NPK + 5 kg vermicompost +150 gm VAM (T_8)

INTEGRATED NUTRIENT MANAGEMENT IN COTTON *(GOSSYPIUM HIRSUTUM* L.*)*

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Abstract

Soil works for you if you work for the soil by using management practices that improve soil health and increase productivity and profitability immediately and into the future. Keeping this view, an experiment was conducted during *kharif* season of 2016-2017 to study the effect of integrated nutrient management on soil fertility, soil enzymes activity, and their influence on yield, nutrient uptake and quality of cotton cropat research farm of CCS HAU, Hisar-(Haryana). The experiment was conducted in randomized block design with ten treatments replicated thrice. The treatments include, T_1 (Control), T_2 (50%

RDNF through inorganic fertilizer + 50% RDNF through vermicompost), T_3 (75% RDNF through inorganic fertilizer + 25% RDNF through vermicompost), T_4 (100% RDNF through vermicompost), T_5 (100% RDNF through inorganic fertilizer), T_6 (50% RDNF through inorganic fertilizer + 50% RDNF through poultry manure), T_7 (75% RDNF through inorganic fertilizer + 25% RDNF through poultry manure), T_8 (100% RDNF through poultry manure), T_9 (50% RDNF through vermicompost + 50% RDNF through poultry manure) and T_{10} (50% RDNF through inorganic fertilizer + 25% RDNF through vermicompost + 25% RDNF through poultry manure). Among the different treatment combinations, highest seed cotton yield (1,459 kg ha^{-1}) was recorded at T_3 (75% RDNF + 25% VC) followed by T_7 (75% RDNF + 25% PM) and T5 (100% RDNF). It can be concluded that thecombined use of 75%RDNF+25%ofN throughVCor PM is the best for Obtaining highest yield apart from maintaining soil biological activity and soil fertility for longer period.

CLIMATE CHANGE IMPACT OF PRODUCTION AND REPRODUCTION OF GANGATIRI COW

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Abstract

Gangatiri is one of the important dual purpose breed of North India. Coat color of Gangatiri cow is dull white. Muzzle is black, Hump and dewlap are medium. It is known to be originated in the region along the banks of Ganga River in Eastern Uttar Pradesh and Western parts of Bihar state. Gangatiri breed has been recognized as a separate breed by NBAGR-ICAR (Accession no. 03039). The upper critical temperature is the point at which heat stress effects begin to affect production and reproduction performance the cow. There are a number of environmental factors that contribute to heat stress. These include high temperature, high humidity and high sunlight. Milk production–There is normally a decrease in milk production for cows under heat stress. This decrease can be either transitory or longer term depending on the length and severity of heat stress. These decreases in milk production can range from 10 to 25 percent in the summer season. Reproduction–Heat stress has also been reported to decrease reproductive performance in cows. The effects on reproduction can be prolonged and impact the cow for months after the heat stress exposure. These effects are decreases the length and intensity of the estrus period ,conception (fertility) rate, growth, size ,development of ovarian follicles, fetal growth and calf size ,Increased risk of early embryonic deaths,.

FOLIAR APPLICATION OF SALICYLIC ACID ON GROWTH AND YIELD OF BLACK GRAM UNDER RAIN FED CONDATION

Deepak Kumar Rawat, M.A. Khan, Amit Kumar and C.B. Verma
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Abstract

The experiment was conducted in the department of Crop Physiology C S Azad University of Agriculture & Technology. Kanpur in field during kharif 2017 adopted Randomized Block Design with 3 treatment and Azad 3 variety including control and each treatment were replicated three (3) times. The treatment comprised of control, three level of salicylic acid i.e. 50 ppm, 100 ppm and 150 ppm at the time of 20 DAS, 40 DAS and 60 DAS which was given through foliar application. Maximum increase growth of plant height at 70 DAS (36.5 cm), number of leaves per plant (23.66), number of branches (8.66) per plant was recorded under the treatment of salicylic acid @ 150 ppm through foliar application at the time of 60 DAS followed by 100 ppm through foliar application at the time of 60 DAS and 50 ppm through foliar application at the time of 60 DAS of salicylic acid over control.

FOLIAR APPLICATION OF THIOUREA AND POTASSIUM NITRATE ON YIELD AND YIELD ATTRIBUTES IN SESAME (*SESAME INDICUM* L.) UNDER MOISTURE STRESS ENVIRONMENT

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Abstract

An experiment was conducted behind the wire net house of Department of Crop Physiology, C.S. Azad University of

Agriculture and Technology, Kanpur. To study the response on Sesame of thiourea and Potassium nitrate along with foliar application at two spray (55 DAS and 70 DAS) during Kharif season 2015. Crop under foliar application of thiourea and KNO_3 attained maximum growth, and total dry matter production per plant in treatment 1.0% Potassium nitrate foliar application at 50% flowering and 50% capsule formation ($T_{7)}$ (46.95 g) at 80 das and yield attributes number of capsules per plant (60.66), number of seed per capsule (50.66) test weight of (1000 seeds) in (3.32 g), seed yield (7.76 Q/ha) and biological yield per plant (55.44 g) as well as over control among the application of thiourea 0.05% and KNO_3 1% along both recorded maximum improvement to control but the KNO_3 is recorded maximum improvement in all these parameters followed by thiourea.

DUS CHARACTERIZATION OF RICE FARMERS' VARIETIES UNDER PPV&FRA IN CHHATTISGARH

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Abstract

In order to validate the distinctive of rice (*Oryza sativa* L.) varieties. For the establishment of the distinctness among One hundred thirty six farmers' varieties of rice, Characterization of 136 landraces/farmers' varieties of rice was done using fifty five agro-morphological traits following Distinctiveness, Uniformity and Stability test (DUS) during *kharif* season of 2014 at the IGKV instructional cum research farm. Out of one thirty six varieties studied, sixty six FVs were found to be distinctive on the basis of fifty five essential characters. Out of 66 Jengene and Tichun Dhan were found very early FVs under testing. "Gangtai" and "Matari Pochi" were found light green for colour of stigma. This study will be useful for breeders, researchers and farmers to identify and choose the restoration and conservation of beneficial genes for crop improvement and also to seek protection under Protection of Plant Varieties and Farmer's Rights Act.

BIODEGRADATION OF PESTICIDES : NECESSARY FORSUSTAINABLE ENVIRONMENT

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Abstract

Pesticides are substances or mixtures of substances intended to prevent, destroy or control any Pest and they are widely used mainly in agriculture, industry and the domestic sector. These compounds have been extensively used for decades and have significantly increased food Production. However, a large amount of applied pesticides often never reach their intended target due to their degradation, volatilization and leaching, resulting in serious environmental problems. As an efficient, economical and environmentally friendly technique, biodegradation has emerged as a potential alternative to the conventional techniques. In the recent years, bioremediation technology has progressed for the degradation of a wide range of pollutant compounds. Different microorganisms have been used to bio transform pesticides. A fraction of the soil biota cans quicklydevelop the ability to degrade certain pesticides, when they are continuously applied to the soil. Ingeneral, microorganisms that have been identified as pesticide degraders have been isolated froma wide variety of sites contaminated with some type of pesticide, e.g. Aspergillus fumigatus, A.niger, A. Terreus, Pseudomonas sp etc. At present, in different laboratories around the world thereare collections of microorganisms characterized by their identification, growth and degradation ofpesticides.Therefore, it is important that efforts are made for the disposal of waste and for the remediation ofcontaminated sites. Biodegradation of pesticides with specific microorganisms is economic andenvironmental and socially acceptable. By understanding the mechanisms for degradation, it ispossible to develop technologies to increase the efficiency of degradation, such as theimmobilization of cells in different support systems and the construction and use of bio beds forwaste degradation in situ.

BT CROPS : PAST AND FUTURE

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Abstract

Bt crops are named for *Bacillus thuringiensis* (Bt) bacteria that naturally produces a crystal protein that is toxic to many insect pests. *Bt* crops are crops that are genetically engineered to produce the same toxin as *Bt* in every cell of the plant. The development and commercialization of transgenic plants expressing insecticidal toxin genes from the bacterium *Bacillus thuringiensis* (Bt) has revolutionized agriculture in past two decades rather than it was a controversial issue.The main advantage of utilising biotechnology in agriculture are the possibilities of increase in productivity through the use of newer varieties that possess properties such as resistance to pests ,disease and others stressful conditions like drought,salinity or water logging.It is considered one of the most advanced application of biotechnology. *Bt* cotton (MON531, MON5981-BOLLGARD 1&2, COT102, COT67B, mhb-4Bt, mhb69Bt, mhb80Bt & mhb99Bt) provide excellent resistance from caterpillar pest in India such as American bollworm, spotted bollworm, the spiny bollworm and the pink bollworm. *Bt* brinjal, mustard and potato awaiting permission in India.*Bt* cotton is the only other genetically modified crops permitted in the country.

THE USAGE OF IT TO TRANSFER INFORMATION AND KNOWLEDGE IN THE ANIMAL HEALTH

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Abstract

The information technology played an important role in information and knowledge circulation in the last 10-15 years. The usage of IT to transfer information and knowledge in the animal health care domain using expert systems is one of the areas enquired by many institutions. The present era is witnessing a vast progress in all fields of animal health care. Therefore there is a need for an unconventional method to transfer the knowledge of experts in this domain to the general public of livestock holders, especially that the number of experts in new technologies is lesser than their requirement in a certain domain. The transfer of knowledge from veterinary guide & scientists to livestock holders represents a hold-up for the progress of animal health care in any country. Expert systems are simply computer software programs that mimic the department of human experts. They are one of the successful approach of the artificial judgement field, a branch in Computer Science that enquired how to make the machine think like human or do tasks that humans do. Expert Systems are very helpful to ensure a successful and nationally coordinated approach in response to emergency incidents and in routine bio-security activities. Such systems enable better executives of the information and facility used to manage animal's diseases and emergency responses to invasion.

PROSPECTUS OF VALUE ADDITION OF CITRUS PEEL

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Abstract

Citrus plants belonging to the family Rutaceae include fruits such as orange, mandarin, lime, lemon, sour orange and grape fruit, appear as a well known promising source of multiple beneficial nutrients for human beings.These fruits are highly consumed worldwide as fresh produce, juice and most often the peel is discarded as waste which contains a wide variety of secondary components with substantial antioxidant activity in comparison with other parts of the fruit. Citrus-processing industries generate huge amounts of wastes every year and citrus peel waste alone accounts for almost 50% of the wet fruit mass. Currently this residue is mainly used as food for animals as of its nutritional capacity. If enough agricultural land is available close to the processing industries, the use of citrus peel waste as organic soil conditioner or as substrate for compost

production is also possible, thus improving the organic matter content of the soil and will help in boosting the economy of this industry as well as of its high economic value. Processing of citrus by-products potentially represents a rich source of phenolic compounds, dietary fibre, essential oils, and ascorbic acid, as well as considerable amounts of some trace elements, owing to the large amount of peel produced. These citrus fruit residues, which are generally discarded as waste in the environment, can act as potential nutraceutical resources.Due to their low cost and easy availability such wastes are capable of offering significant low-cost nutritional dietary supplements. The utilization of these bioactive rich citrus residues can provide an efficient, inexpensive, and environment friendly platform for the production of novel nutraceuticals or for the improvement of older ones. A number of commercially important high value-added compounds can be potentially extracted from citrus peel waste to be used mainly in food, pharmaceutical and cosmetic industries and even directly sold for domestic usage. However, to date, the most common process with industrial importance is EO/limonene extraction.

PANCHAGAVYA : COWPATHY TREATMENT FOR CROPS

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Abstract

One of the main reasons for the low yields and poor soil health is the imbalanced and non-judicious use of chemical fertilizers. It is therefore, important from farmer's point of view to reduce the excess use of chemical fertilizers and substitute it with the efficient and nutrient rich organic fertilizers. Organic farming is a holistic approach towards achieving sustainable agriculture as it is nature based and environment friendly. 'Panchagavya' which is an organic formulation can be a better substitute for chemical fertilizers because of its high nutrient contents. Panchagavya is a group of derivatives of elements obtained from cows i.e. cow urine, cow dung (gomaye), cow milk, cow curd (godadhi) and cow ghee (goghrta). The key feature of panchagavya is its efficacy to restore the yield level of all crops when the land is converted from inorganic culture system to organic culture from the very first year. By replacing costly chemical inputs, panchagavya ensures higher profit. Panchagavya promote growth, increases quality of yield and provide immunity in plant system. One of the major advantages of panchagavya is ease of its preparation. There is no need for technical knowledge to prepare and use it. From the study, it can be concluded that the nutritional ingredients present in panchagavya help to increase the growth and ultimately improves the productivity of the crops.

SOIL HEALTH MANAGEMENT AND PRACTICES : KEY FACTOR FOR CROP PRODUCTIVITY

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Abstract

Interest in the quality and health of soil has been stimulated by recent awareness that soil is vital to both production of food and global ecosystem functions.Soil health is the capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health. Soil management is fundamental to all agricultural systems, yet there is evidence for widespread degradation of agricultural soils in the form of erosion, loss of organic matter, contamination, compaction, increased salinity and other harms. The integrated nature and high diversity of the soil health system may contribute a significant degree of resilience under conditions of disturbance, particularly at lower trophic levels. Soil health is presented as an integrative property that reflects the capacity of soil to respond to agricultural intervention, so that it continues to support both the agricultural production and the provision of other ecosystem services. The major challenge within sustainable soil management is to conserve ecosystem service delivery while optimizing agricultural yields. The agricultural practices, enforced by necessity, may contribute to improved soil health and sustainable practice but are generally insufficient in terms of production. Wherever inputs are affordable, they must clearly be used to enhance production, but the risk to other ecosystem services and soil health can be minimized by maintaining the integrated nature of their farming systems.

EVALUATION OF LENTIL GENOTYPES AGAINST *ETIELLA ZINCKENELLA*

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Abstract

Lentil (*Lens culinaris* Medikus), locally known as Masoor, is an important rabi season pulse crop. The average productivity of lentil is lower in India. Abiotic and biotic stresses are the major constraints in its production. Among the biotic constraints, insect pests play a major role in its yield reduction.The major insects pest attacking lentil in India are aphid, *Aphis craccivora* (Koch), pea pod borer, *Etiella zinckenella* (Treitschke) and gram pod borer, *Helicoverpa armigera* (Hubner). Among the above pests, E. zinckenella is a polyphagous pest attackingmany cultivated crops. E. zinckenella infests lentil at flowering and pod formation stages and is considered as main reason of low productivity, besides reduction in yield and quality of the grains is also affected. Keeping this in view 20 genotypes (LL 1136, JL 3, DPL 62, IPL 315, IPL 81, IPL 406, RKL 45-10, PRECOZ, RKL 608-1, FLIPILL 6089, RKL 1-32, RKL 1003-33D, L 4096, IL 2010-75L, RKL 23C-274, Sapna, Garima, HM-1, LH 07-26 , PL 105) were evaluated against *E. zinckenella rabi* 2015-16 in CCS HAU, Hisar. The experiment was designed under Randomized Block Design (RBD) with thrice replications. Screening at maturity stage indicated that 7 genotypes *viz*., LL 1136, IPL 315, RKL 608-1, FLIPILL 6089, RKL 1-32, RKL 1003-33D, L 4096 were characterized as least susceptible, 9 genotypes *viz*., DPL 62, PRECOZ, IL 2010-75L, RKL 23C-274, Sapna, Garima, LH 07-26, HM-1, IPL81 were characterized as moderately susceptible and genotypes *viz*., JL 3, IPL 406, PL 105, RKL 45-10 were characterized as highly susceptible.

USE OF DISTILLERY SPENTWASH R O REJECT AS SOURCE OF NUTRIENTS IN AGRICULTURE TO IMPROVE SOIL HEALTH AND PRODUCTIVITY

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Abstract

Maintaining sustainability in crop production is becoming difficult day by day because of lack proper application of nutrients to soil and due to intensive cultivation nutrient removal also increased. There is a wide gap between nutrient removed and applied due to insufficient fertilizer supply and lack of sufficient organic manures. Because of these things soils are becoming less fertile leading low productivity. Now it is essential to look for other nutrient sources to maintain good soil health. Agro-based industries on the other-hand are producing lot by-products which are rich in nutrients which can be utilised in agriculture. Among different by-products distillery spentwash (DSW) R O reject is one such thing which by-product of sugar industry and is rich in nutrients especially nitrogen and potassium. DSW R O reject is concentrated liquid compared to normal distillery spentwash. So we conducted an experiment to see the effect of this DSW R O reject as nitrogen source on soil fertility in maize crop. The preliminary analysis of DSW R O reject revealed that it contained appreciable amounts of nitrogen (1800 mg L^{-1}), phosphorus (450 mg L^{-1}) and potassium (11887 mg L^{-1}) and also secondary and micronutrients in appreciable amounts. Among the different treatments, the application of 150% N through DSW R O reject recorded significantly higher soil available nutrients compared to other treatments. Soil properties like pH (6.71), EC (0.55 dSm^{-1}), OC (0.83%), available N (283.7 kg ha^{-1}), P_2O_5 (24.1 kg ha^{-1}), K_2O (1213.5 kg ha^{-1}), secondary and micronutrients recorded were higher in treatment with application of 150% N through DSW R O reject, this was followed by treatment receiving 125% N through DSW R O reject and lower values were recorded in treatment receiving RDF only. The soil enzymatic properties like dehydrogenase (14.8 µg TPF g^{-1} of soil hr^{-1}), phosphatase (30.5 µg P-NPP g^{-1} of dry soil hr^{-1}) and urease (65.5 µg NH4-N g^{-1} dry soil hr^{-1}) were recorded significantly higher in the treatment receiving 150% N through DSW R.O. reject. Significantly lower activities of these enzymes (dehydrogenase: 3.7 µg TPF g^{-1} of soil hr^{-1}; phosphatase: 14.5 µg P-NPP g^{-1} of dry soil hr^{-1}; and urease: 35.8 µg NH4-N g^{-1} dry soil hr^{-1}) were recorded in treatment receiving RDF only.

STCR DOSE OF SOLUBLE FERTILIZERS ENHANCES THE NUTRIENT UPTAKE, YIELD AND SOIL PROPERTIES IN HYBRID MAIZE

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Abstract

A field experiment was conducted during *Kharif*2014 at Zonal Agricultural Research Station, University of Agricultural Sciences, Bengaluru to study the influence of different approaches and different forms of fertilizers on nutrient uptake, yield and soil properties in hybrid maize.The experiment was laid out in randomized block design comprisingof ten treatments replicated thrice. The results revealed that significantly higher total uptake of major nutrients by maize crop was recorded in 100 per cent soil test crop response (STCR) dose applied through soluble fertilizer (SF) with three splits and three sprays. Similarly, higher grain(98.22 q ha^{-1}) and stover (130.96 q ha^{-1}) yield was recorded in 100 per centSTCR dose applied through SF at three splits and three sprays of 19: 19: 19 @ 1% concentrationcompared to recommended dose of fertilizer (RDF) through conventional fertilizer (CF). Similar results were recorded higher in post-harvest nutrient status of soil major nutrients. The present study evidently concluded that soluble fertilizer application based on STCR targeted yield approach with three splits at basal, 30 and 50 DAS along with three sprays of 19:19:19 at 20, 40 and 60 DAS was helpful for getting higher nutrient uptake and higher post-harvest nutrient status of soil by maize crop, This increased higher nutrient uptake and higher post-harvest nutrient status of soil might be due to its easy solubility and uniform distribution of nutrients in root zone leading to availability of sufficient available nutrients for uptake by the crop through soluble fertilizers. Split application of soluble fertilizers for three times along with three sprays of 19:19:19 at three stages helps in better translocation and uptake of these nutrients without fixation or any leaching losses.

PROCESSED PRODUCTS OF TAMARIND

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Abstract

Tamarind (*Tamarindusindica*) is one of the important dry land Horticulture crops, native to Tropical Africa and more widely grown in Odhisa, Bihar, Maharashtra, TamilNadu, AndraPrasdesh, Karnataka. Tamarind comprises two parts namely pulp and seeds, tamarind fruit rich in several nutrients. It can act as source of complete nutrition to the consumers; the fruit is equivalent to citrus fruit. The fruit is best described as sweet and sour in taste, and is high in tartaric acid, sugar, and B vitamins. Which contain about 30 per cent, sticky, edible pulp. The acidic pulp is a common ingredient in culinary preparations such as curries, chutneys, sauces, ice cream and sherbet in countries where the tree grows naturally. Green tamarind is pickled in brine. In Asia sweetmeats or the sugared tamarind made by rolling the semi-dried pulp and seed in crystal sugar are very popular products of tamarind fruit. Tamarind fruit is full of acidity which combines well with sugar, chilli and other flavours, hence its pulp is used to prepare a variety of traditional refreshing and highly energetic drinks. Tamarind seed kernel powder (TKP) is a major industrial product, which is used in the sizing of textile, paper and jute. The seed and its extracts can be used in the food processing industry, as an adhesive in the plywood industry and in the tanning industry due to the high tannin content in the seed testa. Processing of tamarind fruit pulp and seeds in to value-added products will increases the farm income of tamarind growers through enhancing their returns by 2 to 5 times more compared to marketing of raw tamarind.

NUTRITIONAL AND MEDICINAL USES OF TAMARIND (*TAMARINDUS INDICA*)

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Abstract

Tamarind (*Tamarindusindica*) fruit used to grow in the hot regions of Africa. The sweet tamarind fruit grows atop extremely tall trees of the ‘fabaceae family. The cultivation of tamarind has now spread to most of the warmer, drier regions of Mexico and Asia, including India and Sri Lanka. It has a tart-sweet taste that is loved by Indian nationals worldwide. No wonder it has

carved a special place for itself in the Indian kitchens in the form of chutneys, digestive candies, pickles, and more. Tamarind is an ace nutrition-wise. Every 100 grams of this tart fruit contains 28 milligrams sodium and 628 milligrams of potassium in addition to 36% of the thiamine, 23% of the magnesium, 35% of the iron, and 16% of the phosphorus of the recommended daily requirement of a healthy woman. Additionally, this amazing fruit also contains niacin, vitamin C, calcium, copper, and pyridoxine. Tamarinds also have very high levels of tartaric acid (thus the tart taste), a powerful antioxidant that can help scavenge harmful free radicals from the system. The other phytochemicals present in tamarind include limonene, geraniol, safrole, cinnamic acid, pyrazine, methyl salicylate, and alkyl thiazoles. A cup of tamarind contains 6.88 grams of natural sugars. It has a calorie count of 287, 0.72 grams fat, and 3.36 grams protein. This fruit also contains 6.1 grams of fiber per 100 grams, which helps promote digestive health. Let's take a look at the skin, hair, and health benefits of tamarind fruit.

HEALTH BENEFIT OF ASHWAGANDHA (*WITHANIASOMNIFERA*)

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Abstract

Ashwagandha (*Withaniasomnifera*), also known as Indian ginseng, and as Indian Winter Cherry is an important ancient plant, the roots of which have been employed in Indian traditional systems of medicine, Ayurveda and Unani. Ashwgandha generally cure for the number of health problems, it is a diuretic, anti-inflammatory, improve the memory power, sedative and increasing energy, ashwagandha is taken for treating coughs, diabetes, ulcers, epilepsy, Parkinson's diseases, conjucativities, nervous curing, asthama, bronchitis, emaction, importance and suppressant in AIDS patients. According to ayruveda system, ashwagandha is considered one of the most important herbs and best adaptigenic. Its contain the chemical constituents like a withenolide, glycosides, anahygrine, tropine with starches and amino acid. Withenolide consists of some of steroidal molecules which is said to fight inflammation. Stimulates the immune system, maintain the general help, combates inflammation and increases memory power and wellness. Ashwagandha is known to increase the production of bone marrow, semen and acts anti-aging. Ashwagandha anti-inflammatory and anti-tumor agents are approved in several health studies. Its steroidal is much higher than that of hydrocortisone which is a common treatment in cancer cases. It is also cure the diseases like chronic upper respiratory diseases and HIV/AIDS have been added to the list of ashwagandha due to its strong immunostimulatory activity, activity, and it is recognized as a blood tonic, especially in gynecological disorders including anemia and irregular menstruation. Patients with anxiety can also benefit from Ashwagandha.

CLIMATE SMART AGRICULTURE FOR FOOD SECURITY AND ENVIRONMENTAL STABILITY—AN OVERVIEW

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Abstract

The population of the world is increasing at a faster rate; it is expected to be 9.7 billion by 2050. To feed this growing population we need to ensure a higher food productivity and security, which is estimated to be 3 billion tonnes. Farming being dependent mainly on the climatic conditions such as rainfall, temperature, relative humidity and in developing countries the majority of the farmers are small and marginal, who cannot get benefit from their produce, when the crop fails because of the afore said variations. Due to erratic weather pattern there is a problem of water availability and conducive environment for cultivation of crops which might be the results of natural and manmade activities, hence large farmers who are well-off are shifting towards precision farming, which requires high investments and which is not possible for small and marginal farmers in developing countries like India. Food and Agriculture Organization (FAO) has introduced the concept of Climate Smart Agriculture in the background document prepared for the 2010 Hague Conference on Food Security, Agriculture and Climate Change. The objectives of the Climate Smart Agriculture are (i) Sustainably increasing agricultural productivity, so as to support equitable increases in farm incomes, food security and development, (ii) Adapting and building resilience of agricultural and food security systems to climate change at multiple levels, (iii) Reducing greenhouse gas emissions from agriculture (including crops, livestock and fisheries).Climate Smart Agriculture targets at helping the farmer in managing the

farm well taking proper measure according to the changes in the monsoon, and the measurements or the practices to be followed changes from one region to other depending on the conditions prevailing. It also improves the ecological stability and sustainability of the environment and for food security.

IMPACT OF CLIMATE CHANGE ON INDIAN FOOD SECURITY: A STUDY

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Abstract

Climate change could potentially interrupt progress towards a world without hunger. A robust and coherent global pattern is discernible of the impacts of climate change on crop productivity that could have consequences for food availability. The stability of whole food systems may be at risk under climate change. However, the potential impact is less clear at regional scales, but it is likely that climate variability and change will exacerbate food insecurity in developing countries like India. Climate change has added to the enormity of India's food security challenges. While the relationship between climate change and food security is complex, most studies focus on one dimension of food security. The food systems on which food security depends are subject to risks of various natures. These risks can impact directly the four dimensions of food security and nutrition: agricultural production, access to food, utilization, and stability. They include climatic risks themselves andmany other risks that are, in turn, influenced by climate changeand have compensative, cumulative or amplifying effects.The impacts of climate change on food security and nutrition are the results of climate changes themselves and of the underlying vulnerabilities of food systems.The first and the worst impacted are the most vulnerable populations (poor), with livelihoods vulnerable to climate change (depending on agriculture sectors), in areas vulnerable to climate change. The main problem of Indian agriculture is low productivity. To meet India's growing food demand, there is an acute need for increasing productivity in all segments of agriculture. But given the vulnerability of Indian agriculture to climate change, farm practices like water use efficiency and irrigation infrastructure needs to be upgraded to provide better climate resilience.Reducing vulnerabilities is key to reduce final impacts on food security and nutrition and also to reduce long-term effects in India.

CLIMATE SMART AGRICULTURE FOR FOOD SECURITY AND ENVIRONMENTAL STABILITY– AN OVERVIEW

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Abstract

The population of the world is increasing at a faster rate; it is expected to be 9.7 billion by 2050. To feed this growing population we need to ensure a higher food productivity and security, which is estimated to be 3 billion tonnes. Farming being dependent mainly on the climatic conditions such as rainfall, temperature, relative humidity and in developing countries the majority of the farmers are small and marginal, who cannot get benefit from their produce, when the crop fails because of the afore said variations. Due to erratic weather pattern there is a problem of water availability and conducive environment for cultivation of crops which might be the results of natural and manmade activities, hence large farmers who are well-off are shifting towards precision farming, which requires high investments and which is not possible for small and marginal farmers in developing countries like India. Food and Agriculture Organization (FAO) has introduced the concept of Climate Smart Agriculture in the background document prepared for the 2010 Hague Conference on Food Security, Agriculture and Climate Change. The objectives of the Climate Smart Agriculture are (i) Sustainably increasing agricultural productivity, so as to support equitable increases in farm incomes, food security and development, (ii) Adapting and building resilience of agricultural and food security systems to climate change at multiple levels, (iii) Reducing greenhouse gas emissions from agriculture (including crops, livestock and fisheries).Climate Smart Agriculture targets at helping the farmer in managing the farm well taking proper measure according to the changes in the monsoon, and the measurements or the practices to be followed changes from one region to other depending on the conditions prevailing. It also improves the ecological stability and sustainability of the environment and for food security.

INTELLECTUAL PROPERTY RIGHTS AND ITS APPLICATIONS IN AGRICULTURAL SCIENCE

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Abstract

Intellectual property characterises products of the mind or intellect. They are thoughts and ideas that, when converted to tangible forms as a product and they can be protected. Inventions, computer software, publications, videotapes, music, and plant varieties are the examples of intellectual properties. Intellectual property rights (IPRs) have become an issue at the international trade agenda since the negotiation and adoption of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) as part of the overall package of agreements leading to the creation of the World Trade Organization (WTO). Intellectual Property Rights covered under TRIPS are patents, new plant varieties, copy rights, trademarks, industrial designs and geographical indications. Agricultural Science is advancing and developing almost on a daily basis at national as well as at the global level. The farm scientists and research scholars are striving hard to solve the problems of the farmers with respect of all the aspects of the production and the preservation of the food. With this backcloth the scientists are developing new varieties of crops, new breeds of animals and to ease the workload of the farmers the implements and the machineries are being invented. The ownership of IPRs on the research work of the scientists is now an issue in the development of products and so as to outreach the technologies to the ultimate end users. This also helps in the recognition of the scientists. Besides this the consideration of IPR is an important element to secure their outputs of the research work. Since the early 1990s, most major research organizations, whether public or private, are actively considering and/or implementing IPR policies.

NUTRITIONAL AND MEDICINAL USES OF TAMARIND (*TAMARINDUSINDICA*)

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Abstract

Tamarind (*Tamarindusindica*) fruit used to grow in the hot regions of Africa. The sweet tamarind fruit grows atop extremely tall trees of the 'fabaceae family. The cultivation of tamarind has now spread to most of the warmer, drier regions of Mexico and Asia, including India and Sri Lanka. It has a tart-sweet taste that is loved by Indian nationals worldwide. No wonder it has carved a special place for itself in the Indian kitchens in the form of chutneys, digestive candies, pickles, and more. Tamarind is an ace nutrition-wise. Every 100 grams of this tart fruit contains 28 milligrams sodium and 628 milligrams of potassium in addition to 36% of the thiamine, 23% of the magnesium, 35% of the iron, and 16% of the phosphorus of the recommended daily requirement of a healthy woman. Additionally, this amazing fruit also contains niacin, vitamin C, calcium, copper, and pyridoxine. Tamarinds also have very high levels of tartaric acid (thus the tart taste), a powerful antioxidant that can help scavenge harmful free radicals from the system. The other phytochemicals present in tamarind include limonene, geraniol, safrole, cinnamic acid, pyrazine, methyl salicylate, and alkyl thiazoles. A cup of tamarind contains 6.88 grams of natural sugars. It has a calorie count of 287, 0.72 grams fat, and 3.36 grams protein. This fruit also contains 6.1 grams of fiber per 100 grams, which helps promote digestive health. Let's take a look at the skin, hair, and health benefits of tamarind fruit.

MEDICINAL PLANTS : A WAY FOR THE BETTERMENT OF LIFE STYLE

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Abstract

There are plenty of archaeological evidences indicating that medicinal plants were regularly used by people in ancient times. Curing of diseases with medicinal plants is as old as manhood itself. The Indian righteous books mention the treatment of diseases with plants, which are available lavishly in the country as India is ranked 6th (sixth) among 12 mega diversity countries of the world. Plentiful spice plants that are used till today are originated from India, such as amla, nutmeg, pepper, clove, etc. According to WHO 80% of the population in developing countries depends on traditional plant medicines to maintain their primary health. Despite the growth and development of modern medical and pharmaceutical industry, the use of traditional medicinal plants has gained an importance in daily life. Medicinal plants have got many characteristics such as

Synergic medicine, Support of official medicine, Preventive medicine and so on. Hence, they have induced interest among the multinational pharmaceutical companies as well as in domestic ayurvedic and herbal medicines. In spite of curing the diseases they also contribute significantly for the economic growth. 30% of medicinal preparations are derived from roots, 14% bark, 16% whole plants, 5% flowers, 10% fruits, 6% leaves, 7% seeds, 3% wood, 4% rhizomes 6% stems and only less than 20% of the species used are cultivated. Due to the steadily increasing demand for the medicinal plants which are important natural resources. India's medicinal plants at risk of extinction hence, a special attention should be given for the sustainability in the production, protection and utilization for the betterment of life.

OUT-SCALING OF WATER EFFICIENT TECHNOLOGIES IN AGRICULTURE: EXPERIENCES FROM SOUTH INDIA

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Abstract

Water is a precious scarce resource and major factors of production in agriculture. Due to climatic variability, decoupling between ground water extraction and recharge, frequent droughts and non-adoption of scientific farming practices, income of small and marginal farmers have rampantly reduced, leading to discontinuance of farming. This has resulted in social unrest and calls for upscaling of irrigation management techniques among farmers to increase the crop productivity and profitability. Experiences of farmers on innovative techniques for increasing water productivity. Aerobic and Systems of rice intensification methods, though it is possible to produce same quantity of rice using less than fifty percent of water, farmers are still following conventional methods, in spite of the formal extension efforts. Water Users Association, farmers in command areas are convinced about the importance but WUAs are not very effective in ensuring equal supply of water at head, middle and tail-end farmers at the distributary level. Watersheds, farmers have shown spectacular response to the programs, but their participation and managing the soil and water conservation structure was discouraging after the withdrawal of the programs. Coupling of ground water extraction with recharge has been neglected, require proper education among farmers and development workers. Drought tolerant millets cultivation, both farmers and consumers are showing good response, there is a need to establish processing units at local level and remunerative price for the products. Drip and sprinkler methods of irrigation, high response of farmers was observed and there is a need to ensure the quality of supply and governance for wider adoption. Participatory rural appraisal techniques, method and result demonstrations with frequent field visits are to be adopted by Extension workers to popularize Cover crops, organic matter availability, coupling tube-well rigging with recharging and mulching besides upscaling drought tolerant high nutritious millets crops in rain-fed situation with policy measures.

MEDICINAL PLANTS: A WAY FOR THE BETTERMENT OF LIFE STYLE

Shivani Dechamma, Manju Prakash and Shanabhoga. M.B.
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Abstract

There are plenty of archaeological evidences indicating that medicinal plants were regularly used by people in ancient times. Curing of diseases with medicinal plants is as old as manhood itself. The Indian righteous books mention the treatment of diseases with plants, which are available lavishly in the country as India is ranked 6th (sixth) among 12 mega diversity countries of the world. Plentiful spice plants that are used till today are originated from India, such as amla, nutmeg, pepper, clove, etc. According to WHO 80% of the population in developing countries depends on traditional plant medicines to maintain their primary health. Despite the growth and development of modern medical and pharmaceutical industry, the use of traditional medicinal plants has gained an importance in daily life. Medicinal plants have got many characteristics such as Synergic medicine, Support of official medicine, Preventive medicine and so on. Hence, they have induced interest among the multinational pharmaceutical companies as well as in domestic ayurvedic and herbal medicines. In spite of curing the diseases they also contribute significantly for the economic growth. 30% of medicinal preparations are derived from roots, 14% bark, 16% whole plants, 5% flowers, 10% fruits, 6% leaves, 7% seeds, 3% wood, 4% rhizomes 6% stems and only less than 20% of

the species used are cultivated. Due to the steadily increasing demand for the medicinal plants which are important natural resources. India's medicinal plants at risk of extinction hence, a special attention should be given for the sustainability in the production, protection and utilization for the betterment of life.

MANAGEMENT OF ROOT-KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*) IN POLY HOUSE ON TOMATO (*SOLANUM ESCULENTUM*) AS SOIL FUMIGATION THROUGH CHEMICALS

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Abstract

The experiment was conducted during 2017 at the Horticulture Farm in poly-house, Department of Nematology, Rajasthan College of Agriculture, Udaipur to find out the effect of two chemicals as soil fumigation on plant growth characters and reproduction of *M. incognita* on tomato. In this experiment two chemicals *viz*. STTC and Metham Sodium were used @ 25ml, 35ml, 45ml/m^2 respectively and control was also maintained. Observations on plant growth characters (shoot and root length, shoot and root weight) and nematode reproduction (number of galls per plant, number of egg masses per plant, number of eggs per egg mass, nematode population/100cc soil, final nematode population) were recorded. Among soil fumigants Metham sodium @ 45 ml/m^2 was recorded most effective fumigant followed by Metham sodium @ 35 ml/m^2 and STTC @ 45 ml/m^2 over control to reduce nematode reproduction and enhance plant growth characters.

MANAGEMENT OF ROOT-KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*) IN POLY HOUSE ON CUCUMBER (*CUCUMIS SATIVUS* L.) AS SEED SOAKING TREATMENT

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Abstract

The experiment was carried out during Feb - May 2016 at farmer's Polyhouse on Cucumber. Cucumber is a warm season vegetable, grown throughout the world under tropical and subtropical conditions. Root-Knot Nematode, *Meloidogyne incognita* is widely distributed in India and causes severe damage to cucumber. Environmental condition of poly-house is congenial for nematode growth and reproduction, so chemical method of control is only promising mean for control.Three chemical *viz*. Dimethoate, Triazophos & Chlorpyrifos were used @ 0.5 ml / lit and 1 ml / lit of water as seed soaking to find out efficacy of chemical agents. Triazophos @ 1 ml / lit water found very promising to improve plant growth characters *viz.* vine length, root length, vine weight and root weight and reducing nematode reproduction *viz.* no. of galls/plant, no. of egg masses/plant, no. of eggs & larvae/egg mass and nematode population/200 cc soil over Chlorpyrifos and Dimethoate as compared to control. Highest yield per vine was recorded in the Triazophos @ 1 ml / lit water (3.03 kg) and lowest nematode population were recorded (1798 larvae/200 cc soil) over control.

POPULATION STATUS OF ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* IN POLY-HOUSES OF CHITTORGARH DISTRICT OF RAJASTHAN

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Abstract

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incognita is widely distributed in India and causes severe damage to cucumber. Environmental condition of poly-house is congenial for nematode growth and reproduction, so determined the population status of root-knot nematode in poly-houses of Chittorgarh district of Rajasthan a survey was carried out in 40 poly-houses and 100 per cent occurrence of root knot nematode was recorded. Highest incidence of root-knot was observed in the poly-house of Tana village 2450 larvae per 200 cc soil followed by Gulfatharosan (Manda), Garhplace, Jalkhari and Sanwata. The moderate incidence was recorded from the poly-houses of village *viz.* Bassi, Meghpura, Kanera, and Jaysingh pura. The lowest infestation was observed from Bhichor, Rajpura, Kalayanpura, and Mnohar Khedi.

INNOVATIVE TECHNOLOGY FOR CROP IMPROVEMENT, BIOTECHNOLOGY AND GENETIC ENGINEERING

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Abstract

Plant biotechnology, a major component of agricultural biotechnology, deals with various aspects of plant tissue culture, genetic transformation, and molecular biology techniquesIt is the use of scientific and engineering principles in the biological materials processing of agents in order to provide goods and services for human use. During the past 15 years, remarkable achievements have been made in the production, characterization, field evaluation, and release of transgenic varieties/hybrids in several crops. Transgenic varieties/hybrids of maize, cotton, soybean, potato, tomato, and papaya are now being commercially grown on and spread across 25 countries.Globally, the systems of agriculture have advanced tremendously owing to the advancement of technological knowhow. A Genetically Modified Organism (GMO) is that whose genetic material is altered using genetic engineering techniques called recombinant DNA technology. Modern Genetic engineering has provided a wide range of genes which are valuable in the creation of desired germlines for new crops.Genetic engineering has also helped immensely in recent creation of crops with various beneficial and development traits like harvest durability, colors, resistance etc.The Insect-Resistant Plants are genetic engineered crops which possesses a gene from soil *Bacillus thuringiensis* (Bt) bacterium, that releases a specific toxin against insects protecting the plant against attacks by insects.Recombinant DNA technology has significantly augmented the conventional crop improvement, and has a great promise to assist plant breeders to meet the increased food demand predicted for the 21st century.This advancement in technology provides farmers with useful toolsto improve sustainable farming and limit environmental footprint.

EVALUATION OF WHEAT GENOTYPES IN NATIONAL GENETIC STOCK NURSERY FOR STEM RUST RESISTANCE

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Abstract

Wheat is the second most important cereal food crop in India after Rice. During 2017-18, India recorded highest wheat production of 99.76 million tonnes. With increasing population, rate of food production is also to be increased to meet the growing demand. However, several and abiotic factors affect global as well as India's wheat production. Biotic factors like rust, leaf blights, bunts, powdery mildew, insects and nematodes cause heavy production losses. Among these factors, wheat rust (stem, leaf and stripe) diseases are the major limiting factors for wheat production in the country. Stripe rust occurs in the cooler climate of northern India, stem rust occurs in the central and southern India and leaf rust occurs throughout India. Central Indian wheat suffers from both leaf and stem rusts. Continuous screening, Identification and utilization of rust resistant genotypes in the development of wheat varieties is important in order to manage these rust pathogens. A total of 90 wheat genotypes of National genetic stock nursery were evaluated in the field against stem rust resistance. The two lines of each wheat genotypes were planted in 2m row length. A susceptible genotype/infector row was planted after every 20 rows. The infector row was inoculated with uredospore suspension of stem rust through hypodermic syringes and sprays. The stem rust score was recorded at terminal severity. A total of 48 wheat genotypes were found to be resistant (co-efficient of infection

less than 10.0) to stem rust. The genotypes viz., GW 451, HD 3171, HPW 360, DDK 1048, DDK 1049, MACS 3972, MACS 5041, PBW 719, UAS 455, FLW 10, KBRL 79-2, PHSL 10 and DWAP 1531 were found to be highly resistant to stem rust. As these genotypes were evaluated over years and were selected for different traits viz., agronomic, yield, resistance etc., they can be utilized to breed the varieties for incorporating stem rust resistance along with their identified traits.

EFFECT OF DIFFERENT CARBON AND NITROGEN SOURCES ON GROWTH, SPORULATION AND TOXIN PRODUCTION IN *A. CYAMOPSIDIS*

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Abstract

Guar or Clusterbean [*Cyamopsis tetragonoloba* (Linn.) Taub.] is an important leguminous crop and is being grown for vegetable, fodder, gum and green manure. Gum from its seeds is becoming an important commodity in international trade.The crop is commonly grown in Zaid and Kharif seasons. Among all the states, Rajasthan ranks first in its production. Of late, the crop has been credited for having potentialities of producing an excellent gum for industries. *Alternaria cyamopsidis* Rang. and Rao was found to be associated with blight of guar. The best medium for growth, sporulation and toxin production of *A. cyamopsidis* was Richard's broth medium. Sucrose and potassium nitrate were found best for growth, sporulation and toxin production as carbon and nitrogen sources, respectively. The pathogen produced detectable toxins *in vivo* as well as *in vitro* .Culture filtrate (crude toxin) was partially purified using ammonium sulphate precipitation method, which was further separated through Sephadex G-75 column and eluted with acetate buffer (0.05 M, pH 5.5) which resulted in different 20 fractions of toxins. Out of these fractions, fraction nos. 9 and 13 were found to be highly toxic.

CONSTRAINTS AND POSSIBILITIES RELATED TO ESTABLISHMENT OF AGRO-FORESTRY SYSTEMS IN NORTH EAST INDIA FOR THE ECOLOGICAL SUSTAINABILITY AND YOUTH EMPOWERMENT

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Abstract

Acceleration in growth of human and livestock population necessitated acquisition of more and more land under cultivation. The area under agriculture and forest has been reduced drastically due to population pressure which resulted in a wide gap between demand and production of agricultural and forest products *viz.* food, fodder, vegetables, fuel wood, timber medicines etc. Hence, an interest in agroforestry has therefore become necessary in order to encourage sedentary. Agroforestry is of great importance in recent times primarily because of meeting the diversified needs of people and for sustaining the frazzle ecosystem for generations to come. Agroforestry is an intensive land management system that optimizes the benefits from the biological interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock. About 80% of the people of north-east (NE) India are directly or indirectly concerned with agriculture. Farmers, in this region, are generally small holders and thus, an attempt with agroforestry practices can result in an increase in their earnings without endangering the fragile ecosystem. In the NE region, trees are deliberately integrated with the crop and livestock production system. A number of crops like maize, ginger, pineapple, coffee, and vegetables are grown with tree species such as *Pinus kesiya*, *Alnus nepalensis*, *Schima wallichii*, *Pyrus communis*, *Prunus domestica*, *Areca catechu* etc. Though different problems such as lack of knowledge, credit facilities, land availability saplings availability, etc., were present in this region, prospects are also available. Different agroforestry models available in respect to the different locations are needed to be studied through different researches. So, an effective strategy based on agroforestry with scientific introduction of suitable tree species with crops on farm lands require not only for feeding the presently increasing population, but also for conservation of land

resources for the future generations to come as well as creation of different employment opportunities for the youths of N.E India.

EFFECT OF VERMICOMPOST AND SULPHUR ON YIELD, QUALITY OF FANUGREEK (*TRIGONELLA FOENUM* GRAECUM L.) AND POST HARVEST FERTILITY STATUS OF SOIL

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Abstract

A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during rabi season of 2011-12 to study the Effect of Vermicompost and Sulphur on Yield, Quality of Fanugreek (Trigonella foenum raecum L.) and and post harvest fertility status of soil .The experiment was laid out according to randomized block design with three replications. The treatments were consisting of four levels of vermicompost (0, 2, 4 and 6 t ha^{-1}) and four levels of sulphur (0, 20, 40, and 60 kg ha^{-1}). The sulphur was applied through elemental sulphur alongwith uniform application of recommended doses of nitrogen, phosphorus and potassium in soil on which fenugreek variety RMt-1 was grown. Results showed that the application of vermicompost significantly increased the seed, straw yields and protein content in seed up to 4 t ha^{-1}, however, their further increase with application of vermicompost @ 6 t ha^{-1} was not significant. The available nitrogen, phosphorus, Potassium, sujphur and dehydrogenase activity in soil increased significantly with increasing levels of vermicompost at harvest stage of the crop. Results further indicated that the application of sulphur significantly increased the seed, straw yields and protein content in seed up to 40 kg ha^{-1}, however, their further increase with application of sulphur @ 60 kg ha^{-1} was not significant. The available nitrogen, phosphorus. Potassium and sulphur and soli dehydrogenase activity in soil increase significantly with increasing levels of sulphur at harvest stage of the crop.

AN ECONOMIC ANALYSIS OF PRODUCTION, CHANGE IN AREA PRODUCTION AND PRODUCTIVITY AND CONSTRAINTS IN SEED PRODUCTION OF PADDY IN RAIPUR DISTRICT OF CHHATTISGARH

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Abstract

The study and examine the change in area, production and productivity under seed production of paddy in Raipur during *kharif* season in the year of 2016-17. Two blocks were selected *viz.*Arang and Dharsiwa of Raipur district. Sixty farmers from Arang and sixty farmers from Dharsiwa block were selected by using probability proportional to size technique. The primary data were collected from the selected households of the paddy seed producers through personal interview method with the help of well pretested schedule and questionnaire for the year 2015-16. Cost of cultivation of paddy was workout by using standard method of cost of cultivation adopted by Commission on Agricultural Costs and Prices (CACP). The major findings of this study revealed that the average size of holding of the sample households was 5.31 hectares. The cropping intensity was observed to be 154.89 percent. Cost of cultivation per hectare of paddy come to be Rs.52852.01. Cost of cultivation increased with the increase in farm size. The study suggested that the area, production and productivity is increase by providing require package and practices and other important inputs to the paddy growers or farmers.Production of paddy is increasing from 30346.65qt/ha to 46868.84qt/ha from the year 2010-11 to 2014-15. The area also increases from 1182.32ha to 2051.99ha from the year 2010-11 to 2014-15. Hence, the production of paddy is increasing every year but the productivity is decreasing *i.e.* 25.46kg/ha, 24.36kg/ha, 23.37kg/ha respectively from the year 2010-11, 2012-13, 2014-15 respectively. The percentage change in 2014-15 over 2010-11, change in total area, change in production and productivity is73.56%, 54.44% and-8.21% respectively. The major constrains in seed production of paddy were non availability of desired seeds at the time of sowing procedure of payment is too long and shortage of labour during key operations. Under major constraints pertaining to cultivation of paddy, lack of labour was the most important problem as reported by 45 percent paddy producer. The second most important constraint faced by the paddy growers was Low adoption of recommended packages of practices of crop (20

percent). The other most important constraints reported by the paddy growers were lack of literacy (6 per cent), time factor (7 per cent), lack of knowledge (20 per cent) and lack of guidance (2 per cent). Looking to the problems faced by paddy growers in the study area, it is pertinent to address these constraints. Accordingly, there is a need to impart training skills to the paddy growers on production aspect through extension support such as on farm training, demonstration *etc.* to enhance the adoption of recommended package of practices for paddy Seed production. The study also suggested that all the growers and dealers must know how to introduce latest scientist technology in the cultivation of seed production of Paddy in the district and the state of Chhattisgarh.

EFFECT OF VERMICOMPOST AND PHOSPHORUS ON YIELD, QUALITY OF GREENGRAM [*VIGNA RADIATA* (L.) WILCZEK] AND POST HARVEST FERTILITY STATUS OF SOIL.

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Abstract

A field experiment entitled "Effect of vermicompost and phosphorus on yield, quality of Greengram [*Vigna radiata* (L.) Wilczek] and on post harvest fertility status of soil" was conducted during kharif of 2011 at Agronomy Farm, S.K.N. College of Agriculture, Jobner. The treatments comprising four levels of vermicompost (0, 1, 2 and 3 t ha^{-1}) and four levels of phosphorus (0, 10, 20 and 30 kg ha^{-1}) making 16 treatment combinations were laid out in factorial randomized block design with three replications. The greengram variety RMG-62 was sown on July 14th 2011 using seed rate 20 kg ha^{-1} in rows of 30 cm apart. Results showed that application of vermicompost @ 2 t ha^{-1} significantly increased the total, effective, fresh and dry weight of root nodules per plant, seed, straw yield, protein content in seed and chlorophyll content in leaves, over preceding levels of vermicompost. After harvest of crop the percent organic carbon, available nitrogen, phosphorus, potassium and sulphur content in soil increased significantly with the application of vermicompost @ 2 t ha^{-1}. Results further indicated that total, effective, fresh and dry weight of root nodules per plant, seed, straw yield, and the available phosphorus content in soil after harvest of crop increased significantly with increasing levels of applied phosphorus upto 30 kg ha^{-1} over lower levels. While the protein content in seed, chlorophyll content in leaves, the available nitrogen, potassium and sulphur content in soil after harvest of crop increased significantly with the application of phosphorus upto 20 kg ha^{-1}.

EFFECT OF SULPHUR FERTILIZATION ON GARLIC UNDER INFLUENCE OF SOWING DATES

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Abstract

Garlic (*Allium sativum* L), a member of the Alliaceae family, is one of the most aromatic herbaceous annual spices. It is especially rich in protein, carbohydrate and ascorbic acid with a characteristic pungent smell. The date of sowing and appropriate dose of sulphur are the crucial factors that can decide establishment, growth and performance of garlic crop through changing morphological system, physiological functioning and time available for the crop to complete its life cycle. A field experiment entitled "Effect of Sowing date and Sulphur levels on Quality of Garlic (*Allium sativum* L.)" was conducted during *Rabi* season 2014-15 at Horticulture farm, S.K.N. College of Agriculture, Jobner, Jaipur. The experiment consisted of 16 treatments and each treatment was replicated thricely under Randomized Block Design. The treatment consist of four dates of sowing viz. 10th October, 25th October, 10th November and 25th November and four levels of sulphur viz. control, Sulphur 30 kg/ha, 60 kg/ha and 90 kg/ha. The sulphur was applied as basal dose in its elemental form. Besides it, the recommended dose of NPK for garlic (120: 40: 100 kg ha^{-1}) was also applied uniformly in all plots. Five plants were selected randomly from each plot for recording observations on growth and yield of garlic crop. During investigation, results indicated that when garlic crop produced with a treatment combination of sulphur application upto 90 kg/ ha under 25th October sowing date recorded maximum polar diameter of bulb (5.76 cm), average weight of bulb (41.37 g) and yield (232.37q/ha) and it was observed as significantly superior over rest of the treatment combinations except application of sulphur 60kg /ha under 25th October sowing date, being statistically at par with each other.

STUDY OF INDUCED MUTATION IN M_2 GENERATION OF URDBEAN (*VIGNA MUNGO*)

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Abstract

The major aim in mutation-based breeding is to develop and improve well-adapted plant varieties by modifying one or two major traits to increase their productivity or quality. Mutation breeding may be additional tool for the plant breeders. Under specific circumstances, where conventional methods may be found to be inadequate, the mutational approach could become crucial to further success in breeding of crop species. This study was undertaken to explore the possibility of inducing mutations in quantitative characters of urdbean after seed irradiation by gamma rays. Two locally high yielding but susceptible to yellow mosaic virus varieties PU-1 and Co-6 were used to irradiate by differential dose of gamma radiation 200, 300 and 400 Gy. M_1 generation was grown at ARS Kota & TNAU, Coimbtore, simultaneously. Single plants were selected on the basis of MYMV resistance and yield & its contributing characters. Seed from these selected plants were grown as M_2 generation at both the locations in summer 2018. MYMV resistance and yield and its contributing characters were analyzed quantitatively to assess the extent of variation in M_2 generation. All characters varied significantly in M_2 generation. Plant yield was considerably reduced at all doses level in both of the variety associated with the significant reduction in plant health and fertility. Gamma ray treatments shifted the mean values of all characters and range of variability also increased positively. The genetic variability increased at all dose levels but it was not linear with dose.

EFFECT OF SINGLE SUPER PHOSPHATE ON QUALITY AND FORAGE YIELD OF COWPEA (*VIGNA UNGUICULATA* (L.) WALP.) ENTRIES

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Abstract

The field experiment was conducted at GPB Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar, Kumarganj, and Faizabad (U.P.) during *Kharif* season of 2015 to evaluate the effect of Single Super Phasphate doses on quality and forage yield of cowpea (*Vigna unguiculata* L.) entries. Twelve treatments comprised of three SSP doses- F_1: 190 kg SSP ha^{-1}, F_2: 375 kg SSP ha^{-1} and F_3: 560 kg SSP ha^{-1} and four entries- E_1: TNFC- 0926, E_2: Bundel Lobia-1, E_3: UPC-5286 and E_4: UPC- 622were replicated thrice in Randomized Block Design (Factorial). The experimental soil having pH (1:2.5) 8.62, EC dSm^{-1} 0.39, Organic Carbon 2.9 g kg^{-1}, B.D. 1.45 Mg m^{-3}. Available N 166.73, P 13.20, K 207.55 and S 12.73 kg ha^{-1}. The maximum quality (crude protein content 11.37 % and chlorophyll content 1.98 %) were recorded with application of F_3: 560 kg SSP ha^{-1} which was significantly superior over F_1 and statistically at par with F_2 among the entries maximum crude protein content (crude protein content 10.81 % and chlorophyll content 1.98 %) were recorded with F_3: UPC-5286 entry which was significantly superior over E_1 and E_2 and Statistically at with E_4. Same trend were also recorded in nutrients content, uptake, yield and yield attributes of forage crop of cowpea. The maximum gross income was calculated with E_3F_3: 28065 and net income with E_3F_2: 13289. However, highest benefit cost ratio (0.84) was obtained with treatment combinations E_3F_2: UPC- 5286+ 375kg SSP ha^{-1}. Thus the recommendation of F_2 (375 kg SSP ha^{-1}) and E_3(UPC-5286) be made to the farmers of eastern (U.P.) for successful cultivation of forage crop cowpea in *kharif* time.

MARKET POTENTIAL OF WILD EDIBLE FRUITS IN JAMMU REGION OF J&K

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Abstract

Millions of the people in many developing countries don't have enough food to meet their daily requirements and a further more people are deficient in one or more micronutrients. Wild edible plants are major source of food for rural and tribal inhabitants in forests. Edible parts of wild plants (fruits, tubers, leaves, flowers, inflorescence, rhizome, roots, tubers, etc.) are the nature's gift to mankind. Theseplant parts are not only delicious and refreshing but also the chief source of vitamins,

proteins and minerals.In India,large rural populations depend on the wild resources including wild edible plants to meet their food needs in periods of food crisis. These plants serve for additional food supplements also. Now a day's wild edible plants play an important role as a cheap source of valuable food. Overgrazing and overstocking, over exploitation of forest product, expansion of agricultural land, forest cuttings for construction and technology, etc and uncontrolled fire settings are major factors threatening wild edible plants. Some wild fruit species which are being used commercially are *Aeglemarmelos* L., *Emblicaofficinalis*Gaertn., *Berberisaristata* DC., *Artocarpuslacucha*Buch.-Ham., *Moringaoleifera* Lam., *Ficuspalmata* F., *Diospyros lotus* L., *Syzigiumcumini* L., *Zanthoxylumarmatum* DC.and*Cordiamyxa* L. These fruits are collected from natural forests by the neighboring villagers and sell in the nearby markets. This is the main source of the earning of these rural people. These fruits are used for direct consumption, pickle, jam, juice, marmalade making, so they have great market potential. Due to less availability of these fruits they have more economic value and market. Due to irregular supply of these fruits their prices are continuously increasing. By the value addition there cost may be increased more and they can prevent for the off season also. Value addition may increase the market potential also. These all grow in the sub tropics and tropics nearby the Jammu area, which is a big market of the whole region. Many food processing units are working in Jammu which provides a good market to the wild edible fruits.

EFFECTS OF FRAME STRENGTH ON THE COMB AREA DAMAGE BY GREATER WAX MOTH, *GALLERIA MELLONELLA* IN STORED COMBS AND ITS CORRELATION WITH WEATHER PARAMETERS

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Abstract

Experiment was carried out at Research farm of the Department of Entomology, Chaudhary Charan Singh Haryana Agricultural University, Hisar to examine the damaged area of combs. The damage area of combs (cm^2) caused by *G. mellonella* larvae in stored combs of different frame strength (7, 8, 9 10 frame/ hive body) was recorded from June to October 2016 and 2017. Mean area damage was recorded highest in hive body having 10 frames (121.69 cm^2 and 123.94 cm^2) followed by 9 frames (106.21 cm^2 and 108.14 cm^2) and 8 frames (94.81 cm^2 and 97.33 cm^2) while lowest was recorded in 7 frames (81.37 cm^2 and 83.42 cm^2), respectively in year 2016 and 2017. Irrespective of the different frames strength, damaged area was found highest (195.11 and 172.00) in September followed by October (150.50 and 105.89), August (133.30 cm^2 and 113.95 cm^2), July (77.94 cm^2 and 29.32 cm^2) and June (19.35 cm^2 and 12.90 cm^2) respectively, in 2^{nd} and 1^{st} fortnight except in October (1^{st} and 2^{nd}) during year 2016. Same trends were also observed in year 2017. There was a highly significant difference found between the time interval of different month and frames strength in the occurrence of damaged area. The correlation study indicated significant positive correlation of extent of damage with maximum temperature (r = 0.703 and r =0.704), maximum humidity (r = 0.227 and r = 0.222) and negatively non-significant with minimum temperature (r = -0.512 and r = -0.475) and minimum RH (r = -0.267 and r = -0.315) respectively, in year 2016 and 2017.

IMPACT OF KISAN MOBILE ADVISORY SERVICES (KMAS) IN BARWANI DISTRICT OF MADHYA PRADESH

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Abstract

Kisan Mobile Advisory Service (KMAS) delivers real-time based agricultural information and customized knowledge to improve farmers' decision making ability so that they are able to increase their production and productivity, better aligning the farm output to market demands; securing better quality and improved price recovery. Keeping the emerging ICT scenario and potential of mobile application in transfer of agricultural technology and importance of Kisan Mobile Advisory Service (KMAS) in view, a research study was conducted to assess the impact of Kisan Mobile Advisory Service as perceived by the

beneficiaries. The study was conducted in Barwani district of Madhya Pradesh by selecting a sample of 140 beneficiaries of KMAS as respondents. The sample for the study was selected through proportionate random sampling method. The data were collected through a structured interview schedule and inferences were drawn on the basis of statistical analysis. The respondents of the study were dominated by young age group with moderate level of education and belong to SC/ST category. They live in small joint families and practice agriculture on small & irrigated land holdings which is their major source of income. Most of them had middle level exposure to information and extension sources with medium innovativeness. They have medium level of scientific and risk orientation abiility. As far as impact assessment of KMAS is concerned, the findings reveal that the beneficiaries gave first preference to applicability of message followed by subject matter, need of message, timeliness of message, *understandability of message, horizontal spread and cost effectiveness of messages provided under KMAS programme. The study concludes medium level overall impact of the KMAS programme on respondents.* It is also concluded that applicability, subject matter, timeliness and felt need are most vital in planning any mobile based advisory. The socio-economic and agricultural profile of the farmer should be properly analyzed before advocating any technological interventions.

MARKET INTELLIGENCE AS INNOVATIVE IDEA FOR PROFITABLE AGRICULTURE

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Abstract

There is a need for improvement in agricultural marketing system by adopting systematic approach and latest technology like Information Technology, for collection and dissemination of Market Information and Intelligence. One of the reasons for lack of returns in agriculture is traditional way of marketing through middlemen and absence of awareness about market information and intelligence. The scope and coverage of market information dissemination needs to be expanded. Market intelligence is the information relevant to a company's markets, gathered and analyzed specifically for the purpose of accurate and confident decision-making in determining strategy in areas such as market opportunity, market penetration strategy, and market development. To generate information on wholesale prices, arrivals and trends in various markets of the country for important crops and also on retail prices for increased number of selected markets, to analyze the trends of arrivals, prices etc and generate Market Intelligence Reports, information dissemination through publicity, advertisements, films, printed literature and development of technology packages in electronic form to be shared through IT. Market intelligence has been recognized as essential in developing government policy and a requisite of successful marketing and stable sector development. The entire marketing process includes functions of production planning, production and dissemination of market information, financing of markets and their administration, the activities of marketing intermediaries, research activities etc. key potential areas to increase the production and productivity of crops like higher returns per unit area through production scheduling, the emerging opportunities for this sector in global trade in placed at higher peaks. the commercialization of Indian agriculture sector like supply chain management, integrated value chain, market oriented/demand driven/export oriented production systems, orienting the production and post harvest handling towards future market, strengthening the back ward and forward linkages, developing Agri-business opportunities through linkage models for integrating Indian farm gates with international food plates, integrated development of agriculture including storage and on farm preservation facilities, processing, marketing and export.

SHORTENING OF BREEDING CYCLE IN FRUIT CROPS

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Abstract

The world population is relentlessly increasing, while there is a consistent decline in the environment to which crops are exposed. Due to climate change, productivity and quality of fruit crops also deteriorated. The only way to stand in the competitive global fruit market with the other countries is through production of high quality fruits. Fruit breeding plays an important role in increasing the productivity and quality of fruit crops. Yet, fruit tree breeding remains a slow, laborious

process due to a long juvenile phase before attaining reproductive life. Fruit tree breeding limitations include: prolonged generation cycles, i.e. the time between seed planting and fruiting which can last from 3 to 20 years depending on the fruit crop; the large land areas necessary for planting seedlings. In perennial fruit trees flowering occurs only once each year in most of the cases and is temperature dependent too. However, recent advances in biotechnologies and genomics have the potential to accelerate cultivar development greatly in all crops. Use of fast track breeding, embryo rescue, budding and grafting, girdling, use of plant growth regulators, artificial dormancy breaking techniques, optimum growing conditions, protected cultivation and spray of bud breaking chemicals viz., thio-urea, HCl etc. can shorten the juvenile period of fruit crops. With the help of these biotechnological and physiological tools, fruit breeding can be made easier and quite shorter in duration. Consequently, good quality fruits can be supplied in the global market in a short span of time, this will help in strengthening the nation‘s economy.

EFFECT OF CEMENT : WOOD PARTICLE (LANTANA CAMARA AND DENDROCALAMUS STRICTUS) RATIO ON PHYSICAL PROPERTIES OF CEMENT BONDED PARTICLE BOARD

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Abstract

Now a day’s agro-based materials play major role in engineer’s wood panel products because of decrement of wood raw materials and increment of demand for wooden composite materials. Therefore it is essential to encourage, evaluate, utilization of weeds and agro-based materials for composite manufacturing panel products including cement bonded particle board (CBPB). CBPB play major role, because of its physio-mechanical behaviour against fire, decay resistant and dimensional stability in adverse climatic conditions. Wood cement panels are currently used in many countries for roof decking, flooring, exterior walls, partitions, wall panelling, and industrial buildings. Therefore, present work was carried out to examine the compatibility of lignocellulosic woody shrub Lantana and Bamboo particle mixture were used in three different cement: particle ratios to find the effect of physical properties on cement bonded particle board. It was observed that physical properties of the board decreases with increase in cement: wood particle ratio.

EFFECT OF CONSERVATION AGRICULTURAL PRACTICES ON PHYSICO-CHEMICAL PROPERTIES OF SOILS

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Abstract

The growing concern for food security through improved soil management techniques demands identification of an environmental friendly and crop yield sustainable system of agriculture. Conservation agriculture (CA) is a way of farming that conserves, improves and ensures efficient use of natural resources. It ia a concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment (FAO 2010). The major role of CA is to conserve natural resources and attain sustainable production in this climate change era. Sustainable agriculture is a farming practice that is economically viable and socially acceptable and that aims at conserving land, water and genetic resources for future generations. As per FAO (2010), CA is characterized by three interlinked principles namely: (i) Continuous minimal mechanical soil disturbance, (ii) maintaining permanent organic soil cover, AND (iii) Diversified crop rotations of annual crops and associations of perennial crops. These principles ensure improvement or maintenance of soil organic carbon at the desired level. The Conservation Agricultural Practices have potential to arrest or reverse land degradation, boost productivity and increase food security. Tillage is defined as the mechanical manipulation of the soil for the purpose of crop production affecting significantly the soil characteristics such as soil water conservation, soil temperature, infiltration and evapotranspiration processes. This suggests that tillage exerts impact on the soil purposely to produce crop and consequently affects the environment. As world population is

increasing so the demand for food is increasing and as such the need to open more lands for crop production arises. Conservation tillage, along with some complimentary practices such as soil cover and crop diversity (Corsi, & de MoraesSà, 2012) has emerged as a viable option to ensure sustainable food production and maintain environmental integrity. The adoption of heavy mechanized farming on large farms in India (i.e. >8 ha; Foster and Rosenzweig, 2011) has led to the serious sub-surface soil compaction problems. The judicious use of tillage practices overcomes edaphic constraints, whereas inopportune tillage may cause a variety of undesirable outcomes, for example, soil structure destruction, accelerated erosion and reduced water transmission through soil. Reducing tillage positively influence the several aspects of the soil whereas excessive and unnecessary tillage operations give rise to opposite phenomena that are harmful to soil.

ZINC MANAGEMENT IN MUNGBEAN [*VIGNA RADITA* (L.) WILZECK] IRRIGATED WITH SODIC WATER

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Abstract

The pot experiment to study the "Zinc management in mungbean [*Vigna radiata* (L.) Wilczek] was conducted to evaluate the effect of different RSC water and sources of zinc on soil properties (pH_2, ECe, SAR, OC and DTPA-Zn), yield attributes and yield, nutrient concentrations and sodicity tolerance in mungbean on loamy sand soil during kharif season of 2016. The experiment comprising of 12 treatment combinations replicated three times, was laid out in completely randomized block design with three levels of RSC water (2, 4 and 6 mmol L^{-1}) and four levels of sources of zinc (0, $ZnSO_4.7H_2O$, zinc enriched vermicompost and zinc enriched FYM). Results revealed that under 6 mmol L^{-1} RSC of irrigation water, the ECe and DTPA-Zn were decreased significantly, while, pH and SAR of soil increased significantly. The number of total, effective nodules and nodule index, total chlorophyll content, plant height, number of pods per plant, number of seeds per plant, seed index, root mass, seed and straw yield of crop, nutrient concentration*viz.,* P, K, Ca, Mg and Zn in seed and straw, Ca/Mg ratio in seed and straw decreased significantly with all levels of RSC waters and maximum reduction was recorded with the application of 6 mmol L^{-1} of RSC water, while N, Na, Na/K, Na+K/Ca and Na/Ca ratio in seed and straw, protein content in seed increased significantly.The application of zinc enriched vermicompost decreased the pH and SAR significantly. Organic carbon and DTPA-Zn of soil, number of total and effective nodules, nodule index, total chlorophyll content, pant height, number of pods per plant, number of seeds per pod, seed index, root mass, seed and straw yield of crop, nutrient concentration*i.e*. N, P, K, Zn and Cain seed and straw, protein content in seed, Ca/Mg in seed and straw increased significantly, while Na, Na/K, Na/Ca and Na+K/Ca ratio decreased significantly in seed and straw due to application of zinc enriched vermicompost.

ORGANIC FARMING IN INDIAN RURAL ECONOMY

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Abstract

During 1960s, the green revolution was the government's most important program. Organic fertilizers were replaced by chemical fertilizers and locally made pesticides were replaced by chemical pesticides. As time went by, extensive dependence on chemical farming has shown its darker side. The land is losing its fertility and is demanding larger quantities of fertilizers to be used. Pests are becoming immune requiring the farmers to use stronger and costlier pesticides. Due to increased cost of farming, farmers are falling into the trap of money lenders, who are exploiting them no end, and forcing many to commit suicide. Many farmers in India are shifting to organic farming due to the domestic and international demand for organic food.

Further stringent standards for non-organic food in European and US markets have led to rejection of many Indian food consignments in the past. Organic farming, therefore, provides a better alternative to chemical farming. Organic production has stimulated dynamic market growth, contributed to farm incomes and created employment for more than three decades now. At the same time it delivers public goods in terms of environmental protection, animal welfare and rural development. Organic farming is being groomed to end modern farmers' struggles resulting to various debts and farm land mortages. Numerous small farmers have been practicing organic farming; however, since they are unaware of the market opportunities they are not able to reap the benefits of organic farming. The main advantages of organic farming for small farmers in India rural economy are as follows; High premium: Organic food is normally priced 20 - 30% higher than conventional food. This premium is very important for a small farmer whose income is just sufficient to feed his/her family with one meal. Low investment: Organic farming normally does not involve capital investment as high as that required in chemical farming. Further, since organic fertilizers and pesticides can be produced locally, the yearly costs incurred by the farmer are also low. Agriculture greatly depends on external factors such as climate, pests, disease. Furthermore, most of the small farmers are dependent on natural rain for water. Therefore in cases of natural calamity, pest or disease attack, and irregular rainfall, when there is a crop failure, small farmers practicing organic farming have to suffer less as their investments are low. Less dependence on money lenders: Many small farmers worldwide commit suicide due to increasing debt. Since chemical inputs, which are very costly, are not required in organic farming, small farmers are not dependent on money lenders. Crop failure, therefore, does not leave an organic farmer into enormous debt, and does not force him to take an extreme step. Synergy with life forms: Organic farming involves synergy with various plant and animal life forms. Small farmers are able to understand this synergy easily and hence find it easy to implement them. Traditional knowledge: Small farmers have abundance of traditional knowledge with them and within their community. Most of this traditional knowledge cannot be used for chemical farming. However, when it comes to organic farming, the farmers can make use of the traditional knowledge.

SUPPLEMENTATION OF DRIED RUMEN DIGESTA ON GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND HEAMATO-BIOCHEMICAL PROFILE OF BROILERS

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Abstract

An experiment was conducted at Poultry Research and Training Center of SardarVallbhbhai Patel University of Agriculture and Technology Modipuram Meerut to determined effect of Dried Rumen Digesta (DRD) on growth performance, carcass quality and serum biochemistry of broilers. A total 300 day old (Cobb- 400) divided into five experimental groups *viz.,* T_1 (basal ration without DRD), T_2 (basal ration plus 5 % DRD), T_3 (basal ration plus 10% DRD), T_4 (basal ration plus 15 % DRD) and T_5 (basal rationplus 20 % DRD) with three replications and each replication had 20 chicks. Results revealed that inclusion of 20 per cent DRD in diets of broilers significantly ($p<0.5$) improved body weight gain (2270.23±1.17 g), feed conversion efficiency (1.45) and performance index (366.55) along with blood profile *viz.,*total protein, glucose, HDL, LDL and calcium and carcass characteristics namely; eviscerated weight, carcass weight, giblet weight and dressing percentage. Therefore, it can be concluded that inclusion of 20 per cent DRD in broilers diet is improved growth performance, carcass quality and blood profile.

PERFORMANCE OF CASTOR HYBRIDS/VARIETIES UNDER IRRIGATED CONDITION OF UTTAR PRADESH

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Abstract

India has the legitimate pride of being the largest producer of castor (*Ricinus communis* L.) in the world from the largest

castor-growing acreage. Besides meeting the domestic demands, India earns sizeable foreign exchange through the export of castor oil and its derivatives. Selection of suitable hybrid/variety is very essential for obtaining good yield in the particular location. Thus, this trial was conducted at Oilseeds Research Farm, Kalyanpur of the University to observe the performance of different hybrids/ varieties of castor. The experiment was carried out during *Kharif* - 2015-16 in randomised block design with three replication. Among 24 entries, hybrid NCH-1 produced highest seed yield of 1349kg/ha closely followed by RCH-424 (1324kg/ha), SHB-982 (1284kg/ha) and variety Chandraprabha which gave seed yield of 1219kg/ha. The lowest seed yield (803kg/ha) was recorded by hybrid DCH-1715.

SOIL HEALTH MANAGEMENT AND PRACTICE : KEY FACTOR FOR CROP PRODUCTIVITY

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Abstract

Healthy soil is the foundation for profitable, productive, and environmentally sounds agricultural systems. By understanding how the soil processes that support plant growth and regulate environmental quality are affected by management practices, it is possible to design a crop and soil management system that improves and maintains soil health and crop productivity. Proper soil management practices are considered as a better way to enhance agriculture production in healthy soil without forgetting environmental quality, human and animal health. Soil management practices, cropping systems, and weather conditions influence soil health. Therefore, a healthy soil that is well managed can increase soil water infiltration and storage, storage and supply of nutrients to plants, microbial diversity, and soil carbon storage. Soil organic matter (SOM) is a central soil property that is heavily affected by management practices, which in turn influences soil physical, biological, and chemical functions. The soil management practices improve soil health through their influence on soil aggregation and soil micro flora and fauna: conservation tillage, crop rotations, intercropping, cover cropping, agroforestry, organic manure amendment, soil liming and inoculation of different effective microorganisms. These practices have positive influences on nutrient availability to the crops through soil microbial activities and the increase of soil microbial population, diversity and functions. Soil having better structure, texture and effective microorganisms will enhance crop productivity. Healthy soils increase the capacity of crops to withstand weather variability. A healthy soil is always the key factor for improving crop productivity.

CRITICAL ANALYSIS OF PROBLEMS AND PROSPECTS OF PEA CULTIVATION IN KOTA REGION OF RAJASTHAN

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Abstract

The present study was conducted in Kota region of Rajasthan. Kota region consist of five districts, out of which three districts namely Bundi, Kota and Tonk were selected purposively on the basis of maximum area under pea cultivation. Two tehsils from each identified districts were selected on the basis of maximum area under pea cultivation. Thus, in all six tehsils were taken for the present study. Total twenty villages were identified on the basis of proportionate sampling from the selected tehsils. To select the respondents, a comprehensive list of all pea growers was prepared for all villages. Thereafter, the farmers were categorized into two groups *i.e.* small and marginal on the basis of pea cultivation. The respondents selected randomly from each category of the farmers. It was planned to select 10 respondents *i.e.* five in each category from the each selected village. Thus, the total sample size of the study was 200 respondents. Data were collected through prestructured interview schedule. The after, data were analyzed and results were interpreted as given below: The study revealed that out of 200 respondents, 50.50 per cent respondents had medium level of knowledge, while 28.50 and 21.00 per cent farmers having high and low knowledge level regarding pea production technology respectively. It was also noted that extent of knowledge of marginal farmers was from 38.73 to 80.60 per cent, whereas in case of small farmers the extent of knowledge was found to be from 40.20 to 82.30 per cent in all improved cultivation practices of pea. There was significant difference in knowledge between marginal and small farmers about improved pea production technology. The findings revealed that 45.50 per cent

respondents had low information processing behaviour and 31.50 per cent farmers having medium level of information processing behaviour. Whereas, only 23.00 per cent respondents were observed in high information processing behaviour group. There was significant difference in information processing behaviour between marginal and small farmers about pea cultivation technology.

ANALYSIS OF POST- HARVEST LOSSES IN PADDY AND WHEAT IN DISTRICT KANPUR DEHAT, UTTAR PRADESH

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Abstract

While enhancing our Agricultural production system itself it is a big challenge but it is further aggravated by post harvest losses. From many times the major emphases was given on generation and refinement of production technology for enhancing the productivity of per unit area of crops. However, the benefit of increased production has not reached the farmers proportionately due to post harvest losses in food grains particularly in paddy and wheat crop cultivators suffer such huge losses. The productivity of wheat in selected district Kanpur dehat was highest from other districts of Kanpur division during 2016-17. Likewise, the average yield of paddy in district Kanpur dehat was higher than the average yield of other districts of Uttar Pradesh. Therefore, the district Kanpur dehat was selected for the study. Two blocks namely Maitha and Rasulabad under district Kanpur dehat were selected. Over all 100 farmers from both the blocks were selected for detailed study. It was estimated that the total losses at different stages in paddy and wheat under Maitha block were found 17.40 and 14.90% respectively while the total losses at different stages in paddy and wheat under Rasulabad block were found 13.30 and 12.90% respectively.

DIVERSITY INTOTAL PHENOL AND FLAVONOIDS AMONG LITCHI GENOTYPES

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Abstract

An investigation was carried out to determine the differences in phenolic and flavonoids profiles on by-product of (*Litchi chinensis* Sonn.) from thirty genotypes available in India at ICAR-NRC on Litchi, Muzaffarpur, Bihar during 2017 and 2018. Litchi contains significant amounts of phenol and flavonoids which have been found to exhibit diverse biological activities. The results indicated that the total by-product in litchi fruit varied from 19.85 per cent in genotype IC-0615587 to 59.54 per cent in genotype IC-0615595. The maximum seed and pericarp per cent was found in genotype Coll.38 (22.58%) and genotype IC-0615595 (36.96%), respectively. A wide variation in total phenol and flavonoids content has been observed in the present study. The maximum phenol in pulp was found in genotype IC-0615593 (8.41 mg GAE/g) followed by IC-0615588 (7.9 mg GAE/g) whereas, lowest was found in genotype IC-0615600 (0.2 mg GAE/g) followed by IC-0615594 (0.24 mg GAE/g).The highest phenol in pericarp was found in genotype IC-0615613 (61.24 mg GAE/g) followed by IC-0615588 (56.44 mg GAE/g) whereas, lowest phenol was found in genotype IC-0615606 (8.57 mg GAE/g) followed by Coll. 35 (9.3 mg GAE/g) and maximum phenol in seed was found in genotype IC-0615597 (86.56 mg GAE/g) followed by IC-0615603 (74.41 mg GAE/g) whereas, the minimum phenol in seed was recorded in Coll. 35 (23.68 mg GAE/g) followed by IC-0615608 (24.12 mg GAE/g) and IC-0615606 (25.49 mg GAE/g). The maximum pulp flavonoid content was observed in genotype IC-0615613 (23.88 mg GAE/g) followed by genotype IC-0615586 (21.02 mg GAE/g) whereas lowest was found in genotype Coll. 36 (0.5 mg GAE/g). Similarly, the highest flavonoids in pericarp was found in genotype Coll.37 (96.49 mg CE/g) followed by IC-0615613 (96.37 mg CE/g) while, the minimum flavonoid in pericarp was found in genotype IC-0615610 (0.75 mg CE/g) followed by IC-0615600 (0.79 mg CE/g). The maximum flavonoid content in seed was observed in genotype IC-0615586 (27.50 mg CE/g) followed by IC-0615602 (20.79 mg CE/g) whereas, the minimum flavonoid content in seed was found in genotype IC-0615597 (2.41 mg CE/g) followed by IC-0615591(2.92 mg CE/g) and IC-0615592 (3.20 mg CE/g). The correlation study showed that total phenol in pulp had significant positive correlation with total phenol in pericarp (0.483). The total phenol in pericarp had significant positive correlation with flavonoids content in pericarp (0.413) and had highly significant negative correlation with per cent of seed (-0.635) in fruit.Similarly, flavonoids in pulp had significant positive correlation with total flavonoids in seed (0.460). Theflavonoids in pericarp had significant negative correlation with

flavonoids in seed (-0.436) but had positive correlation with per cent of pericarp (0.341). Total phenol in seed had positive correlation with per cent of pericarp (0.336) in fruit at harvesting.

NUTRITIONAL PARAMETERS OF RASOGOLLA PREPARED FROM COWMILK CHHANA AND HERBAL COAGULANTS

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Abstract

Rasogolla is popular sweetmeat prepared by chhana in South Asia. Rasogollas contains high amount of protein, fat, minerals and vitamins. The study was conducted in the department of animal husbandry & Dairying, CSAU Ag & Tech. Kanpur. The Rasogolla was prepared from cow milk as was used for making chhana and four different types and levels of coagulants Citric Acid 2%, Lactic Acid 2%, Papaya Extract 160ml/L, Ginger Extract 65ml/L as A_1, A_2, A_3, A_4 and two sugar levels 50%, 60% as B_1, B_2 and storage period of the product are analysis on 0,3, 6, 9, 12,15 days as represented D_1, D_2, D_3, D_4, D_5, D_6 respectively, and replicated three times. The experimental treatment combination ($A_1B_1C_2D_6$) of rasogollas contained highest percentage of fat (7.32%). The highest percentage of protein (6.60%) was found in treatment combination ($A_3B_1C_2D_6$). The experimental treatment combination ($A_1B_2C_2D_6$) contain highest percentage of sucrose (95.26%). The highest percentage of ash (0.522%) was noted in experimental treatment combination ($A_4B_1C_2D_6$). The highest total solid content (59.95%) was found in the treatment combination ($A_1B_2C_1D_6$)

EVALUATION OF HERBAL RASOGOLLAS ON BASIS OF SENSORY PARAMETERS

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Abstracts

Rasogolla is popular sweetmeat prepared by chhana in South Asia. Rasogollas contains high amount of protein, fat, minerals and vitamins. The study was conducted in the department of animal husbandry & Dairying, CSAU Ag& Tech. Kanpur. The Rasogolla was prepared from cow milk as was used for making chhana and four different types and levels of coagulants Citric Acid 2%, Lactic Acid 2%, Papaya Extract 160ml\L, Ginger Extract 65ml/L as A_1, A_2, A_3, A_4 and two sugar levels 50%, 60% as B_1, B_2 and storage period of the product are analysis on 0,3, 6, 9, 12,15 days as represented D_1, D_2, D_3, D_4, D_5, D_6 respectively, and replicated three times. The experimental treatment combination ($A_4B_1C_1D_1$) of rasogollas contained highest scores (8.60) in flavor&Taste. The highest scores of body and texture (8.50) was noted in ($A_1B_1C_1D_1$) samples, while minimum scores (3.80) in treatment combination ($A_4B_2C_2D_6$) sampels. In colour and appreances maximum scores (8.70) was recored in experimental treatment. The highest scores (8.40) was recorced in ($A_1B_1C_1D_1$) for sweetness. The overall acceptability score of rasogollas maximum was (8.60) noted in ($A_1B_1C_1D_1$) and minimum scores (3.90) was noted in ($A_4B_2C_2D_6$)

ACCEPTABILITY SCORES AND ENHANCEMENT OF NUTRITIONAL QUALITY PARAMETERS OF POMEGRANATE PEEL POWDER ENRICHED COOKIES.

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Abstract

Fruit peel is generally discarded in majority of fruits juice corners. Even when it is safe for consumption. Peel is recognized as essential components of diet as it contains vital nutrients which play important role in well being. Pomegranate peel is rich source of flavonoids which is powerful antioxidant and protect cells from cancer-causing free radicals. Pomegranate peel can be incorporated in cookies to enhance its fiber content. On basis of findings it was observed that average sensory scores of

different parameters in control and treated sample of *pomegranate peel cookies* indicates that treatments T_2 (8.7) had highest score followed by T_1 (8.2), T_0 (7.3) and T_3 (6.3) making it obvious that an increase in amount of Pomegranate peel powder also increase Overall acceptability of *Cookies* gradually. At 10% of Pomegranate peel flour incorporation overall acceptability was maximum but it slightly decreased when level of incorporation was increased to 15%.

PHENOLICS AND ITS RELATION WITH FLOWERING IN LITCHI (*LITCHI CHINENSIS* SONN)

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Abstract

Litchi (*Litchi chinensis* Sonn.) is one of the most important subtropical fruit of India.It is perennial fruit trees originating from southern China need cool and/or dry environmental conditions especially during flower bud differentiation which triggers flower induction to ensure good flowering and fruiting.Tree growth occurs as periodic, ephemeral flushes of shoots emerging from apical or lateral resting buds before returning to a quiescent state. Periods of stem dormancy are short in young plants but can last more than 8 months between flushing episodes in mature trees. A flower stimulus (Florigen) is produced in leaf and move to shoot to induce floral bud. Irregular flowering is major problem especially at juvenile phase of the tree and some cultivars of litchi shows alternate bearing or shy bearing which ultimately reduces productivity of the crop. There are many factors associated with irregular bearing and litchi contains greater amount of secondary metabolites (Phenol and flavonoids) which might have important role in litchi flowering and fruiting.To establish a relation between phenolics and flowering, the present study was conducted on 20 diverse litchi genotypes were grown at ICAR- National Research Centre on Litchi, Muzaffarpur for two year (2016-17 and 2017-18). Ten years old tree of all genotypes were arranged in randomized block design with three replications at spacing of 8 m (row to row and plant to plant). The great variations in total phenol and flavonoids among the genotypes in flowering and non-flowering trees were recorded. The total phenol content in leaf was varied from 22.86 – 53.59 mg/g in flowering tree among the genotypes while it was ranged from 10.03 – 33.7 mg/g in non-flowering tree during 2017. The highest phenol content was recorded in genotypes IC-0615590 (53.59 mg/g) whereas lowest was found in genotype IC-0615589 (22.86 mg/g) during 2017. The difference in phenol content between flowering and non-flowering tree ranged 12.74 -66.09%. The genotype IC-0615598 contained 66.09% more phenol in flowering tree as compared to non-flowering and IC-0615597 possessed 12.74% more phenol in flowering tree as compared to non-flowering tree in 2017. Similarly, phenol content was ranged from 16.51-50.35 mg/g in flowering tree among the genotypes whereas, it was ranged from 6.45 – 31.17 mg/g in non-flowering tree in 2018. The highest phenol was found in genotype IC-0615590 (50.35 mg/g) whereas, lowest was found in IC-0615593 (16.51 mg/g) in 2018. The difference in phenol content between flowering and non-flowering tree ranged 3.27-71.46%. The genotype IC-0615604 possessed 71.46% more phenol in flowering tree as compared to non-flowering tree and IC-0615593 contained 3.27% more phenol in flowering tree as compared to non-flowering tree. The level of total phenol in litchi tree varied from year to year but flowering tree always possessed more content of phenol as compared to non-flowering tree during flowering. The phenol acts as analogues of hormone which trigger floral development in litchi. The flavonoids content in leaf varied irrespective of flowering and non-flowering trees and there no clear information was obtained that flavonoids are high or low in flowering or non-flowering tree. It can be concluded that floweringhasdirect relation with phenol, not with flavonoids.

ENTREPRENEURIAL BEHAVIOR OF TOMATO GROWERS IN PANAGAR BLOCK OF DISTRICT JABALPUR (M.P.)

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Abstract

The present study entitled “Entrepreneurial behavior of tomato growers in Panagar Block of District Jabalpur (M.P.)” was focused to know the Entrepreneurial behavior of tomato growers. The total sample size consists of 120 tomato growers selected from 6 villages of Panagar block of Jabalpur district. The primary data pertains to the year 2016-2017 were collected from the respondents through survey and personal interview method. The present study is an endeavour to fill some of the gaps in the area of farm entrepreneurship where the studies are insufficient. The study reveals that the majority of tomato

growers were middle age group to young age, acquired the majority from up to primary level to higher education, having small to marginal size of land holding, and tomato growers were having 0.501 to 1 ha area, and they had medium annual income, the tomato growers had medium scientific orientation, the half of tomato growers were having medium economic motivation, the majority they had medium extension contact, and had utilized medium information sources, they had medium to high level of Knowledge, and having medium adoption level and the higher percentage of tomato growers had medium entrepreneurial behavior.

EVALUATION OF MANGO CULTIVARS AND RECIPES FOR PREPARATION OF RTS BEVERAGE

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Abstract

The present investigation entitled "Evaluation of Mango Cultivars and Recipes for Preparation of RTS Beverage" was conducted during the year 2014-15. on summer season mango crop. Among the 12 treatment combinations consisting of 3 levels of sugar, i.e. (100g, 120g and 140g per lit. Of RTS) 2 levels of citric acid i.e. (0.50g and 0.75g per liter of RTS) and two cultivars of mango (Totapuri & Neelum) were use for the preparation of RTS. higher concentration of sugar and lower concentration of citric acid increased the TSS per cent of mango RTS and this effect was observed up to 80 days of storage. Similar, effect of sugar contents with various recipes (1 to 3) with 100g, 120g, 140g, of sugar + 0.50g, 0.75g of citric acid per liter of RTS. The observations revealed that the order of % acidity was increased in accordance with the increasing storage period gradually up to 80 days of storage. The highest (%) acidity (0.079) was recorded with the recipe 2nd. (10% Pulp + 100 g sugar + 0.75g Citric acid / litre) TSS/Acid ratio was recorded (382.85) with the recipe 11th (0.50g citric acid + 120g sugar per liter of RTS). The maximum pH value (4.84) was recorded with RTS of 11th recipe (10% Pulp +140 g sugar + 0.50 g citric acid / litre) and the recipe 4th showed maximum value of ascorbic acid content (26.00g/100ml of RTS).

EFFECT OF PLANT GROWTH REGULATORS ON GROWTH, FLOWERING AND QUALITY OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL).

Jyoti Singh
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Abstract

The experiment was laid out in randomized block design with three replication at Deptt of Horticulture, CSAUAT Kanpur (UP) during rabi season 2016 to 2017 with the objectives to study the effect of varying levels of NAA, 2, 4-D and GA3 on growth, flowering and quality of tomato and to ascertain the best concentration of NAA, 2, 4-D and GA 3 for vegetative growth and fruit quality of tomato. The experiment consisted one tomato variety viz. Azad T6 and different levels of NAA (20, 30, 40 ppm), 2, 4-D (2.5, 5.0, 7.5 ppm) and GA 3 (10, 20, 30 ppm) of different concentrations were used. The result showed maximum yield per hectare. These results are of my own study and are unique and can be very useful in research from trial to field, so it will be of interest to implement these results to the field to harvest good yield of tomato.

VARIABILITY STUDIES IN DIFFERENT ACCESSIONS OF JAMUN (*SYZYGIUM CUMINI* SKEELS) FROM MADHYA PRADESH

Vijay Agrawal, N.R. Rangare and Reena Nair

Abstract

A survey was carried out during 2016 in Madhya Pradesh, India to identify elite genotypes of jamun. Morphological qualitative, quantitative characteristics and biochemical attributes of sixteen genotypes were studied. The study revealed that there was a wide variation among the accessions. JJ-5 was the most promising genotype among the 16 accessions for average fruit weight (55.40 g), fruit length (27.78 mm), fruit width (22.01 mm), pulp weight (31.60 g) and seed weight (14.70g). This genotype can be used for table purpose as well for preparation of seed powder. The biochemical characteristics also showed high variability among all the accessions of jamun. Maximum TSS was found in JJ-4 (21.25° Brix) and JJ-3 (19.85° Brix). Acidity was highest (0.53%) in JJ-9 and ascorbic acid in JJ-15 (42.30 (mg/100 g).

IMPACT OF PRUNING INTENSITIES ON CROP AND WOOD PRODUCTION UNDER *DALBERGIA SISSOO* ROXB. BASED AGRISILVICULTURE SYSTEM

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Abstract

Agricultural crops grown with agroforestry trees relatively poor yielder due to effect of shade. The shade is important factor affecting production and compatibility in an agroforestry system. Management practices of trees and crop are very necessary to get optimum production from an agrisilviculture system. For this point of view the present investigation carried out in 15 year old *Dalbergia sissoo* plantation with paddy crop at New Dusty Acre research form, Department of Forestry, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during kharif season with four pruning intensity 0% (no pruning), 25 %, 50%, 75 % pruning and open condition (without tree). The result showed that open condition showed higher number of tllers, number of effective tillers, length of panicles, test weight, grain yield and straw yield (72.1, 51.3, 25.3 cm, 30.2 g, 26.8 qha^{-1} and 45.5 qha^{-1}). Among different pruning intensity 75 % pruning intensity found higher number of tllers, number of effective tillers, length of panicles, test weight, grain yield and straw yield (68.5, 50.3, 24.2 cm, 27.0 g, 23.7 and 40.5 qha^{-1}), whers as no pruning recorded significantly lowest growth and yield of paddy. The 25 % pruning recorded higher tree height, dbh, cylindrical volume and stand biomass (11.50 m, 23.50 cm, 193.8 m^3 ha^{-1} , 150858 Kg ha^{-1}) followed by no pruning and 50 % pruning. The managed agroforestry system was found higher net monetary return (47761 Rs. ha^{-1}) than the tree alone and crop are growing without tree.

BENEFICIAL EFFECT OF MICRONUTRIENTS ON ECONOMICS OF BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALICA*) CV. GREEN MAGIC

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Abstract

A field experiment was conducted to study of "Effect of different micronutrient on plant growth, yield and flower bud quality of broccoli (*Brassica oleracea* var. *Italica*) cv. Green Magic" during *rabi* season 2015-16 at Vegetable Research Field, Central Orchard, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad (U. P.) India. The experiment was laid out in Randomized Block Design (RBD) with 10 treatments and each replicated thrice. The four micronutrients B, Mo, Mn and Zn were applied @ of (3:0.5:2:2.5 kg/ha) in which the application of micronutrients was found economically best treatment T5 (B+Mn+Zn) with the benefit: cost ratio of (3.47:1 follow 1.42:1), respectively T0 (control). Treatment T5 (B + Mn +Zn) was recorded maximum gross return (Rs 277,080 ha-1) followed by Rs. 239,180 ha-1 with T7 (B + Mo + Mn+ Zn), while the minimum gross return (Rs 106,680) was recorded with (conrol).

IDENTIFICATION AND MAPPING OF GENE(S) FOR RESISTANCE TO BPH IN RICE (*ORYZA SATIVA* L.)

Prakriti Meshram, Sandeep Bhandarkar, D.K. Rana, S.K.Nair, Vipin Kumar Pandey and Vishal Kumar Gupta
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Abstract

Identification and the incorporation of new BPH resistance genes into modern rice cultivars are important breeding strategies to control the damage caused by new biotypes of BPH. DNA marker based technology is being increasingly used to overcome difficulties of plant breeding based on phenotypic characters like insect resistance. Molecular breeding approaches facilitate the early and efficient selection for resistance genes. Simple sequence repeats (SSR) or Sequence Tagged Microsatellite Site (STMS) markers are tandem repetitions of mono, di, tri or tetra nucleotide units. Studies in various organisms provide

evidence that the number of microsatellite sequences in a genome, their length, composition, mutation rate and chromosomal distribution can vary drastically among taxa. These features coupled with the ease of detection and transferability between laboratories has made them an excellent marker system for genome analysis. Simple sequence repeat (SSR) marker loci are widely distributed in the rice genome and can be easily analyzed using PCR. SSR markers have been extensively used to map rice for disease and insect resistance. The gene mapping involves identification of polymorphic markers between parents and establishing marker- trait association using segregating populations. QTL mapping involves construction of genetic maps and searching for relationship between traits and polymorphic markers. A significant association between traits and the markers is the evidence of QTL near the markers. In rice, a substantial progress has been made to identify and map several genes conferring BPH resistance. Now, efforts are underway to refine the map positions of important BPH resistance genes and QTLs using molecular markers to enable marker assisted selection for BPH resistance in breeding programmes.

MEDICINAL PROPERTIES OF RICE: ITS FUTURE STRATEGY IN ANTHER CULTURE FOR CHHATTISGARH

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Abstract

Rice is the leading crop produced and consumed on a large scale in the state of Chhattisgarh that is it is a staple food of the inhabitants residing in the domical, and is variably rich in genetic diversity. Rice production is the principal activity and a major source of income for the State. Traditional rice varieties have an enhancing potential in wide range of neutraceutical and functional foods. Traditional healers and local farmers have been using these traditional varieties in ayurveda and in curing of various kinds of ailments, such as cooling the body in ayurvedic treatments, removing weakness of mothers after delivery, curing of joints pain, cure for prolonged cough husk smoke is also used for half side headache in human being. Some local varieties are also used for easy removal of placenta of cow after delivary, better for removal of cattles weakness. Extracts of brown rice are also used as energy drink in individuals, patients and in treatment of chronic gastric problems, jaundice, dysenteric complaints and to increase lactation and nutrition to Childs. Diabetic patients should include brown rice rather than white rice, which contains low levels of glycemic index, provides a person with almost 100% of their daily manganese requirement. *In vitro* androgenesis is an important component of plant biotechnology when the pollen grains are forced to switch from their normal pollen developmental pathway towards an embryogenic route. Haploid and doubled haploid produced through androgenesis have long been recognized as a valuable tool in plant breeding as it can shorten the breeding cycle, fix agronomic characters in homozygous state and enhance the selection efficiency of useful recessive agronomic traits. Recently, doubled haploids have been largely recognized as an important component of crop improvement through genome mapping, quantitative trait locus analysis, and genetic mutation, and as targets for genetic transformation programs. Thus, this review is focused mainly on various facets of doubled haploid in the chief staple food crop rice and sights its recent applications in plant breeding, genetics and genomics. The nutritional value of rice needs to be improved even more so that it benefits mankind. It, being the most dominant cereal crop in most of the world can improve the lives of millions of people who consume it.

GERMPLASM EVALUATION OF CUSTARD APPLE (*ANNONA SQUAMOSA* L)

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Abstract

A survey was carried out during 2016 in Madhya Pradesh, India to identify elite germplasm of custard apple. Morphological qualitative, quantitative characteristics and biochemical attributes of sixteen genotypes were studied. The study revealed that there was a wide variation among the accessions. JCA-5 was the most promising germplasm among the 16 accessions average fruit weight (363.0g) fruit width (91.46), fruit volume (330.00cc) and Good quality germplasm should posses less rind weight. This germplasm can be used for table purpose as well for preparation of mixed jam and bar. The biochemical characteristics also showed high variability among all the accessions of Custard apple. The maximum TSS (30.90°Brix), ascorbic acid (21.60mg/100g), reducing sugar (5.78%), non-reducing sugar (19.37%) and total sugar (22.98%) recorded under JCA-5 were as maximum acidity (0.275) under JCA-12.

AN ECONOMIC ANALYSIS OF MAJOR SPICES CROPS OF CHHATTISGARH

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Abstract

The present study was conducted in the Kanker district of Chhattisgarh. 150 farmers were selected from three blocks Kanker, Charama and Narharpur categorized into marginal, small, medium and large farmers based on their holding size. The primary data were collected for the year 2015-16. The major findings of this study revealed that the average size of farm was worked out to be 3.77 hectares, overall on an average cropping intensity was observed to be 202.19 percent. Out of total cropped area kharif, rabi, and zaid crops occupied about 54.00, 38.85 and 18.57 per cent of total cropped area respectively. On an average the cost of cultivation per hectare of Chilli, Coriander and Turmeric was found Rs.36576.63, Rs. 48135.60, and Rs 47303.00 respectively. Overall on an average the cost of production of Chilli, Coriander and Turmeric was observed as Rs.346.17, Rs .943.61 and Rs.1041.82. respectively. Cost of production per quintal of these Spices shows decreasing trend with increase in farm size where as cost of cultivation increase with increase in the farm size. Overall On an average the input-output ratio of Chilli, Coriander and Turmeric came to 1:3.43, 1:5.29, and 1:2.90 respectively on the sample farms. There were three marketing channels found for the marketing of spices, which are: Channel-I: Producer –Consumer. Channel-II: Producer – Commission agent/Retailer-Consumer and Channel –III: Producer – Shopkeeper– Consumer. More than ninety five per cent marketable surplus was observed in all the major Spices crops in different size groups of farmers. Horticultural (Spices) crop producer's cooperative societies should be formed for better performance and achievement. Some specific minimum prices should be declared for Spices to ensure benefit for the producers.

ARTIFICIAL GENETIC VARIABILITY CREATION FOR PIGEONPEA IMPROVEMEN

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Abstract

Pulses exist pioneering in a key role Indian agriculture. Within this protein-rich group of crops, red gram or pigeonpea occupies an important role between rainfed resource and poor farmers because it provides quality food, fuel wood fodder and broom. Hybrids are plants that result from controlled cross-breeding of two different but specific varieties or breeding lines of the same species of plant. One common feature of domesticated plants is condensed genetic diversity paralleled to their wild families. Two key forces that basis the drop in genetic diversity are lesser population sizes (''Bottleneck effect'') that happen during the primary formation of a domesticated lineage, and selective sweeps and/or directional selection for genes related with domestication traits. Domestication is a human social-ambitious process; it can also be predisposed by random gene flow from wild relatives. Constricted genetic base coupled with low levels of resistance against important biotic/abiotic stresses in cultivated pigeonpea is the major constraint affecting its production and productivity globally. Wild species are important birthplaces of resistance to biotic and abiotic stresses as they have evolved to survive droughts, floods, extremes of temperature (heat/ cold), and have the ability to tolerate damage by insect pests and diseases. Wild *Cajanus* species are the reservoir of many important genes and can be utilized to improve the crop cultivars, enrich variability, and increase the genetic base. Pre-breeding populations involving wild *Cajanus* species from the secondary and tertiary genepools as Donors. In wild *Cajanus* species, new and diverse sources of resistance/tolerance to various biotic stresses, such as alternaria blight, phytophthora blight, sterility mosaic disease, pod borer, cyst nematode, and abiotic stresses, such as salinity, as well as accessions with agronomically desirable traits, such as early flowering, high seed number per pod, high seed protein content and photoperiod insensitivity have been identified. Ten alleles reported exclusive to inter-specific derivatives of *Cajanus cajan* x *C. scarabaeoides*. The presence of alleles unique to specific population or group shows an incomparable genetic variability at confident loci. This material is valuable to classify interspecific hybrids with exclusive genetic variability, whose

selection can increase the allele abundance of breeding population. High levels of resistance is presented in wild *Cajanus* species, these are not being exploited sufficiently in pigeonpea breeding programs. The major restriction is due to the linkage drag and different incompatibility barriers between cultivated and wild species. Under such situations, prebreeding provides an exceptional prospect to increase primary genepool by exploiting genetic variability present in wild species and cultivated germplasm, and will ensure continuous supply of new and useful genetic variability into the breeding pipelines to develop new cultivars having high levels of resistance and broad genetic base. Exploitation of wild *Cajanus* species has also subsidized expressively in the direction of improvement of nutritional quality of cultivated pigeonpea. Some wild *Cajanus* species namely *C. scarabaeoides, C. sericeus, C. albicans, C. crassus, C. platycarpus,* and *C. cajanifolius* have higher seed protein content (average 28.3%) compared to pigeonpea cultivars (24.6%). The major limitation in well using *Cajanus platycarpus* for the enhancement of cultivated pigeonpea is embryo abortion in the BC1 generation from the cross *C. platycarpus* × *C. cajan*. *Cajanus platycarpus,* although placed in the tertiary gene pool of pigeonpea, is now amenable to gene transfer with the development of suitable embryo rescue techniques.

EFFECT OF TREE CANOPY MANAGEMENT IN *DALBERGIA SISSOO* ROXB. ON PRODUCTIVITY OF TURMERIC UNDER AGRI-SILVICULTURE SYSTEM

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Abstract

The shade is important factor affecting production and compatibility in an agroforestry system. Turmeric is a shade loving crop which was well grown under shading condition. The present investigation was carried out to known about growth and yield of turmeric under well established 16 years old *Dalbergia sissoo* plantation at New Dusty Acre area, Department of Forestry, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during Kharif season of 2014-15 with four pruning intensity 0%, 25 %, 50%, 75 % pruning and open condition (without tree). The result showed that all observations, significant increase was noted at 25% pruning i.e., leaf area index, number of fingers (3.2, 5) and fresh yield (3385.9 kg/ha) followed by 50% pruning (2.8, 4.8 and 3221.3 kg/ha) whereas, open conditions recorded significantly lowest leaf area index, number of fingers (2.7, 3.6) and fresh yield (3012.9 kg/ha). The morphological growth and biomass of *D. sissoo* was also influenced by pruning intensity. The higher tree heght, dbh, cylindrical volume and stand biomass (13.1 m, 26.2 cm, 293.3 m^3/ha and 12833 kg/ha) was found under 25 % pruning followed by 50 % pruning whereas, lowest found under 75 % pruning. The 25% pruning recorded significantly higher net monetary return (149873/ha) at par with no pruning (Rs118245/ha) under *Dalbergia sissoo* Roxb. Agri-silviculture System.

FOOD SECURITY OF INDIA

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Abstract

Food is essential to the survival of people and grain is the principal food. Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active living and healthy life. South Asia houses well around 1/5th of the world's population and around 1/5th of world's undernourished people. India is home to 25 per cent of the World's hungry population. Food security concerns are very important for developing countries like India, where a large percentage of its population is poor and devotes a high share of total household expenditure to food. India has moved away from dependence on food aid to become a net food exporter, with a five-fold increase in foodgrain production from 50 million tonnes in 1950-51 to about 277 million tonnes in 2017-18. Food production is base for food security as it is a key determinant of food availability. India is a net agricultural exporter, particularly of milk, fruits and vegetables and cereals. However, food availability is threatened by the effects of climate change and declining water resources on agricultural output. It impacts crops, livestock, forestry, fisheries and aquaculture, and can cause social and economic consequences in the form of reduced incomes, trade disruption and adverse effect on health.

STUDIES ON POLLEN MORPHOLOGY, VIABILITY AND GERMINATION IN RASPBERRY FRUITS (RUBUS ELLIPTICUS) UNDER HILLY CONDITIONS OF UTTARAKHAND

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Abstract

The present investigation was carried out at College of Horticulture, Uttarakhand University of Horticulture and Forestry, Bharsar during 2015-2016. The experiments were subjected to Complete Randomized Block Design (CRD) analysis under laboratory condition. The pollen grains of raspberry exhibited the average size (length x width) of 177.73 x 124.43µ in glycerol conditions, followed by (173.29 x 173.29 µ) in water suspension. The viability of fresh pollen grains ranged from 32.50 % to 97.70 % in hermaphrodite or bisexual flowers. 25 % sucrose solution + 0.4 % boric acid solution showed the highest pollen germination of 36.66% with the maximum pollen tube length (284.37µ), after 48 hours interval. After 3 days storage, the pollen grains were quite normal and showed 46.66 % germination. The longetivity of pollen grains stored under room conditions have been presented in which indicate that on the 3rd day of storage, the pollen grains were quite normal and showed 97.70 % germination. But after that the longetivity of pollen decreased rapidly and after 9 days of storage, the viability dropped to nill. Hence, the studies indicated that the best concentartion solution (sucrose + boric acid) and different time intervals (6 to 48 hours) is suitable for raspberry production and breeding programme. At present, the area, production and productivity data in India is completely negligible. Due to poor knowledge about the raspberry Indian farmers do not cultivate it and rural folks used to exploit it from the wild. There is little literature about its pollen study in India. Therefore, to enlighten this part of the raspberry improvement present study is conducted.

THREE LINE BREEDING FOR CROP IMPROVEMENT

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Abstract

Male and female gametes are normal and functional, but can only produce offspring when correct parents are mated. Male sterility is the failure of plants to produce functional anthers, pollen, or male gametes. Koelreuterin 1763 reported male sterility in flowering plants. There are different types of male sterility *viz*., phenotypic (structural male sterility, sporogenous male sterility, functional male sterility) and genotypic (genetic, cytoplasmic, cytoplasmic-genetic male sterility). Genetic male sterility system in which sterility expression is conditional by environmental factors. In environmental sensitive genic male sterility, a particular range or concentration of environmental factor at sensitive stage of the crop, which occurs during panicle development, result in complete male sterility *i.e.* photoperiod sensitive genic male sterility, thermo sensitive genic male sterility, photo-thermo sensitive genic male sterility, micronutrient sensitive genic male sterility. Male sterility is also use in crop improvement for production of hybrids.When pollen sterility is controlled by both cytoplasmic and nuclear genes is known as cytoplasmic genetic male sterility. Cytoplasmic genetic male sterility includes A, B, and R lines.Hence it is also called as three line system.Jones and Davis first discovered Cytoplasmic genetic male sterility in 1944 in onion.The system consists of three lines: A line(CMS line),B line(maintainer line)and R line(restorer line)A line is a cytoplasmic male sterile seed parent used as female.B is similar to A in all features but it is a male fertile, it maintains the fertility and is referred as maintainer line.R is restorer line it restore the fertility in the F1 hybrid and is called restorer line. It is used commercially to produce hybrid seed in rice, maize, bajara, cotton, sunflower, jowar, etc.hybrid seed production involves the following two steps production of A line (A x B) or CMS multiplication production of hybrid seed (A x R).In cotton,three hybrids has been developed through the use of three line breeding *i.e.,*PKVHy3, PKVHy4 & MECH4.

ASSOCIATION ANALYSIS ON AROMATIC RICE GENOTYPES (*ORYZA SATIVA* L)

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Abstract

Rice (Oryza sativa L.) (2n=24) is the most important cereal crop that has been referred as "Global Grain" because of its use as prime staple food in about 100 countries of the world. Rice (Oryza sativa L.2n=24) is one of the most important cereal crop in the world and serves as the primary source of staple food for more than half of the global population. Association analysis is an important approach in a breeding program. It gives an idea about relationship among the various characters and determines the component characters, on which selection can be based for genetic improvement in the grain yield. Degree of association also affects the effectiveness of selection process. The present study was conducted during kharif season. The experiment was consisting of about 47 Aromatic genotypes of rice were selected for the study including 3 popular checks viz., Kalanamak, Badshahbhog and Indira Sugandhit Dhan-1 in a Randamized Block Design (RBD).Correlation coefficients were estimated at genotypic and phenotypic levels in all possible characters combinations. Grain yield per plant had positive significant correlation with number of unfilled grains per panicle and spikelet sterility %. Path analysis revealed that number of grains per panicle, number of unfilled grains per panicle, days to 50% flowering, leaf L/W ratio, panicle length, 1000 seed weight and leaf width showed positive direct effects on grains yield per plant.

AWARENESS LEVEL OF FARM FAMILIES ABOUT WATER SAVING METHODS IN WESTERN RAJASTHAN : BOON FOR COMING GENERATION

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Abstract

Water is needed to move, eat, reproduce, work and think, in other words, to survive and to live. Water resources are challenged in our world today due to pollution and overuse of the local resources. There are also fights for water between different users: farmers, people in cities and industries. We are using much more water than what is really needed and available in many locations around the world. This is due sometimes because of lack of water, but more often it is due to a bad management of the water resources available, bad or non-existent urban planning and bad or non-existent population planning. We are also wasting our water resources when we are discharging our wastes and sewage into it, making the receiving waters unsuitable for life.

SURVIVALITY OF BIO-AGENTS IN PRESENCE OF ORGANIC AMENDMENT IN SOIL

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Abstract

The population of four bioagents i.e. *Trichoderma harzianum, Trichoderma viride, pseudomonas fluorescens* and *Bacillus subtilis* and the effect of three organic amendment viz., farm yard manure, vermicompost and mustard cake on survival of bioagents.significantly higher in three amended soil as compared to un amended control. The four respective bio-agents were enumerated in selective media at monthly interval up to 180 days of soil application of bio-agents. The recovery of this bio-agent was found at 30 days after application as compared to initial stage i.e. immediate after soil application. The survival of the bio-agent was relatively better in mustard cake amended soil as compared to farm yard manure and vermicompost amended soils. The population of *T. viride* was considerably less in unamended soil as compared to amended soils. The population of *P. fluorescens* was considerably higher in amended soils as compared to control i.e. unamended soil. The population of this bacterium in soil gradually decreased from 30 days of soil applications onwards up to 180 days. Survival of the bacterium was higher in mustard cake and vermin-compost amended soil as compared to soils amended with farm yard manure. Statistical analysis of data revealed that A perusal of the data showed that mustard cake and vermicompost was slightly better for survival of *B. subtilis* in comparison to farm yard manure. The survival of *B. subtilis* was relatively less in unamended control in comparison to amended soils.

BIOINFORMATICS IN CROP IMPROVEMENT

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Abstract

Bioinformatics is an interdisciplinary area of the science composed of biology, mathematics and computer science. Bioinformatics is the application of information technology to manage biological data that helps in decoding plant genomes. Bioinformatics involves biological databases and bioinformatics tools. Biological databases are archives of enables of consistent molecular biological data that are stored in a uniform and efficient manner to enable easy retrieval of information. Bioinformatics tools are software that are used to analyze the databases. BLAST (Basic Local Alignment Sequence Tool) is one of a number of generally available programs doing sequence alignment. Crop improvement being a challenging science and fortunately, genomics resources and tools such as bioinformatics are already available which are assisting to give another quantitative leap in plant breeding. Beside this bioinformatics will also help conventional breeding in achieving important advances in the breeding of crops by identification of agriculturally important genes. The application of bioinformatics tools to practical plant breeding will thus push forward the genetics gain obtained by the breeding programmes.The complete genome sequence of the mustard plant *Arabidopsis thaliana* has been available to the scientist since 2000, similarly the rice complete genome sequence has been documented since 2005. Team from countries such Brazil, Chile, Russia, India, China, Peru and New Zealand are working to sequence all 840 million base pair of DNA on potato's 12 chromosome. All data may be used by the scientist to improve potato, which is the world's fourth most important crop. The importance of bioinformatics will grow as we continue to generate and integrate large quantities of genomic, proteomic and other data. As the amount of data grows exponentially, there is a parallel growth in the demand for tools and methods in data management, visualization, integration, analysis, modeling and prediction.

AONLA, A SEMI-ARID FRUIT : QUALITIES AND THERE STORAGE

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Abstract

Aonla (Emblica officinalis Gaertn) , also known as Indian gooseberry. The fruit is a good source of Vitamin C. The fruit is having medicinal value. It belongs to family Euphorbiacea and is widely pharmaceutical and processing industries because of the presence of some useful neutraceuticals like ascorbic acid and polyphenols. It has acrid, cooling, diuretic and laxative properties. Aonla are preferred for Muraba making average fruit weight 30g with light stone. Dried fruits are useful in haemorrhages, diarrhea, dysentery, anaemia, jaundice, dyspepsia and cough. Fruits are commonly used for preserving (murabbas), pickles, candy, jelly and jam. Aonla is used in the indigenous medicines (Ayurvedic system) viz. trifla and chavanprash. Besides fruits, leaves, bark and even seeds are being used for various purposes. Fruit are large size, light yellow at full maturity. An Aonla preserve, called aonla murabba is a processed product consumed in India, and is an important product in the indigenous system of medicine. It contains ascorbic acid 660mg per 100g. of pulp. Fruits have poor shelf life. The TSS of juice is 10%.

RESPONSE OF PHOSPHOGYPSUM TO VARIOUS CULTIVARS ON SOIL FERTILITY AND FODDER PRODUCTION OF OAT *(AVENA SATIVA* L.*)* IN SODIC SOILS

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Abstract

The field experiment was conducted to evaluate the effect of phosphogypsum levels to various cultivar on fertility and fodder

production of oat crop at Genetics and Plant Breeding Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh, India during *Rabi* season 2015-2016 under the project of All India Coordinated Research Project (AICRP) on forage crops. The twelve treatment were comprised of one time application of four levels of phosphogypsum on basis of sulphur content (0, 125, 250 and 375 kgha^{-1}) with three cultivar viz. NDO-1, NDO-2 and NDO-711 in randomized block design replication each treatment thrice. The experimental soil having silty loam in texture, pH (1:2.5) 8.59, EC 0.38 dSm^{-1}, Organic carbon 3.1 gkg^{-1}, available nitrogen 173.4, phosphorus 14.80 and potassium 195.10 kgha^{-1}. The plant spacing was row to row 25cm and plant to plant 5cm. The phosphogypsum was applied through broadcast and surface incorporation. The half dose of nitrogen @ 100 kg N ha^{-1} though urea, and full dose phosphorus @ 40 kg P_2O_5 ha^{-1} through Diammonium phosphate applied at the time of sowing of the crop. The remaining half dose of nitrogen was top dressed in standing crop at 25 DAS just after first irrigation of the crop. The cutting was done with the help of sickle at 50% flowering stage at 105 DAS to obtain the green fodder yield. The maximum fodder, dry matter and crude protein yield were obtained with the application of phosphogypsum @ 375 kg ha^{-1} (60 kg S ha^{-1}) along with V_3 (NDO-711) followed by phosphogypsum @ 250 kgha^{-1} and minimum was received with control with entry NDO-1. Subsequent reduction in pH and EC, build up of organic carbon, available nutrients viz. nitrogen, phosphorus and potassium with the application of phosphogypsum @ 375 kg ha^{-1} with the entry NDO-711.

PERFORMANCE EVALUATION OF MANUALLY OPERATED HAND HELD VEGETABLE SEEDLING TRANSPLANTER

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Abstract

Presently, manual transplanting method is being adopted at most of the area under vegetable cultivation. Manual transplanting one has to make a dug by hand and place the seedling in the soil and cover it. All operations need to be done in bending posture and very tedious. The labour and time consuming; it consumes the 260-320 man-h/ha. Semi-automatic vegetable transplanters are available in India for bare root, plug and pot type of seedlings. But they are too costly for small farmers. Therefore, a need was felt to develop a transplanter low cost, lightweight which can be operated at less efforts and higher work rate. Hence, hand-held vegetable transplanters for transplanting of vegetable seedlings on ridge/raised bed and plastic mulch has been developed to provide a solution to the manual operation at small farms. The hand held vegetable seedling transplanter consists of different component like handle, lever, hollow pipe, jaw and jaw operating lever. To raising the transplanter up to one feet height and allow to free fall in the soil, dropping the seedling in the seedling delivery tube, pressing the lever in upward direction which enable the jaw to open the soil and seedling was placed in the soil by gravity and lifting the transplanter with open jaw and close the after raising the transplanter by one feet height. It was evaluated in farmers field for inter and intra-row spacings of 45×45 cm. The result obtained from the trial tests concluded that transplanter functioned properly as there is no miss planting. The cost of operation is comparatively less than traditional method of transplanting. From visual observation we have seen that there is no damage to the seedling during operation. The transplanting capacity observed from trail is 0.03 ha/hr, theoretical field capacity is 0.035 ha/hr, field efficiency is 86.50% and also it is reduce the human labour efforts and time required for transplanting.

CHANGE IN FOOD CONSUMPTION PATTERN IN SELECTED HOUSEHOLD UNDER *WADI* PROGRAMME: AN EVIDENCE OF KORBA DISTRICT OF CHHATTISGARH

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Abstract

The present study is based on impact assessment on *wadi* programme. One hundred twenty *wadi* farmers were selected

randomly from Korba district for the year 2016-17 which were related to general characteristics of sample households and changes in food consumption pattern of the selected household before and after *wadi* programme. The major finding of these study revealed that the food consumption was mainly cereal based, large proportion of per capita expenditure and income was spent by all categories of households on cereals, pulses, edible oils, vegetables, sugar and jaggery, spices,addiction and a small portion on milk and its product, meat, fish and eggs,and fruits. In the study area observed that in total food and non-food expenditure comparatively maximum expenditure on food material (75.86%) and in non-food material (24.14%) in before *wadi*, and in after *wadi* food material (75.95%) and in non-food material (24.05%) expenditure done by sample households. Total percent change in per family was highest in food expenditure on meat, fish and egg product which is 189.07 percent followed by edible oil and pulses 125.58 percent and 100.06 percent, respectively after *wadi* programme. Total percent change in per family was highest in non-food expenditure on luxuries 101.47 percent followed by sanitation and vehicles 58.58 percent and 48.57 percent respectively.

PERFORMANCE OF KITCHEN GARDEN IN NUTRITIONAL DIVERSITY IN RURAL AREAS OF HAMIRPUR DISTRICT IN BUNDELKHAND REGION (U.P.)

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Abstract

Food security and nutritional diversity is one of the key areas that a developing country should address. The vast majority of hungry and malnourished people live in our countries under sub-standard living conditions. Kitchen garden is a realistic solution as in rural area to solve the nutritional insecurity. Thus the study were planned keeping in view to Improved food security, Increased availability of food and better nutrition through food diversity and enhanced rural employment through additional or off-season production in rural areas of Hamirpur district. To fulfil the objectives of the present study the purposive experimental study was planned. The study was conducted under Natural Resource Management Interventions (NICRA) Project in 02 villages Manki Khurd and Pachkhura Khurd of Hamirpur District. Twenty Five farm families were selected from each village. Thus the 50 farm families were selected for the study having area near the house of 150 m^2. It was found that farm families in useless land near the house (52 %) which were not used due to awareness followed by cultivated area near the house (20%), only 16 per cent farm family's available court yard for kitchen gardening in Hamirpur district of Bundelkhand Region. majority of the respondents were having no knowledge about variety of seeds and manure and fertilizer (98.00%) followed by manure and fertilizer (96.00%), Transplanting distance (76.00%) and Sowing time of vegetables seed (56.00%). Fifty per cent farm women have no knowledge about daily requirement of vegetables in daily routine diet. It was also found that average net income saved by the farm is Rs. **1478.25** through the kitchen garden.

EVALUATATION OF RECOMBINANT INBRED LINES OF BREAD WHEAT (*TRITICUM AESTIVUM* L. EM THELL) RESPONSE FOR STRIPE RUST RESISTANCE, GRAIN YIELD AND ITS COMPONENTS

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Abstract

Wheat is one of the world's most significant food crops which ranks first among cereals in production and serves as the staple food. It is also the prime cereal crop of India ranks second among cereal crops. Yellow (stripe) rust is one of the most predominant diseases of wheat in both North West Plain Zone (NWPZ) and Northern Hills Zone (NHZ), caused by *Puccinia striiformis* f.sp. *tritici* is one of the major foliar diseases of wheat worldwide, which severely damages wheat production every year, causing yield losses from 10 to 70%. These zones are selectively prone to yellow rust as the pathogen been reported to be prevalent at higher altitudes, cool and temperate regions where wheat is grown. The present investigation was conducted to evaluate 210 recombinant inbred lines of bread wheat to identify *Yr* genes using SSR markers, response to stripe rust reaction, grain yield and its component traits. Recombinant inbred lines were screened under epiphytotic conditions and data in terms of

per cent leaf area infected was recorded using Modified Cobb's Scale. A total of seven *Yr* genes, namely *Yr7, Yr18, Yr26, Yr29, Yr36, Yr47* and *Yr53* were found linked to yellow rust resistance. Out of forty *Yr* specific SSR markers, seven markers (*Xgwm130 (Yr7), Xbarc 352 (Yr18), Xgwm 11 (Yr26), Xwmc 44 (Yr29), Xwmc 149 (Yr53), WKS1_I (Yr36) and Xcfb309 (Yr47*) were found polymorphic in parental genotypes and RIL population indicating the presence or absence of *Yr* genes. Three RILs namely, 51, 52, 55 had largest number of resistant genes (4*Yr* genes) followed by six lines namely, RIL No. 20, 21, 23, 29, 39, 53 had 3*Yr* genes having disease score (0S). RIL Nos. 20, 21, 23, 29, 52 also had better performance than their respective mean values in terms of yield and its components. These RILs may be utilized for incorporation of these genes in well adapted genotypes for improvement of disease resistance in bread wheat.

EFFECT OF FOLIAR APPLICATION OF NAA, GA_3 AND ZINC SULPHATE ON FRUIT DROP, GROWTH AND YIELD OF BER (*ZIZYPHUS MAURITIANA* LAMK.) C.V. BANARASI KARAKA

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Abstract

The ber, Chinese date or Chinese fig is an ancient fruit tree of India and China. The Indian Ber belongs to family Rhamnaceae and genus Zizyphus. It is an extremely drought hardy and native fruit of India, found wild and cultivated. It is cultivated widely for its resistance to grow in drought and diversified soil and climatic conditions, and is known as "King of Arid Fruits" and also as good source of nutrients like Vit.C (50-150mg/100g). Vit. A and carbohydrate. Thus, there is a huge potential to improve market acceptability of ber with application of growth regulators and micronutrients. The present investigation was undertaken on the effect of foliar application of NAA, GA_3 and Zinc Sulphate on quality of ber (*Zizyphus mauritiana* Lamk.) c.v. Banarasi Karaka at main experiment station, Department of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology Kanpur (U.P.) during the years 2016–2017. Plants received uniform cultural operations throughout the experimental period. The experiment was conducted in randomized block design with ten treatments comprising of each three levels of NAA @ 10, 20 and 30 ppm, GA_3 @ 20, 30 and 40 ppm and Zinc sulphate @ 0.2, 0.4 and 0.6 % and control (water spray), respectively. Spray was done in month of November at fruit setting. The results were found that the foliar spray of $ZnSO_4$ @ 0.6% proved most effective in recording maximum initial fruit setting (159), fruit retention (12.22%) and minimum fruit drop (87.78%). The spray of GA_3 20 ppm resulted in maximum length (4.71cm), width (2.76cm) and volume (15.64cc), stone fruit weight (15.68g) and weight of fruit pulp (14.64g). The results were found that the foliar spray of $ZnSO_4$ @ 0.6% proved most effective in recording maximum fruit yield per tree (52.23 kg).

RESIDUAL EFFECT OF ZINC AND BORON ON YIELD AND QUALITY OF GROUNDNUT UNDER FINGER MILLET–GROUNDNUT CROPPING SYSTEM IN ALFISOLS OF CHITRADURGA DISTRICT, KARNATAKA

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Abstract

A field experiment was conducted to study the residual effect of zinc and boron on yield and quality of groundnut during *rabi/summer* 2015-16 at Farmer's field, Gutthikatte village, Hosadurga taluk, Chitradurga district. Immediately after harvesting of finger millet, groundnut was cultivated as succeeding crop without applying any fertilizers and organic manure. The experiment was laid out in randomized complete block design with 15 treatments and replicated thrice. Results revealed that application of RDF + FYM + $ZnSO_4$ @ 20 kg ha^{-1} + Borax @ 12.5 kg ha^{-1} recorded significantly the highest residual impact on yield (number of pods $plant^{-1}$, 100 kernel weight, shelling percentage, pod and haulm yield ha^{-1}) of groundnut and on par with application of RDF+ FYM + $ZnSO_4$ @ 20 kg ha^{-1} + Borax @ 10 kg ha^{-1} as compared to other treatments. The oil content (%) of groundnut differs significantly due to residual effect of graded levels of zinc and boron application. However, higher oil content was recorded with the effect of RDF + FYM + $ZnSO_4$ @ 20 kg ha^{-1} + Borax @ 12.5 kg ha^{-1} (45.29%) and lowest oil content were recorded in absolute control treatment of 39.63%. The micronutrient application caused significant variation in oil yield. Among the different treatments, residual effect of RDF + FYM + $ZnSO_4$ @ 20 kg ha^{-1} +

Borax @ 12.5 kg ha^{-1} recorded significantly higher oil yield (466.00 kg ha^{-1}) as compare to all other treatments. However, lowest oil yield was recorded in absolute control (146.87 kg ha^{-1}).

EFFECT OF ZINC AND BORON APPLICATION ON YIELD AND MICRONUTRIENT UPTAKE IN FINGER MILLET UNDER FINGER MILLET–GROUNDNUT CROPPING SYSTEM

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Abstract

A field experiment was conducted on farmer's field, Gutthikatte village, Hosadurga taluk, and Chitradurga district during *Kharif* 2016-17 in soil which was deficient in DTPA extractable zinc and hot water soluble boron, to study the effect of zinc and boron application on yield and micronutrient uptake in finger millet. The experiment was laid out in a randomized complete block design with fifteen treatments replicated thrice with finger millet variety GPU-28. The treatments were composed of recommended NPK with varied levels of Zn and B with FYM. The results revealed that application of RDF + FYM with $ZnSO_4$ @ 15 kg ha^{-1} and Borax @ 12.5 kg ha^{-1} recorded significantly higher uptake of Fe (717.82 & 456.91 g ha^{-1}), Mn (456.91 & 982.99 g ha^{-1}) and Zn (111.85 & 215.80 g ha^{-1}) both in grain and straw compared to absolute control. Significantly higher uptake of Cu (29.27 & 45.63 g ha^{-1}) and B (133.55 & 217.20 g ha^{-1}) in grain and straw were recorded in the treatment combination of RDF + FYM with $ZnSO_4$ @ 15 kg ha^{-1} and Borax @ 12.5 kg ha^{-1}. The results of the present study evidently concluded that the application of 100:50:50 kg N: P_2O_5: K_2O ha^{-1}, $ZnSO_4$ @ 15 kg ha^{-1} and Borax @ 12.5 kg ha^{-1} along with FYM at 10.00 t ha^{-1} under irrigated condition is beneficial for getting higher yield of finger millet as well as higher benefit cost ratio as compared to absolute control.

DEVELOPMENT OF TRANSGENIC PIGEON PEA PLANTS HARBOURING *LEC*-RLK GENE TO ENABLE SALT STRESS TOLERANCE

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Abstract

Pigeon pea is an important pulse crop in dry land areas. Soil salinity is an ever increasing production constrain in pigeon pea adversely affecting flowering and plant growth as it is grown predominantly in the states where there are more than 51% of saline soils in India. This condition adversely affects plants growth and limits agricultural production worldwide. Minimizing the losses is a major area of concern. A remarkable feature of plant adaptation to stress is the activation of multiple responses involving complex gene interactions and crosstalk with many other molecular pathways. Cell surface localized receptor-like kinases (RLKs) are the ideal candidates to initiate signaling pathways by perceiving and transmitting environmental signals to cellular machinery. Keeping in mind the role of RLK's; transgenic Pigeon pea plants harbouring *lec*-RLK gene for salinity tolerance have been developed. The putative T_0 plants were screened by PCR analysis and the PCR positive plants with transformation efficiency 18.6% were observed. The efficacy of the trans gene was studied in T_1 generation of the PCR positive (transgenic) and non transgenic pigeon pea plants by subjecting them to 75 mM salt stress. The relative water content, chlorophyll content, catalase were found enhanced while, membrane injury index, lipid peroxidation , total sugar content were found to be significantly reduced in transgenic plants in comparison to the wild type plants.

COST OF CULTIVATION OF MUSTARD CROP IN FATEHPUR DISTRICT OF UTTAR PRADESH

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Abstract

Mustard become an essential oilseeds crop with its positive nature of suitability to climatic condition for its cultivation, being an important cooking medium according to the test of human diet and having various industrial uses of its main and by product. Since it is a low cost and high price crop can be cultivated in water stress and low soil fertility condition, mustard become a nice alternative to the farmers in place of wheat in rabi season crops. Keeping in view the importance of the crop a

study on Economics of production of mustard was conducted in distt. Fatehpur Uttar Pradesh. One hundred respondents were selected through purposive cum proportionate random sampling technique from five villages of Hathgam block of Fatehpur district. Personal interview was done on pre-structured schedule for primary data collection. Tabular and functional analysis were used to draw the inferences. Respondents were categorised as marginal, small and medium size of farm. Costs of cultivation was increases with farm size, highest cost incurred in the production of mustard was found in medium farm size Rs.32555.94, per ha.and highest share of cultivation of mustard was human labour Rs. 8870.95, per ha. and overall cost of cultivation of mustard crop was Rs. 30448.01 per ha. and maximum share in cultivation of human labour Rs. 8613.84 per ha. On overall average, gross income was recorded Rs. 43994.73 and net income came to Rs.13847.75. On marginal farms, gross income was highest, which was recorded Rs.44173.71, followed respectively. On an average input output ratio the basis costs A_1/A_2, B_1, C_1, C_2 and C_3 were recorded 1:3.06, 1:2.96, 1:2.06, 1:2.07, 1:1.58 and 1:1.44, respectively At last mustard cultivation was found profitable and showed the further increase in profit per unit of time and area if the constraints of production and marketing is solved.

DETERMINATION OF SELECTION CRITERIA USING ASSOCIATION ANALYSIS OF YIELD AND QUALITY TRAITS IN MAIZE

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Abstract

Maize is the third important major cereal crop in the world after rice and wheat. Maize has several uses for human consumption, industrial purposes and animal feeds. Grain yield in maize is a complex character which is controlled by many factors. The correlation analysis is usually taken up to measure the relative magnitude of influence of each of this independent variable on a dependent variable like yield. Selection for desirable genotypes should be made based on grain yield and also other yield component characters which influence the yield. In this context, sixty three single cross hybrids developed from crossing nine productive maize inbred lines with seven quality protein maize inbred lines in line x tester mating design during *rabi* 2013-14 and these were evaluated along with their parents and standard checks through correlation studies at experimental area of CCS Haryana Agricultural University Regional Research Station, Uchani, Karnal during *kharif* 2014. Depending upon mean performance cross HKI 1126 x HKI 163 was found best for grain yield and quality traits *viz*., no. of grains per cob, cob length, ear height, tryptophan content and lysine content and cross HKI 1128 x HKI 163 and HKI 659-3 x HKI 194-6 were found best for grain yield and yield contributing characters *viz*., plant height, ear height, no. of grains per cob, 100 grain weight and shelling percentage. From the association analysis it was found that grain yield per plant showed significant positive correlation with days to 50 % teselling, days to 50 % silking, days to maturity, plant height, ear height, cob length, cob diameter, number of grains per cob, 100 grain weight, shelling percentage, lysine content whereas it was found significant negative with protein content and starch content. Among yield and quality characters grain yield per plant had significant negative correlation with protein content and starch content. Protein content had significant negative correlation with tryptophan content and tryptophan is significantly positively correlated with lysine content. While oil content and lysine content exhibited positive and significant association with grain yield per plant but with tryptophan content, grain yield per plant showed positive but non-significant association. Strong positive and significant association was established between lysine content and tryptophan content. Hence days to 50 % teselling, days to 50 % silking, days to maturity, plant height, ear height, cob length, cob diameter, number of grains per cob, 100 grain weight, shelling percentage, oil content, lysine content, tryptophan content should be given more importance while formulating selection indices for grain yield improvement in maize.

IMPORTANCE OF FARMER PRODUCER ORGANIZATIONS FOR PROFITABLE AGRICULTURE TO SMALL FARMERS

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Abstract

Agricultural marketing system plays an important role in determining the prices received by the farmers and it seems a

complex process in India. In absence of collectivization, the small scale of operations significantly reduces bargaining power in input procurement as well as sale of output. Government of India has been promoting a new form of collectives called Farmer Producer Organizations (FPOs) to address the challenges faced by the small and marginal farmers, particularly those to do with enhanced access to investments, technological advancements, and efficient inputs and markets for. This approach is demonstrating the potential to be more successful in breaking farmer's dependency on intermediaries, and enabling them access better markets for inputs and output. The government is promoting the formation of FPOs as a viable alternative to cooperatives. The basic purpose envisioned for the FPOs is to collectivize small farmers for backward linkage for inputs like seeds, fertilizers, credit, insurance, knowledge and extension services; and forward linkages such as collective marketing, processing, and market-led agriculture production. FPO offer small farmers to participate in the market more effectively and help to enhance agricultural production, productivity and profitability. As on 31 March 2017, 2157 FPOs were mobilized by the Producer Organization Promoting Institutions and sanctions were accorded by the Regional Offices of NABARD for their capacity building and further development for three years. The major activities in which FPOs are engaged include production and marketing of commodities like cereals, pulses, spices, vermicomposting, mushrooms, fruits, vegetables, certified seeds, etc. Majority of FPOs are undertaking farm aggregation, marketing and input distribution activities. FPO seems an important tool to achieve the mission of doubling the income of the farmers by 2022.

NEW FRONTIERS IN PEST MANAGEMENT : STERILE INSECT TECHNIQUE

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Abstract

Sterile insect technique is defined as a method of pest control using areawide inundative releases of sterile insects to reduce reproduction in a field population of the same species. The sterile insect release method (SIRM) of pest population suppression was first conceived by E.F. Knipling in 1937. Agricultural ecosystems are constantly under various abiotic and biotic stresses and among the biotic ones the insect-pests dominate the scenario undoubtedly. The releases of sterile males in large numbers lead to decline in natural population to zero. Sterile insect technique is most widely used eradication strategy for pests. Under this technique, using gamma radiations from Co^{60} or Cs^{137} isotopes, sterility is induced in male insects. Earlier chemosterilants were also used but due to their carcinogenic nature for humans they are rarely used nowadays. The most targeted pest group by SIT programmes is Order Diptera due to presence of dreaded pests of agricultural, veterinary and medical importance. Successful applications of the sterile male technique are eradications of the New World Screwworm (*Cochliomyia hominivorax*) from the North and Central America as well as Libya, tsetse fly (*Glossina austeni*) from Zanzibar, Tanzania, melon fruit fly (*Bactrocera cucurbitae*) from Japan, pink bollworm (*Pectinophora gossypiella*) from California, USA and of the Queensland fruit fly (*Bactrocera tryonii*) from Western Australia. Also, using SIT Mediterranean fruit fly (*Ceratitis capitata*) was eradicated from California and Florida (USA), Mexico and Chile. The benefit-cost ratio of SIT programmes is also very high as compared to other control methods, for instance the B:C ratio was 150:1 in MOSCAMED programme to control Medfly in Northern & Central America. So far 87% of all eradication programmes have been successful worldwide. In near future there is sheer need for such programmes to control the pests causing devastating losses in agricultural, veterinary or medical aspects.

INTEGRATED PEST MANAGEMENT : A SAFE ALTERNATIVE TO HAZARDOUS PESTICIDES

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Abstract

The well-being of our everyday lives affected by the agriculture industry. For many years, we have been using pesticides to control the pest population in our crops.However, the use of pesticides made it possible to increase the yield and simplify cropping system, but over reliance on chemical control is associated with contamination of ecosystem and undesirable health effects. The future of crop production is now also threatened by emergence of pest resistance. Therefore there is a great need to

design cropping system less dependent on synthetic pesticides. So a program called integrated pest management is recently developed to achieve the desirable pest control while reducing the use of pesticides. To accomplish this, various combinations of cultural, physical, mechanical, biological, chemical control etc.are employed. In the past, pesticides were all too often applied routinely whether needed or not, but in IPM pest population as well as beneficial parasites and predator population are monitored to determine whether the pests actually present a serious problem that need to be treated. If properly and extensively employed, IPM might reduce pesticide use while at the same time improving pest control. If this goal were achieved, the environmental problems would be minimized and significant benefits would results for farmers and society as a whole.IPM coordinates economically and environmentally acceptable methods of pest controlwith judicious and minimal use of toxic pesticides.IPM programs assess local conditions, including climate, crop characteristics, the biology of the pest species and soil qualities, to determine the best method of pest control.The conclusion of this report is that we should pay more attention to integrated pest management to help achieve a better future for our generation and the next generation to come.

DEVELOPMENT OF ORGANIC PACKAGE FOR SYSTEM BASED HIGH VALUE CROP (SOYBEAN–DURUM WHEAT)

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Abstract

A field study carried out on organic package from 2005 – 06 to 2014 – 15 revealed that Soybean–Durum Wheat 100% chemical fertilizer application gave significantly higher yield (16.29 q/ha and 46.09 q/ha) WEY (63.78 q/ha) NMR (51185.85 Rs./Q) and B:C ratio (2.71) as compared to (50% NPK + 50% N as FYM) and 100% organic fertilizer (1/3 FYM + 1/3 vermin compost +1/3 neem cake). The total uptake of major nutrient NPK increased significantly in all the treatments while soil properties viz. OC and ECds/m were improved under all the treatments. The farmers of M.P. state using large quantity of fertilizer as well as pesticides for getting good yield from recommended varieties of all the crops which badly affecting the eco-system of health. The scope of organic farming varies according to soil climate, cropping system, vegetation, irrigation, allied enterprises as well as harmony between different components. However, the basic nutritional components of biological farming are organic manures such as farm yard manure, enriched compost, green manure, besides the mandatory recycling of crop residue and applied of bio-fertilizers and bio-pesticides. Recycling of crop residue may be a potential organic source to sustain the soil health. Incorporation of crop residue of either rice or wheat increase the yield of rice and nutrient uptake and also improve the physico – chemical properties of the soil ensuring better soil environment for crop growth. 50% recommended NPK through fertilizer + 50% n through FYM to both crops (soybean – wheat) stable yield and total productivity of the system. A significant improvement in soil properties also takes place. Sustainable agriculture is possible only when integrated nutrient management system is adopted by the farmers. It hold more promise for small and marginal farmers who are resource poor and cannot afford full package of fertilizer application through inorganic source.

EFFECT OF AZOLLA AS FEED SUPPLEMENT ON MILK YIELD IN CROSSBRED COW

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Abstract

Azolla is a free-floating aquatic fern. Azolla microphylla is a suitable species for quick biomass production under tropical and subtropical climate condition. The Azolla is mainly propagated by vegetates means. The fern Azolla, hosts a symbiotic blue green algae Anabaena azollae, which is responsible for the fixation and assimilation of atmospheric nitrogen. Azolla has been reported to be a very good source of protein, essential mineral elements and vitamins for livestock. Azolla has been reported as potential feed supplement for dairy animals, which have rich nutrient and mineral profile. Azolla can be easily digested by livestock, owing to its high protein and low lignin content. Azolla can also be fed to sheep, goat, pig and rabbit as feed substitute. An On Farm Trail was conducted to study the effect of Azolla as feed supplement in buffaloes. The control group (C) farmers practice was fed wheat straw and green fodder with mustard cake. In the treatment group (T) 2.0 kg fresh azolla/animal/day was supplemented over conventional ration. The average daily milk yield was significantly higher in treatment group.

LIVESTOCK FARMERS' PARTICIPATION AND FACTORS AFFECTING THE SUCCESS OF ANIMAL HEALTH CAMP IN MAD REGION OF KARAULI DISTRICT.

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Abstract

Krishi Vigyan Kendra (KVK) Karauli organized an animal health clinical camp for the livestock belonging to farmers of Mad area sop village of district Karauli. KVK Karauli, during the camp more than 100 livestock farmers including cattle farmers, sheep and goat farmers brought their animals for treatment and advice on different ailments from animal scientist of KVK and Veterinary experts. Adoption of animal health care practices remains poor and there is no centralized agency to monitor the animal health care scheme in mad region. To investigate some of the root causes, a study on farmer participation in animal health and vaccination camps and factors affecting its participation was conducted. The respondents were male and female livestock owners of sop village, who participated in the animal health camps and were randomly interviewed. A logistic regression approach was used to analyze the participation decision. The results indicated a positive relationship between participation in animal health services.

MANAGEMENT OF SORGHUM ANTHRACNOSE CAUSED BY *COLLETOTRICHUM GRAMINICOLA* (CES.) WILSON

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Abstract

Anthracnose of sorghum caused by *Colletotrichum graminicola* (*Glomerella graminicola*) is an important sorghum malady in India. The pathogen exhibits good tolerance to varied ranges of agroclimatic conditions over the globe and causes substantial economic losses. The present investigation was carried out during 2016 and 2017 *kharif* season at Rajasthan College of Agriculture, Udaipur with aimed to find out a sustainable management of anthracnose by using different fungicides and botanical (Neem oil)either individually or in combination. Different treatments were tested in the field growing moderately susceptible dual purpose sorghum cultivar Raj. Chari-2. Seven treatments were designed alone and in different combinations. The two years pooled data results were revealed that application of Carbendazim 50% wp @ 0.2% (ST) + two foliar spray of neem oil @ 0.5% at 7 days interval showed minimum PDI (24.0%) with maximum (67.14) per cent disease control and highest (32.5 q/ha and 231.82 q/ha) grain and fodder yield respectively compare to other treatments over control. Followed by Saaf (Carbendazim 12% + Mancozeb 63% WP) @ 0.3% + two foliar spray of neem oil @ 0.5% was also found effective compare to other treatments for the management sorghum anthracnose. That signifies the synergistic action of chemicals and botanicals in combined application against pathogens.

STUDIES ON BIO-EFFICACY AND PHYTOTOXICITY OF PYRACLOSTROBIN 20% WG AGAINST EARLY BLIGHT OF TOMATO CAUSED BY *ALTERNARIA SOLANI.*

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Abstract

Tomato (*Lycopersicon esculentum* Mill) is one of the most popular cash earning crop to the farmers growing both in protected (poly house) and in natural cultivation. The major tomato growing states in India under protective and traditional cultivation are Bihar, Karnataka, Uttar Pradesh, Orissa, Andhra Pradesh and Rajasthan. Early blight of tomato caused by *Alternaria solani* is a major melody and responsible for most of the defoliation in protected and natural field condition. The incidence caused by early blight on foliage and fruits is around 30 to 65% in various states of India. Considering the drastic incidence of

this disease the present investigation was carried out at Horticulture farm, Rajasthan College of Agriculture-Udaipur by using different doses of Pyraclostrobin 20% WG (i.e. 50, 75 and 100 gm.a.i. ha-1) along with checks Pyraclostrobin 20% WG (BASF-Headline WG) (100 gm.a.i. ha^{-1}), and Mancozeb 75% WP (1500 gm.a.i. ha^{-1}) to manage this disease. Among the different concentration of Pyraclostrobin 20% WG, 100 gm a.i.ha^{-1} was the most effective and optimum dose for management of early blight of tomato with minimum (18.4%) powdery mildew incidence (PDI) with maximum yield (236.38 q/h). It was found significantly superior to Mancozeb 75% WP (1500 gm.a.i. ha^{-1}) and at par with Pyraclostrobin 20% WG (BASF-Headline WG) @ 100 gm.a.i. ha^{-1} with (19.0%) mean disease index (PDI) and 217.75 q/h yield. It was also revealed that none of the tested doses 50, 75, 100, 175 and 200gm.a.i. ha^{-1} were found phototoxic.

EVALUATION OF HERBICIDES EFFICACY AGAINST HERBICIDE-RESISTANT *PHALARIS MINOR* IN WHEAT

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Abstract

In rice-wheat cropping system, the hazard of *Phalaris minor* in wheat has endangered the productivity of wheat crop. Yield losses especially from *Phalaris minor* alone are estimated from 25 to 50 per cent and, under very severe infestations, the losses may go up to 80 per cent and in extreme case even total crop failure. Total crop failure mainly associated with herbicides resistance evolution in *P minor*. A two year field experiment was conducted at regional research station uchhani, Karnal of CCS Haryana Agricultural University, Hisar. Total 18 treatments (combination of Pre and Post-emergence herbicides) evaluated for management of rigid *Phalaris minor* Retz. Pendimethalin (1500 g/ha), metribuzin (210 g/ha), clodinafop (60 g/ha), sulfosulfuron (25 g/ha), pinoxaden (50 g/ha), mesosulfuron + iodosulfuron (RM)* (14.4 g/ha), metribuzin fb clodinafop (175 fb 60 g/ha), metribuzin fb sulfosulfuron (175 fb 25 g/ha), metribuzin fb pinoxaden(175 fb 50 g/ha), metribuzin fb mesosulfuron + iodosulfuron (RM) (175 fb 14.4 g/ha), pendimethalin + metribuzin (1500 + 175 g/ha), pendimethalin + metribuzin (1000 + 175 g/ha), pyroxasulfone (105 g/ha), pyroxasulfone (128 g/ha), pendimethalin fb hand weeding (1500 g/ha fb 1HW), metribuzin fb hand weeding (210 g/ha fb 1HW), weed free and weedy check. Among different weed control treatment pyroxasulfone (105 g/ha) and pyroxasulfone (128 g/ha) found most effective against *Phalaris minor* Retz. but not successful to control the broad leaf weeds. Overall meso + iodo (RM)* (14.4 g/ha), metribuzin fb sulfosulfuron (175 fb 25 g/ha), and metribuzin fb meso + iodo (RM) (175 fb 14.4 g/ha) give effective control of weeds (grassy as well broad leaf weeds) and recorded lowest weed density and dry matter accumulation at 75 and 120 DAS. Consequently recorded higher grain yield, biological yield, gross and net return. Pendimethalin (1500 g/ha) and metribuzin (210 g/ha) reduce the *Phalaris minor* but in combination with alternate herbicides gave synergetic result. In those area alternate herbicides not performing up to mark due to herbicide-resistant Phalaris minor in wheat farmers can go for Pre and Post emergence herbicides for better control.

ASSESSMENT OF ECONOMIC IMPACT OF BOVINE TROPICAL THEILERIOSIS IN CATTLE

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Abstract

In India, dairy farming from much earlier is regarded as an instrument for social and economic development of the people**.** India is the largest milk producer in the world with an annual production of 163.7 million tones and is well known as the Oyster of global dairy industry. However, to maintain continuous productivity of these animals, it is essential that they remain free of diseases including parasitic. Bovine Tropical Theileriosis (BTT) caused by *Theileria annulata* is commonly found in tropical and sub-tropical regions of India which affects large ruminants causing enormous economic losses in bovines in terms of reduced milk production, increased infertility and high mortality rate. In the present study, ten crossbred cattle weighing about 300 kg naturally infected with *T. annulata* were selected at Shaktifarm, Dineshpur and Rudrapur areas of district Udham Singh Nagar, Uttarakhand for the assessment of economic impact of the disease. The animals were confirmed positive with

BTT by thin blood smear examination. All animals were treated with single dose of buparvaquone @ 2.5mg/kg body weight, intramuscular (IM) alongwith oxytetracycline @ 20mg/kg body weight intravenous, multi-vitamin (Tribivet @ 10ml/animal IM) and liver tonic (Belamyl @ 10ml/animal IM) for five days. The haematinic drug (Ferritas @ 10ml/animal IM) was also given to the animals at weekly intervals up to four weeks along with five dose of anti-histaminic (Avilin Vet @ 10ml/animal IM). However, ten uninfected animals were kept as control. Blood samples were collected from each animal on 7, 14, 21 and 28 days post treatment (DPT) to know whether the animals were free from infection or not. Total milk yield was recorded from each animal weekly before treatment and up to 4th weeks post-treatment (in litres). Variation (Increase/Decrease) in milk production was calculated 28 days post treatment (DPT). At last estimation of total profit/loss due to BTT was estimated (Net income – Expenditure). The total increase in milk yield over a period of 28 days was recorded as 50.05 litre increase in milk yield/animal. However, in control group, milk yield remained within normal range. At present, the price of milk per litre is Rs. 40. So, a total income of Rs. 2002 per cow was estimated in the present study. The total profit/losses due to Bovine Tropical Theileriosis were calculated considering the total income and expenditure i.e., cost of treatment. Cost of treatment per animal was estimated of Rs. 2791.85/. However, the income incurred due to increased milk yield over a period of 28 days was Rs. 2002/-. So, the total economic loss per animal was calculated as Rs. 789.85/-. The disease is fatal in nature, so that it is suggested that the farmers should go for proper diagnosis of the disease and consult veterinarians for minimizing the economic losses.

ORGANIC FARMING : A STEP TOWARDS SUSTAINABLE AGRICULTURE DEVELOPMENT

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Abstract

Agricultural Sector has experienced a noticeable growth since the mid-twentieth century. Thegrowth, driven by Green Revolution technology, has made a significant progress on aggregatesupply of food grains, ensuring food security to the growing population. The next stage ofagriculture growth however, faces a serious challenge in terms of sustainability. India is primarilyan agricultural country despite the recent spurt in manufacturing and services; and the decliningshare of agriculture in the national income, since around fifty per cent of its workforce is stillengaged in agriculture and allied activities. In the present paper the need for sustainable agriculturehas been emphasized. Policies for sustainable agriculture and organic farming and possible actionsin India are discussed. The study highlighted that improvement of existing production systems(e.g. altered crop rotations, introduction of green manuring, use of plant species adapted to specificlocations), improved protection of natural resources (e.g. erosion protection), increase in efficiencyof existing resources (e.g. irrigation, use of technology, basic and advanced training), introductionof regenerative branches of business (e.g. horticulture or aquaculture), introduction of a newproduction element in existing enterprises (such as fruit trees to stabilize terraced fields, fishfarmingin rice fields), optimization of post-harvest systems (e.g. storage) and improvement ofchannels of distribution (e.g. market access, transport) etc. are the possible actions need to be takenby the Indian government for the agriculture sustainability.

MANAGEMENT OF SOIL HEALTH

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Abstract

Soil health is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. This definition speaks to the importance of managing soils so they are sustainable for future generations. Healthy soil gives us clean air and water, bountiful crops and forests, productive grazing lands, diverse wildlife, and beautiful landscapes. Soil does all this by performing essential functions like regulating water, sustaining plant and animal life, filtering and

buffering potential pollutants, cycling nutrients and providence of physical stability and support. Aggressive tillage, annual crops raise, mono-cropping, excessive fertilizer use, excessive crop residue removal, and use of broad spectrum pesticide & insecticide are the practices which tend to reduce soil health. Practices like no-tillage/conservation tillage, perennial crops raise, diverse crop rotations, use of organic manures, retention of crop residues, weed control by cultural practices, and integrated pest management promote soil health. Keep the soil covered as much as possible as soil cover conserves moisture, reduces temperature, intercepts raindrops, suppresses weed growth, and provides habitat for members of the soil food web that spend at least some of their time above ground. There must be management of soil by disturbing it less as all forms of soil disturbance diminish habitat for soil microbes and result in a diminished soil food web. Diversify soil biota with plant diversity because biodiversity is ultimately the key to the success of any agricultural system. Lack of biodiversity severely limits the potential of any cropping system and increases disease and pest problems. A diverse and fully functioning soil food web provides for nutrient, energy, and water cycling that allows a soil to express its full potential. Increasing the diversity of a crop rotation and cover crops increases soil health and soil function, reduces input costs, and increases profitability. Healthy soil is dependent upon how well the soil food web is fed; therefore, keep a living root growing throughout the year as a source for microbes.

FIR TECHNOLOGY DEMONSTRATION IN FARMERS FIELDS AT JHANSI

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Abstract

Ground nut (*Arachis hypogaea* L) also known as peanut is an important oilseed crops grown mainly during kharif and summer seasons. In India, the major ground nut cultivation areas are Gujrat, Uttar Pradesh, West Bengal, Andhra Pradesh, Madhya Pradesh etc. However, Gujarat occupied first position in term of production and productivity. It is a rich source of fat, sodium, potassium etc. The 100g pea nut contain 567 calories, 49g fat, 18g sodium, 705g potassium, 16g total carbohydrates, 9g dietary fibre, 26g protein,. Besides, calcium 9%, Iron 25%, magnesium 42%, vitamin B_6 15%. An experiment was conducted at Bharari, Jhansi during 2015-2016 to demonstrate Fungicide Insecticide and Rhizobium culture (FIR) technology for ground nut cultivation at farmer fields. The twenty progressive farmers have been selected to demonstrate FIR technology under the cover area of 8 ha. of lands. It has found that the highest and lowest yield was obtained as 18.3 and 15.8 g/ha, respectively with an average of 16.3g/ha., whereas, in case of control the yield is 14.9g/ha which is 9.62 per cent lowest over average yield data. The economics of demonstration of the experiment revealed that net return come out from the experiment is Rs. 44850 per hectors which indicated the B:C ratio as 2.57.

IMPACT OF FRONTLINE DEMONSTRATIONS ON USE OF MINERAL MIXTURE IN MILCH ANIMAL RATION OF DAUSA DISTRICT (RAJASTHAN)

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Abstract

The front line demonstration trials were conducted in Sindoli, Biharipura, Khadka, Kundal, Bhedoli, Abhayapura, Jaitpura and Churiyawas villages in Dausa Block, Khempuri, Badoli, Dungarpur, Rahuwas in Lalsot Block, Kheda, Thumadi, Dharanwas, Jonn, Paparda, Beegwas, Aluda in Lawan Block, Reta, Girdharpura in Sikarai Block and Mittarwadi in Bandikui Block in Dausa District during the year 2013-14 to 2016-17. The overall percent increase of milk production was 10.04%. In case of extension gap it was highest in Kheda, Thumadi, Dharanwas, Jonn, Paparda, Beegwas, Aluda in Lawan Block (7.140) and the lowest (6.065) in Sindoli, Biharipura, Khadka, Kundal, Bhedoli, Abhayapura,Jeitoura and Churiyawas villages in Dausa Block and Khempuri in Lalsot Block in Dausa District. Overall adoption of technology was 53.98 percent during the reporting period. While the overall average percent milk production, extension gap in liters, adoption percent were 10.04, 0.608 and 53.98, respectively. The evaluation shows that the front line demonstration trails found better (38.20%) in terms of net return than farmers' practice (no use of mineral mixture in animal ration) for increase in milk production of dairy animals in Dausa District. Across the years front line demonstrations were found batter additional return percentage ranging from Rs.

486.90 to Rs.818.70 per month with overall Rs. 642 per month and higher additional BC ratio was ranging from 10.30 to 17.05 (overall 13.48). The BC ratio indicates that the technology of use of mineral mixture in animal ration is highly profitable.

CHANGES IN PHENOTYPIC TRAITS UNDER DIFFERENT COLOURS PATTERN OF BAKERWALI GOAT AT 6 MONTH OF AGE

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Abstract

Bakerwali goat is mainly found in hilly tracts of J&K comprising of Poonch, Rajouri, Udhampur, Jammu, Kathua, Doda, Kishtwar and Ramban Districts. In summer months, Bakerwal people took their animals to hilly areas i.e high land pastures, while in winters, they return to the plains of Jammu, Kathua and Samba. The different phenotypic traits were recorded under different colours pattern of Bakerwali goat at 6 month of age. All the body weights were recorded in kg. The mean body weight of black, brown, white, black white, brown white, mixture, grey white were 21.00±0.40kg, 21.75±0.79kg, 21.45±0.37kg, 21.53±0.49kg, 21.62±0.51kg, 21.52±0.39kg and 21.160.47kg respectively with low % of CV. Body length mean for black, brown, white, black white, brown white, mixture, grey white were 47.00±0.43cm, 46.92±0.56cm, 47.47±0.37cm, 48.40±0.54cm, 47.59±0.52cm, 47.48±0.51cm and 48.88±1.06cm respectively with low % of CV. The mean height at wither of black, brown, white, black white, brown white, mixture, grey white were 59.47±0.41cm, 58.56±0.69cm, 59.47±0.36cm, 60.13±0.54cm, 59.08±0.70cm, 59.63±0.45cm and 60.20±1.26cm respectively. Chest girth mean for black, brown, white, black white, brown white, mixture and grey white were 61.88±0.44cm, 61.41±0.62cm, 61.75±0.34cm, 62.42±0.55cm, 61.33±0.60cm, 61.93±0.48cm and 61.63±1.28cm respectively with low % of CV. The mean ear length of black, brown, white, black white, brown white, mixture, grey white were 14.08±0.54cm, 14.35±0.86cm, 14.44±0.40cm, 14.10±0.51cm, 15.18±0.40cm, 15.56±0.39cm and 14.55±1.07cm respectively with CV low to moderate. The mean horn length of black, brown, white, black white, brown white, mixture, grey white were 10.46±0.46cm, 10.76±0.49cm, 10.07±0.19cm, 10.22±0.28cm, 10.53±0.28cm, 10.20±0.20cm and 10.30±0.19cm respectively with CV low to moderate. Tail length mean for black, brown, white, black white, brown white, mixture, grey white were 14.38±0.61cm, 14.85±1.01cm, 13.90±0.31cm, 14.05±0.43cm, 14.29±0.64cm, 14.34±0.18cm and 13.40±0.25cm respectively with CV low to moderate. Among various colour patterns, the body weight, body length, height at wither, chest girth and tail length did not differ significantly. So colour pattern do not affect improvement of this population under different practices.

EFFECT OF NEEM, *AZADIRACTA INDICA* ON ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* EGG HATCHING AND LARVAL PENETRATION IN TOMATO ROOTS

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Abstract

Study was conducted on the effect of neem, *Azadiracta indica* on root-knot nematode egg hatching and larval penetration of root-knot nematode, *Meloidogyne incognita* in tomato roots. The observations recorded on egg hatching in neem ethanol and water based leaf extract, leaf compost, achook and neem cake treatments showed negative co-relation between the neem products doses and the number of larvae hatched out from the nematode eggs and the number of larvae penetrated the tomato roots. The degree of negative effect of neem product on egg hatching and larvae penetration increased with the increase in the doses and the exposure time period. The reduction in egg hatching was observed 64.42, 62.15, 56.43, 55.62, 52.61 29.11 28.25, 27.64 and 26.18 per cent at 12 hour exposure, 60.69, 56.98, 58.88, 50.68, 55.56, 54.76, 44.54, 42.57, 41.80 and 40.46 per cent at 24 hour exposure, 53.58, 50.94, 50.66, 46.69, 45.49, 44.34, 55.65, 53.93, 52.80 and 51.19 per cent at 48 hour exposure and 46.54, 45.65, 44.49, 42.61, 41.93, 41.01, 61.68, 59.77, 58.81 and 57.72 per cent at 72 hours exposure over control in ethanol leaf extract(5.0 and 2.0 %),, leaf extract (5.0 and 2.0 %), achook (7.50 and 5.00%), leaf compost and neem cake (7.50 and 5.00%) respectively in descending order. However, the reduction in larval penetration was also observed in tomato roots. The extent of reduction in larvae penetration further increased with the doses of the neem products and the exposure time period. The reduction in larval penetration was observed 59.90, 56.92, 55.53, 50.88, 18.99, 17.55, 53.33, 45.61,

15.92 and 12.99 per cent at 12 hour exposure, 55.72, 5132, 50.22, 46.29, 32.59, 31.98, 48.41, 41.98, 32.42 and 29.33 per cent reduction at 24 hours exposure, 46.04, 43.92, 43.93, 37.84, 48.33, 46.49, 39.34, 34.84, 50.72 and 46.71 per cent at 48 hours exposure and 49.11, 45.70, 43.99, 39.76, 61.31, 60.80, 38.36, 37.24, 59.32 and 56.94 per cent at 72 hours exposure over control in ethanol leaf extract (5.0 and 2.0%), leaf extract (5.0 and 2.0%), achook (7.50 and 5.00%), and leaf compost (5.0 and 2.0%), (7.50 and 5.00%) and neem cake respectively in descending order.

EVALUATION OF SESAME GERMPLASM LINES FOR RESISTANCE AGAINST CHARCOAL ROT INCITED BY *MACROPHOMINA PHASEOLINA* (TASSI) GOID

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Abstract

Charcoal rot incited by *Macrophomina phaseolina* (Tassi) Goid is one of the most destructive diseases and causes heavy loss in sesame. The disease is becoming severe every year in sesame growing areas due to increased level of inoculums in soil. The pathogen of sesame crop becomes destructive particularly when high temperatures and water stress conditions occur during the growing season. A field experiment was conducted for two consecutive years during *Kharif* 2017 and 2018 at oilseed research farm, CCSHAU, Hisar. Three hundred and fifty (350) sesame germplasm lines were evaluated against charcoal rot to identify the resistance source. Among them, none of germplasm line showed complete resistance against *M. phaseolina*. Based on the pooled incidence data of two year experiment, eighteen germplasm lines *viz.,* NIC-7837, NIC-7875, NIC-17849, SI-2174-1, SI-3296, IS-92-2, HT-9913, IS-455-A, PCU-129, PCU-136, IC-303419, HT-20, HT-9907, KMR-13,TC-159, TC-184, TC-318 and EC-303419 showed moderately resistant reaction. Two genotypes NIC-8533 and S-1671 showed highly susceptible reaction, twenty four germplasm lines as susceptible whereas majority of them were falls under moderately susceptible category. The information generated through this experiment can be utilized in imparting the horizontal resistance in resistance breeding programmes.

IMPACT OF IMPROVED DRYLAND TECHNOLOGIES FOR ENHANCING THE PRODUCTIVITY OF RAINFED CROPS IN SOUTHERN RAJASTHAN

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Abstract

Operational Research Project on dryland agriculture with its main focus on participatory technology demonstration functioned at Newariya village of Chittaurgarh district from 2015-16 to 2017-18. The onset, intensity and distribution of rainfall is highly unpredictable in the region and hence, the productivity of the dryland crops is very low. In order to evaluate and disseminate the improved rainfed agro technologies, on farm trials and demonstrations under different themes *viz*., rainwater management, cropping systems, energy management, integrated nutrient management and alternate land use systems were conducted. Results revealed that Improved moisture conservation practice performed better at farmers field and gave the 28.53 per cent higher maize grain yield over the farmers practice (1812 kg ha^{-1}). Foliar spray potassium nitrate @ 1% along with RDF performed better at farmers field and gave the 20.77 per cent higher maize grain yield over the farmers practice. Most profitable and remunerative intercropping systems viz., maize+ blackgram (2:2), groundnut+ sesame (6:2) and sorghum+ greengram (2:1) performed better at farmers field gave the 17.02, 39.29 and 20.44 percent higher equivalent yield over mixed cropping, respectively. Higher seed/grain yields were obtained by adopting all the improved variety of different crops in comparison to farmers' cultivar. Improved variety of different crops resulted in overall increase in crop production from 28.8 to 55.1% over the farmers' practices. Higher net return and B:C ratios were also obtained with improved practices. Improved practice of nutrient management (50 kg N+ 30 kg P_2O_5 ha^{-1}) + 25 kg $ZnSO_4$ ha^{-1} performed better at farmers and gave 29.07 per cent higher yield over farmers practice (1777 kg ha^{-1}).

EXTENT OF DEVIATION IN APPLICATION OF CHEMICAL FERTILISERS IN REDGRAM CULTIVATION IN KALBURGI DISTRICT OF KARNATAKA

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Abstract

Importance of chemical fertilisers in yield improvement, which is essential for achieving, increased agricultural production. The level of use of fertilizer in India was imbalance, this trends was continuous in India as well as Karnataka and also in North Eastern Karnataka region. In the study area to find out the answers for this issue, whether the consumption of fertilizer according to Recommended Dosage of Application (RDA) or is there deviation, what extent deviation in fertilizer use at farm level. The result pertaining to this aspect was based on the primary data collected through survey method from redgram cultivated 60 farmers in Kalburgi district during 2015-16. The extent of deviation for nitrogen usage was observed at 50.90 per cent (+5.09 kg/acre) for large farmers and 25.20 per cent (2.52 kg/acre) for small farmers in redgram cultivation. It was found that the application of phosphorous among both the categories of farmers was under application as against RDA. In case of small farmers actual application was 14.83 kg per acre and deviation observed was 25.85 per cent whereas in case of large farmers actual usage was 17.92 kg per acre and the deviation observed was 10.04 per cent from RDA (20 kg/acre). While, NP apllication by small farmers was 27.35 kg per acre and large farmers 33.01 kg per acre as against RDA (30 kg/acre). However, over application of nitrogen was observed in both small and large farmers in redgram cultivation. Hence, there is a need to conduct the awareness programmes on the balance usage of chemical fertilisers.

MANAGEMENT OF SOIL HEALTH BY INTEGRATED FARMING SYSTEM

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Abstract

Integrated farming system plays an important role in maintenance of soil health by increasing nutrients availability in soil, improving the physical condition of the soil like improving water holing capacity, aeration and aggregation stability and higher microbial activity. The farmers concentrate mainly on crop production which is subjected to a high degree of uncertainty in income and employment to the farmers. It is imperative to evolve suitable strategy for augmenting the income of a farm. Integration of various agricultural enterprises *viz.,* cropping, animal husbandry, fishery, forestry etc. have great potentialities in the agricultural economy with this we can also improve the soil health by using the by-products of individual IFS enterprises helps to build up soil organic carbon. By-products from the IFS enterprises are used as raw materials for preparation of bulk organic manures like Compost, Enriched Compost, Vermicompost, Vermiwash and FYM *etc*. Organic matter in soils plays an essential role in improving soil physical, chemical and biological processes. Soil organic carbon is one of the most important indicators of soil quality and soil health which can be maintained by incorporation of residues produced from IFS enterprises into soil. Also conservation measures including conservation agriculture, good agricultural practices and integrated plant nutrient sources. Further, problematic soils management with proper soil amendments is very essential for accelerating productivity and enhancing soil health for future productivity.

RURAL DEVELOPMENT FOR NATION BUILDING

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Abstract

Rural Development is not only needed for ensuring food security but also to boost the Gross National Product of the nation.

Fortunately, India has plenty of natural resources, idle labour, necessary technology and good market both in India and abroad. Presently, the people engaged in agriculture lack motivation and organisational strength at the grass-root level. The rural developmental programmes intend to reduce the poverty and unemployment, to improve the health and educational status and to fulfil the basic needs such as food, shelter and clothing of the rural population. Industrial development and adoption of modern technologies are likely to generate additional employment in urban areas and pay rich dividend to elite and rich investors. This in turn might widen the gap between the urban and rural as well as the rich and the poor, with respect to wealth accumulation, resulting in further hardship to the poor. Therefore, we need to address the problems of the poor to ensure social justice and better quality of life.

WOMEN EMPOWERMENT : A PIVOTAL ROLE TO DEVELOP THE NATION

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Abstract

The empowerment of women means psychological sense of personal control in the persons, domestic, social and political realms. It is a process by which one is authorized to think, act and control resources in an autonomous way. The most critical component of women's empowerment is found to be education. It leads to improved economic growth, low fertility rate, health and sanitation and an awareness of factors that disempowered women. Work participation rate and political participation also grows in women's education. The expansion of the market economy and industrialization and globalization brought increased inequalities, resulting in lose of livelihoods, erosion of natural resources and with it decreased women's access to water, fuel, fodder and traditional survival resources. It also brought new forms of exploitation-displacement, tourism, sex trade and retrenchment to mention a few. Women are being pushed into less productive sectors. Increased pressure on rural resources accelerated migration to urban areas in search of livelihood. People from backward regions, tribal communities, disadvantaged castes and the displaced communities were being pushed against the wall. If Women empowered means the country has empowered.

SOIL ENZYME ACTIVITIES AS BIOLOGICAL INDICATORS OF SOIL HEALTH

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Abstract

soil enzyme activities have great potential to provide a unique integrative biological assessment of soils and the possibility of assessing the health of the soil biota. Some enzymes only facilitate the breakdown of organic matter (e.g. hydrolase, glucosidase), while others are involved in nutrient mineralization (e.g. amidase, urease, phosphatase, sulfates) With the exception of phosphatase activity, there is no strong evidence that directly relates enzyme activity to nutrient availability or crop production. The soil enzymes are the mediators of organic matter decomposition and soil transformations. Nutrient cycling in soils involves biochemical, chemical and physicochemical reactions. All biochemical reactions are catalyzed by enzymes, hence making enzymes suitable as indicators of biological activity. Enzymes are the indicator of soil biological quality, responding to soil management changes much before other soil quality indicator changes are detectable. In the dynamic climate change era, the influence of climate change on soil productivity can be assessed by monitoring soil enzyme activities as well as changes occurring in soil properties. Thus, knowledge of soil enzymes is essential to design and evaluate new sustainable crop management practices. Soil enzyme activity is a good indicator of agricultural management practices, as well as of the impact of pollution or severe perturbations on soil health, and of the efficacy of remediation activities. Finally, although certainly a promising indicator of soil health, the use of soil enzyme activity requires sound judgment in the interpretation of the data.

INFLUENCE OF SELECTED FACTORS ON FAMILY ENVIRONMENT OF PUC STUDENTS

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Abstract

A study on "Influence of selected factors on family environment of PUC students" was taken up in rural and urban areas of Dharwad taluk, Karnataka during the year 2016-2017. The sample comprised of 320 pre-university college students in the age group of 16 to 18 years, among them 120 were from rural area and 120 from urban area of government and aided colleges. Bhatia and Chadda's family environment scale was used to assess the family environment of pre-university college students. The results revealed that majority of the PUC students belonged to average level of family environment among both rural and urban areas. In comparison of rural and urban areas on family environment revealed that PUC students in urban area had high level of organized family environment than rural area. However, locality had no significant influence on family environment of PUC students. Class wise comparison indicated that PUC-I year college students had better active recreational orientation and controlled family environment than PUC-II year students. Among rural area, significant association was observed between boys and girls in the category of independence among PUC students. While, girls had better active recreational family environment than boys. Whereas, boys had high level of independence in family environment than girls. Ordinal position had significant association with family environment in active recreational orientation category among rural PUC students. While, in urban area significant association was observed between ordinal position in the categories of cohesion, active recreational orientation, independence and organization among PUC students.

INFLUENCE OF SELECTED FACTORS ON PSYCHOLOGICAL WELL BEING OF RURAL AND URBAN PUC STUDENTS

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Abstract

A study on "Influence of selected factors on psychological well being of rural and urban PUC students" was carried out in the year 2016-2017 in rural and urban areas of Dharwad taluk, Karnataka. The sample for the study comprised of 160 pre-university college students from rural area and 160 from urban areas of Dharwad taluk. The respondents' age ranged from 16 to 18 years, studying in PUC-I year and PUC-II year from Arts and Commerce streams. Ryff's psychological well being scale (1995) was used to assess the psychological well being of pre-university college students. The results revealed that PUC students from Government College had better psychological well being than aided college in rural area. Further, the study concluded that among urban area aided pre-university college students had high level of psychological well being than government PUC students. In comparison of arts and commerce PUC students on psychological well being revealed that arts stream students significantly had better psychological well being than commerce stream students in rural area. Whereas, no significant difference was observed between arts and commerce stream students in urban area. Ordinal position had no significant influence on psychological well being among rural and urban PUC students. Further, the study indicated that first born PUC students had high level of psychological well being than later born ones. Type of families had no significant influence on psychological well being among both rural and urban PUC students.

AN OVERVIEW OF PRADHAN MANTRI FASAL BIMA YOJANA

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Abstract

The Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched by the Centre on April 1, 2016 to help farmers cope with crop

losses due to unseasonal and extreme weather. It replaced the National Agricultural Insurance Scheme (NAIS) and the Modified National Agricultural Insurance Scheme (MNAIS). The Weather-Based Crop Insurance Scheme (WBCIS) remains in place, though its premium rates have been streamlined with the latest scheme. PMFBY was more farmer-friendly provisions than its predecessors. It reduced the burden of premium on farmers significantly and expanded coverage. It also promoted use of advanced technologies to estimate losses accurately and accelerate payments to farmers. The positives of PMFBY: Coverage of agricultural insurance has significantly increased in kharif 2016 compared to kharif 2015 across India. The number of farmers insured crossed 4 crores during kharif 2016, a jump from 3.09 crores in kharif 2015. The sum insured is now closer to the cost of production than before. It has gone up from Rs 20,500 per hectare of land during kharif 2015, to Rs 34,370 in kharif 2016. This means in case of losses, farmers should theoretically get significantly higher compensation than before. **The negatives** of PMFBY: Gaps in assessment of crop loss, Inadequate and delayed claim payment, High actuarial premium rates, Massive profits for insurance companies, Coverage only for loanee farmers, Poor capacity to deliver, delayed notification by state governments, less number of notified crops, problem with threshold yield estimation etc. that has diluted the usefulness of PMFBY.

RECOMMENDATIONS FOR IMPROVEMENT OF THE PRADHAN MANTRI FASAL BIMA YOJANA

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Abstract

Pradhan Mantri Fasal Bima Yojana is a insurance arrangement aiming at mitigating the financial suffered by the farmers due to damage and destruction of their crops as a results of production risks. It helps in stabilization of farm production and income of the farming community. Hence, the further improvement of PMFBY the Government of India should implement the following recommendations. a) Coverage of tenant and sharecropper farmers should increase. b) All important crops should be covered under crop insurance. Diversification of crops and mixed farming should be promoted. c) Instead of threshold yield, 'Potential yield' should be used for crops for which historical average yield data is not available. d) Damage caused by wild animals, fire, cold waves and frost to crops should also be considered at the individual level and damage caused by unforeseen weather events like hailstorms should also be included in the category of post-harvest losses. e) Farmers must be informed before deducting crop insurance premium. They must be given a proper insurance policy document, with all relevant details. f) Panchayati Raj Institutions (PRIs) and farmers need to be involved at different stages of implementation. g) The insurance unit must be reduced over a period of time. In any case, it should not be more than village level. If the insurance unit cannot be at the individual level and is kept at village panchayat level, premium should also be collected at the village panchayat level. h) Incentivise groups of small farmers or women farmers and promote group insurance. i) Sum insured should not be less than scale of finance and/or cost of production. j) PMFBY timelines from insurance coverage to claim payment should be strictly adhered to. Robust assessment of crop loss should be done through capacity building of state governments, involvement of PRIs and farmers in loss assessment, auditing and multi-level checking to ensure credibility of data and testing incorporating technology such as remote sensing, drones and online transmission of data. k) All PMFBY related data related to farmers must be available in the public domain and shared openly with farmers. l) The clause addressing prevented sowing and post-harvest losses must be implemented appropriately by issuing state notifications prior to sowing.

SCREENING OF BACTERIAL STRAINS ASSOCIATED WITH RHIZOSPHERE OF RICE AND THEIR EVALUATION FOR PLANT GROWTH PROMOTION

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Abstract

Fourteen isolates were characterized on the basis of biochemical features like IAA production, ammonia production, P

solubilisation, salt tolerance and antibiotic sensitivity against tetracycline. The PGPR isolates were also evaluated for their efficiency to promote plant growth under pot conditions. The quantitative IAA production from the isolates ranged between 61.460 µg/ml to 138.30 µg/ml. The screening of isolates for salt tolerance was done at 3% - 10% NaCl concentration. Screening of antibiotic sensitivity test of the fourteen rhizobacterial isolates was done on nutrient medium against 2µg/ml to 30µg/ml concentration of tetracycline. The PGPR isolates increased seed germination by 16.40% to 33.40% over control. Seed inoculation by PGPR resulted into increase in root length, shoot length, root fresh weight, and shoot fresh weight, root dry weight and shoot dry weight. The molecular characterization of isolated rhizobacterial strains was done by SDS-PAGE and RAPD. Protein profiling of bacterial isolates by SDS-PAGE was done to demonstrate the proteomic variability. The RAPD analysis of these bacterial isolates revealed that bacterial isolates were different in banding pattern and showed polymorphism.

POST-HARVEST MANAGEMENT OF HORTICULTURAL COMMODITIES

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Abstract

Horticultural produces are highly perishable in nature thus there may be a surplus of fruits and vegetables in the market during the peak harvest season. These crops undergo a rapid alteration between the harvest and consumption which results in spoilage of the commodities and reduces its market value. The spoilage has been estimated to be nearly 30-40 per cent in most of the produce which account for more than 25,000 crores of rupees every year. This is not only a loss to the growers but a net loss of huge human nutrition and expenditure of inputs involved. These losses can be reduced to a considerable surplus with timely and safe management of post-harvest produce. The post-harvest management of fruits and vegetables includes pre and post-harvest practices, their harvesting, handling, packaging, storage, distribution, marketing, etc. Since fruits and vegetables contain a very high percentage of their fresh weight as water. Subsequently, fruit exhibit relatively high metabolic activity when compared to other plant derived foods such as seeds. This metabolic activity continues post-harvest and thus makes most fruits highly perishable commodities. This perishability, with its inherent short shelf life, that presents the greatest problem to the successful transportation and marketing of fresh fruits and vegetables. Thus, augmentation of their shelf life would be of great help in reducing postharvest losses, avoiding gluts in the peak season and avoiding distress sale. This would also help in ensuring more availability of fruits and vegetables without bringing additional land into production and fetching higher economic returns to the farmers.

CONTROLLED ATMOSPHERE STORAGE OF FRUITS

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Abstract

World trade has transformed food retailing and driven the development of technology for the transportation and storage of horticultural products, providing year-round supply of fruit and vegetables. Horticultural produce is highly perishable, as fruit and vegetables continue their metabolic processes such as respiration and transpiration that lead to ripening and senescence after harvest, making them ultimately unmarketable. Advanced postharvest technologies are essential for reducing post-harvest losses while maintaining high standards of safety and quality. Together with cold storage, controlled atmosphere (CA) and modified atmosphere packaging (MAP) have been applied to alter the produce's internal and external environment, decreasing its metabolic activity and prolong the shelf-life of fruits. CA technology is one of the most successful techniques developed by the postharvest industry in the 20th century. The application of conventional CA generally consists of increasing level of carbon dioxide and decreasing the oxygen concentration. This atmosphere surrounding the produces reducing metabolic activity and delaying senescence process. The effectiveness of CA depends on: cultivar, climacteric nature, storage temperature, selected concentration of gases, stage of maturity, commodity quality at harvest and pre-storage treatments. If the conditions are optimal for the chosen crop, senescence will be delayed through reducing respiration rate and substrate

oxidation, delaying ripening of climacteric fruit and reducing the rate of ethylene production. Also, CA reduces the pathogen respiration rate and thus CA storage can maintain natural disease resistance. Subjecting a cultivar of a given commodity to O_2 levels below and/or CO_2 levels above its tolerance limits at a specific temperature-time combination will result in stressful condition for stored produces, which is manifested as various symptoms such as irregular ripening, initiation and aggravation of certain physiological disorders, development of off-flavors, and increased susceptibility to decay. To obtain the best results, it is essential to have a deep knowledge about the produces physiology and their respiration rate, tolerable minimum concentration of oxygen and maximum concentration of carbon dioxide.

ROLE OF KVK'S SCIENTISTS ON SANITARY TRAININGS IN UTTAR PRADESH

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Abstract

The present study was carried out with the objective of knowing the role of Scientist of KVKs in sanitary trainings in various villages of Uttar Pradesh. For this purpose One Hundred rural women were randomly selectedwho have gained knowledge about Swachhata, drinking clean water etc. from time to time by KVK's Scientists. Four villages were also randomly selected from the three districts of Uttar Pradesh. The data was collected with the help of structured interview schedule and supplemented by personal observations of the rural areas. The study revealed that 99 percent of rural women considered need of toilet facility for their home, where as One percent Rural women considered that there is no need of toilet facility for their home because they believe that house is like a temple where they worship hencetoilet should not be built in the house. The study revealed that it is basically due to illiteracy, ignorance and misbelief.

THE ROLE OF AGROFORESTRY IN ECOLOGICAL SUSTAINABILITY

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Abstract

The increased pressure on the world natural resources which arises from population growth as well as economic pressure has resulted in unsustainable use of natural resources and ecological instability. The unstable nature of the world climate, attributed to human activities, depletion of forest cover due to increased hunger for forest and non-forest products has caused a lot of environmental problems such as, land erosion, flooding, frequent and severe storm, depletion of soil fertility, natural disaster as well as seasonal changes of world climate: These negative effect on the world ecosystem required a crucial attention. This paper reviews the importance of agroforestry and discusses various agroforestry practices that are capable of enhancing the sustainability of the environment. Agroforestry is a means of halting the vicious circle of deforestation, soil erosion and other environmental problems facing the country. Agroforestry refers to the combination of agriculture and forestry practices within a farming system. As a land-use system, it serves the diverse needs of individual farmers in harnessing the natural resources around them, as this cannot be reconciled by the traditional cropping system. It involves the combination of trees and crops that increase the medicinal, environmental, and economic value of land with the much-needed profit and food security. Hence Agroforestry systems such as live fence, home garden, shelterbelt, alley farming, taungya system, improved fallow and agro silvopastoral are highly recommended as solution to environmental problems.

SOIL HEALTH MANAGEMENT AND PRACTICES: KEY FACTOR FOR CROP PRODUCTIVITY

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Abstract

As we all knows that soil health which is one of the most important key factors for crop productivity is degrading day by day

due to various faulty management practices. Fifth December is celebrated as World soil day to aware everyone about importance of maintenance of soil health. Unfortunately, 33 per cent of our global soil resources are under degradation due to unsustainable use of soil and human pressures on soils are reaching critical limits, reducing and sometimes eliminating essential soil functions. Approximately, an increase of 60 per cent in food output is required to feed the ever increasing human population due to which soils are under increased pressure. Against an annual depletion of 28 million tonnes (mt) of nutrients, against addition of 20 mt, leaving a net gap of 8 mt per annum, a deficiency which accumulating year after year, thereby depleting Soil health and quality. Due to mismanagement of soil health, soil degradations is continuously occurring and many developing countries are strongly constrained by lack of institutional capability and commitment to undertake the needed soil management activities. So there is an urgent need to address this problem at Government level. It is mandatory to effectively utilize the currently available technologies through public private partnerships to get desired results. The concept of soil health is being promoted largely by various scientific institutions all over the world. Policy makers, farmer and scientist should pay good attention to see that Sustainable soil management is a reality in the field because of significance of soil health management in India and to suggest aspects of strategic action plan to conserve this precious resource for the benefit of mankind.

VALUE ADDITION IN FLORICULTURE (DRY AND MODERN FLOWER ARRANGEMENTS)

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Abstract

There is an increasing demand all over the world for decorating living and working places with eco friendly things like flowers, foliages and dry floral arrangements. Dried floral arrangements could be seen in 19th century homes on pianos, sideboards and window sills. The beauty and value of dried flower are that they can be kept and cherished for years, which survive the cold of winter and heat of summer. These dried arrangements were found mainly during the winter months when garden flowers were absent. Traditional Victorian dry flower arrangements are opulent, colorful pieces. This style of dry flower arrangement can be modernized by varying styles and forms. A dynamic splash of vibrant and breathtaking dried flowers can be composed beautifully in several forms or arrangements. A selection of interior design baskets and other whimsical containers are used to enhance any interior design scheme. Different pattern followed in dry flower arrangements like Crescent, S-curve, Triangle, Fan Round, Oval, Pyramid etc. Moss, twigs, wheat and grasses also enhance the dried flower arrangements. There are number of different dried floral arrangements including dry flower bouquet, mixed potpourri, bleach bouquet, swag, garland, dry flower sachet, dry flower wreath and bouquet. There are different methods for preservation of plant materials like Hanging upside-down, Glycerin method, Pressing etc. design is given much important in dried arrangements

MPORTANCE OF BIOCHAR IN AGRICULTURE AND ITS CONSEQUENCE

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Abstract

Climate change is affecting all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. It's also affecting human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows. Keeping in view the present we are focusing mostly on biochar. Biochar is usually produced by pyrolysis of biomass at around temperature range of 300 to 600 degrees centigrade. It is under investigation as an approach to carbon sequestration to produce negative carbon emission. Present agriculture is leading mining of nutrients and reduction in soil organic matter levels through repetitive harvesting of crops. This decline of the soil continues until management practices are improved, additional nutrients are applied, rotation with nitrogen fixing crops is practiced, or until a fallow period occurs allowing a gradual recovery of the soil through natural ecological development. Soil health is the foundation of a vigorous and sustainable food system. Plants obtain their nutrition from organic matter and

minerals present in soils. As the land is cultivated, the agricultural process disturbs the natural soil systems including nutrient cycling and the release and uptake of nutrients. As the natural stores of the most important nutrients for plant growth decline in the soil, growth rates of crops are inhibited. The most widespread solution to this depletion is the application of soil amendments in the form of fertilizers containing the three major nutrients: nitrogen, phosphorus, and potassium. Among these nutrients, nitrogen is considered the most limiting for plant growth. Nitrogen builds protein structures, hormones, chlorophyll, vitamins, and enzymes, and promotes stem and leaf growth. Biochar may be added to soils with the intention to improve the soil health, improve soil fertility, and sequester carbon. However, the variable application rates, uncertain feedstock effects, and initial soil state provide a wide range of cost for marginally improved yield from biochar additions, which is often economically impracticable. The need for further research on optimizing biochar application to improve crop yields.

AGROFORESTRY SYSTEM : AN OPPORTUNITY FOR CARBON SEQUESTRATION AND CLIMATE CHANGE ADAPTATION IN TRANSITIONAL PLAIN OF INLAND DRAINAGE (ACZ IIA)

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Abstract

The increase in atmospheric carbon dioxide (CO_2) concentrations due to emissions from fossil fuel combustion is contributing to recent climate change which is among the major challenges facing the world. Agroforestry systems can contribute to slowing down those increases and, thus, contribute to climate change mitigation. Agroforestry refers to the production of crop, livestock, and tree biomass on the same area of land. The soil organic carbon (SOC) pool, in particular, is the only terrestrial pool storing some carbon (C) for millennia which can be deliberately enhanced by agroforestry practices. Up to 2.2 Pg C (1 Pg=1015 g) may be sequestered above and belowground over 50 years in agroforestry systems, but estimations on global land area occupied by agroforestry systems are particularly uncertain. Agroforestry is a natural resource management system that integrates trees, crops and animals in a manner that produces two or more crops from a small unit of land sustainably. It is a sustainable land use system that is ecologically and economically sound and offers the added benefit of carbon sequestration. This paper reviews agroforestry practices in Rajasthan and its role in carbon sequestration and climate change adaptation. Agroforestry is being practiced in the agriculture research centre for the requirement of daily needs like fodder, food and fuel as a substitute to forests. The fodder trees, fuelwood and fruit trees around the farm have an important role in diet supplement as well as in carbon storage. Various researchers have estimated carbon content in agroforestry range from between 12 and 228 MgC/ha with a median value of 95 Mg/ha in the terrestrial agro ecosystem.

OZONE LAYER DEPLETION AND ITS EFFECTS : A REVIEW

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Abstract

There are many situations where human activities have significant effects on the environment. Ozone layer damage is one of them. The objective of this paper is to review the origin, causes, mechanisms and bio effects of ozone layer depletion as well as the protective measures of this vanishing layer. The chlorofluorocarbon and the halons are potent ozone depletors. One of the main reasons for the widespread concern about depletion of the ozone layer is the anticipated increase in the amounts of ultraviolet radiation received at the surface of the earth and the effect of this on human health and on the environment. The prospects of ozone recovery remain uncertain. In the absence of other changes, stratospheric ozone abundances should rise in the future as the halogen loading falls in response to regulation. However, the future behaviour of ozone will also be affected by the changing atmospheric abundances of methane, nitrous oxide, water vapour, sulphate aerosol, and changing climate. The causes, mechanism and bio-effects of ozone layer depletion on humans were addressed. It is revealed that introduction of Chlorof-lourocarbons (CFCs) in the environment is the most rated cause of said depiction. Ozone depletion is allowing the UV radiation to earth surface. The exposure to these radiations is severely affecting all life forms on earth, especially the humans.

Permanent or temporary blindness, skin cancer and immunity suppression are the main effects of these radiations reported by various researchers on humans. The prospects of ozone recovery are still undiscovered. The current situation of ozone depiction demands urgent remedial measures to protect lives on this earth.

STUDY ON HUMAN ECOLOGICAL FACTORS AFFECTING VISUAL SPATIAL INTELLIGENCE OF YOUNG ADOLESCENTS

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Abstract

A theory developed by Howard Gardner (1983) states that people perceive the world around them through their intelligences. There are nine well-known intelligences: linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalistic and existential. Visual Spatial (picture smart) Intelligence adheres particularly to our capacity to course of action information through visualization. Children who favor a spatial intelligence tend to learn through visual aids and images and individuals with strong spatial intelligence will gravitate towards artistic and highly visual forms of communication. Visual artists and interior designers illustrate creative spatial abilities and a flourishing architect will necessitate both the creative abilities as well as technical achievement. Ecological Systems Theory given by Urie Bronfenbrenner in 1940s focuses that there are five layers arranged from the closest to the individual to the farthest: the microsystem, mesosystem, exosystem, macrosystem and chronosystem. These all systems directly or indirectly affects the individual' growth and development. Hence, the effect of these variables was studied alongwith Multiple Intelligence of the young adolescents. For this, 200 respondents in the age group of 12-14 years from both urban and rural area of Mahendergarh district of Haryana state were selected. From research findings it can be concluded that family size, caste and availability of newspaper at home were significantly associated with the visual spatial intelligence. It is evident from the research that other microsystem variables and mesosystem variables had no significant association with visual spatial intelligence of the respondents.

STUDY ON HUMAN ECOLOGICAL FACTORS AFFECTING LINGUISTIC INTELLIGENCE OF YOUNG ADOLESCENTS

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Abstract

A theory developed by Howard Gardner (1983) states that people perceive the world around them through their intelligences. There are nine well-known intelligences: linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalistic and existential. Linguistic (word smart) Intelligence pertains specifically to our ability to process information using words and language. Children who errand linguistic intelligence lean to have strong verbal skills and become skilled at well through reading and writing. Authors, poets, speakers, and newscasters exhibit high degrees of linguistic intelligence. Whereas, Ecological Systems Theory given by Urie Bronfenbrenner in 1940s focuses that there are five layers arranged from the closest to the individual to the farthest: the microsystem, mesosystem, exosystem, macrosystem and chronosystem. These all systems directly or indirectly affects the individual' growth and development. Hence, the effect of these variables was studied alongwith Multiple Intelligence of the young adolescents. For this, 200 respondents in the age group of 12-14 years from both urban and rural area of Mahendergarh district of Haryana state were selected. Research revealed that there was no significant association between the microsystem, mesosystem, macrosystem variables and the linguistic intelligence of the young adolescent girls. Therefore, it may be recommended that as linguistic intelligence is independent of living habitat of the children so, parents should shore up their children in their education by making necessary provisions needed to enhance their language/ linguistic skills.

BIOCHEMISTRY OF INSECT IMMUNE SYSTEM

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Abstract

The multicellular organisms have been encountered by a diverse array of pathogens. In response to the foreign invaders, the insects have been reported to develop an immune system which is basically the interaction between the virulence of the pathogen and the defending capacity of the host insects. The immunity system in insects may be divided into basically innate and adaptive type immunity, but in insects only innate immunity is functional and the adaptive immunity is being absent in insects unlike mammals. Furthermore, the innate immunity is divided into cellular and humoral immunity in insects. Cellular immunity is being imparted by various haemocytes such as, plasmatocytes, granulocytes and oenocytoids and the humoral immunity is provided by various Anti Microbial Peptides (AMPs) which are produced by fatbodies. Behavioural immunity includes the avoidance and antiseptic behavior by the host insects towards the pathogens or the products of pathogens. The insect has to overcome a series of barriers before reaching the haemocoel. The cuticle, trachea and midgut act as major site for invasion by the nonself microbes. The cuticle or integument is the outermost layer for taget. It is chemically composed of chitin which is crosslinked with various types of proteins. Integument is the primary target for fungi on which the fungal spore adheres and germinates. After overcoming the morphological external barriers in insects the pathogen has to gain access to haemocel by overcoming the physiological immunity in insects. Physiological immunity basically comprises of the cellular immunity and the humoral immunity. For the activation of physiological immunity in insects, the identification of nonself is the most important. Recognition of nonself occurs by the help of fat body cells, hemocytes, midgut epithelium and cuticular epithelium. Thus different biochemical pathways such as IMD, TOLL, JAK-STAT are activated in response to the nonself invaders. The study if immunity in insects can help in better understanding and effective utilization of entomopathogens for the control of insects.

STUDY ON LIFE CYCLE OF CEREAL CYST NEMATODE, *HETERODERA AVENAE* ON BARLEY

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Abstract

Life cycle and development of cereal cyst nematode, *Heterodera avenae* on barley were carried out in earthen pots of one kg capacity under screen house conditions, Department of Nematology, CCS HAU, Hisar. The development of *Heterodera avenae* was studied on four resistant cultivars (BH 393, BH959, RD 2035 and DWRB 91) and one susceptible cultivar (BH 902). After 20 days of germination inoculation with second stage juveniles@ 250 J_2 / pot. Plants of each cultivar were uprooted at 15 days interval after the inoculation and observations were taken till adults were formed. Roots of uprooted plants were stained with 0.1% acid fuchsin lactophenol and observations on the development stages were taken by mounting the nematode dissected out of root in lactophenol. Penetration of the J_2 of *H. avenae* was occurred in susceptible as well as in resistant cultivars but penetration was more in susceptible cultivars than resistant cultivars. In all the varieties, almost all the J_2 could reach the fourth stage. Infected roots exhibited only slight swelling at the site of infection. *H. avenae* completed life cycle from J_2 to female in 75 days on all varieties except, on RD 2035. Maximum number of cysts and cyst content were found in susceptible variety than resistant varieties but on RD 2035 no cysts were formed.

DAMAGE POTENTIAL OF DIAPAUSING AND NON-DIAPAUSING *CHILO PARTELLUS* (SWINHOE) ON MAIZE

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Abstract

The damage potential of F_1 generation of diapausing (hibernating and aestivating) and non-diapausing populations of spotted

stem borer, *Chilo partellus* (Swinhoe) were studied on resistant (CML 345) and susceptible (Basi local) maize genotypes under field and laboratory conditions at Division of Entomology, ICAR-IARI, New Delhi. The test maize genotypes were sown in the pots. After 15 days of germination, the maize genotypes were inoculated with 5 neonates of each *C. partellus* population in the central whorl of total 15 plants in 3 replications. Observations were recorded on leaf damage and deadheart formation after 2 weeks of inoculation. Under laboratory conditions, 5 cm leaf discs of both resistant and susceptible maize genotypes were inoculated with 10 neonate larvae of each *C. partellus* population, and there were five replications. Observations were recorded on leaf area damage, larval survival and larval weight after one week of inoculation. The leaf disc bioassay revealed that the leaf area damage and larval survival was significantly higher in F_1 progeny of hibernating as compared to aestivation and non-diapause *C. partellus* populations on both resistant and susceptible maize genotypes. Further, the leaf area damage and larval survival was significantly lower on resistant as compared to susceptible maize genotypes in all the three *C. partellus* populations. The field bioassays showed that the leaf damage and deadheart formation by all the three *C. partellus* populations were significantly higher in susceptible as compared to resistant maize genotype. Further, the leaf damage and deadheart formation in resistant maize genotype were significantly higher in the F_1 progenies of hibernating and aestivating as compared to non-diapausing *C. partellus* population.

EFFECT OF PHYTOPHAGOUS MITES ON VEGETABLES GROWN UNDER INDOOR CONDITION AND THEIR MANAGEMENT

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Abstract

Phytophagous mites are serious pest of Indian agricultural ecosystems. These mites cause biotic stress in its host plants and adversely affect the quality of produce. In India, average yield losses in vegetable crops due to mites were estimated 25 per cent. In recent few years, these mites gaining tremendous importance in indoor vegetable crops due to their devastating and notorious nature.Phytophagousmites suck the sap from the leaves producing small white specks, leaves lose their chlorophyll content, wilted leaves, dry and drop off. They also affect the plant growth, flowering and fruiting. So these mites become an indirect non-insect pest that reduces the quality and quantity of indoor vegetable crops. For better management of these mites, several cultural and chemical methods are used. Use of pesticides to kill the mites, adversely affect the natural enemies and create environmental pollution, human health related problems and risk of pest resistance. Now a day, demand of organic pesticides and integrated pest management tactics are used for the control of phytophagous mites in developing countries. These eco-friendly management tactics are effective against mite pest and safe for human health and environment.

MOLECULAR MAPPING FOR GRAIN WEIGHT AND DIMENSION TRAITS IN A RIL POPULATION OF RICE (*ORYZA SATIVA* L.)

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Abstract

Rice grain size, shape and weight are determined by grain length, grain breadth, length/breadth ratio (L/B ratio) and 1000-grain weight (TGW), while cooked rice appearance is influenced by cooked kernel length (CKL) and elongation ratio (ER). Molecular markers have enormous potential to increase the precision and accuracy for the dissection of quantitative trait loci (QTLs) of economically important traits. The present study was carried out with the objective of mapping QTLs governing grain weight and dimension traits in rice using a recombinant inbred lines (RILs) population generated from the cross between Sonasal, a short grain aromatic rice landrace with TGW of 13.75 g, rough rice length (RRL) of 6.37 mm; and Pusa Basmati 1121, a Basmati rice variety possessing extra-long slender grains with TGW of 28.28 g and RRL of 12.43 mm.

Among the 352 RILs evaluated, TGW ranged from 8.80g to 28.33g, RRL ranged from 5.40 mm to 12.52 mm, rough rice breadth (RRB) ranged from 1.80 to 2.93 mm, RRL/B ratio ranged from 2.20 to 5.97 mm, milled rice length (MRL) ranged from 3.47 to 8.00 mm, milled rice breadth (MRB) ranged from 1.40 to 2.53 mm, MRL/B ratio ranged from 1.80 to 4.76 mm, CKL ranged from 6.27 to 17.13 mm and cooked kernel breadth (CKB) ranged from 1.91 to 3.13 mm. A total of 41 STMS markers polymorphic between Sonasal and PB1121 providing genome wide coverage were used for genotyping of 352 RILs and single marker analysis (SMA) was carried out using QTL Cartographer V.2.5. A major gene *GS3* located on chromosome 3 was found to be associated with the traits RRL, RRL/B, MRL, MRL/B, CKL and TGW with the phenotypic variance explained to an extent of 49.33%, 39.68%, 51.90%, 43.24%, 39.63% and 44.75%, respectively. The marker RM505 located on chromosome 7 was found to be associated with the traits RRB, MRB and CKB with the phenotypic variance explained to an extent of 6.62%, 15.97% and 14.02%, respectively. Validation of two *GS3* based markers SF28 and *aksGS3-12* were used for genotyping in F_2 and F_{11} RILs population. Using SMA, showed significant R^2 values between two groups formed by genotypic and phenotypic data in F_2 (SF28=31.63% and *aksGS3-12*= 16.07%). In F_{11} RILs the R^2 values calculated for SF28 and *aksGS3-12* were 38.27% and 49.33%, respectively. The QTL linked markers identified in the present study are valuable resources as they can be utilized in marker assisted selection for not only Basmati rice but also for improvement of short grain aromatic rice varieties.

GENIC MARKER BASED DIFFERENTIATION AND MAINTENANCE AMONG MAIZE VARIANTS

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Abstract

Over the last decade, maize (*Zea mays* L.) has been emerged as world's leading crop among the cereals with highest production and productivity. In India, maize is third important food crop after wheat and rice but its productivity is almost half to the world average. Therefore, maize stands uncompetitive to wheat and rice due to low productivity in addition lower minimum support price. To bring maize competitiveness, the only avenue is to explore the maize variants like sweet corn, popcorn etc. In present scenario, the demand for maize variants is increasing with exponential rate due to changing food habits with upsurge in income status of consumers. To get the premium price of these types of corn, purity maintenance is utmost important, but differentiation at phenotypic level before grain maturity is not possible. Molecular marker has been identified as effective and additional tool for varietal identification and description. However, these molecular markers have technical differences with respect to cost, speed, amount of DNA needed, degree of polymorphism, precision of genetic distance estimates and statistical power of tests. In this context, single nucleotide polymorphism (SNP) markers offer the promise of higher map resolution, higher throughput, lower cost and no recombination with target gene. For differentiating the maize variants specific SNP genic marker for target gene can be designed like mutant gene *su1* is responsible for sweetness in sweet corn. Therefore, designed primers for this gene would be much more helpful in differentiating the sweet corn form normal maize before maturity. Likewise primers of target gene for particular variant can be designed and employ for differentiating the variants.

EVALUATION OF EATING AND COOKING QUALITY IN THE INDIAN AROMATIC RICE GERMPLASM

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Abstract

Rice is the major staple food for more than half of the global population providing about 19% of global human per capita energy and 13% of per capita protein. Rice is generally consumed after the removal of bran layers through the process of polishing and starch remains as the predominant component of polished rice. Rice starch is composed of two major glucose polymers viz. amylose and amylopectin, whose proportions determine the eating and cooking quality (ECQ) of rice. Higher

amylose content makes cooked rice hard upon cooling, less tender, dry and separate while cooked rice of low amylose varieties becomes sticky, soft and glossy. Based on the digestibility in the small intestine, rice starch is further categorized into rapidly digestible starch, slowly digestible starch and resistant starch (RS). Higher proportion of RS contributes to low Glycaemic index and is beneficial to patients suffering from type II diabetes. The present study assessed a set of 283 aromatic rice accessions for the traits determining the rice ECQ like Apparent Amylose Content (AAC), Gel Consistency (GC) and RS. The accessions depicted enormous variability for these traits with AAC ranging from 4.81% (Manipur Black Rice) to 35.88% (ANP 61). Based on the AAC, the accessions were grouped into 5 amylose groups as per classification proposed by International Rice Research Institute (IRRI). Two accessions were found in the glutinous category (0–6%), 12 in very low category (6–12%), and 15 in low category (12–20%), 56 in intermediate category (20–25%) and 198 accessions in high amylose category (25–32%). The results reveal predominance of intermediate and high amylose genotypes in the aromatic rice cultivars. GC varied from 47mm (ANP61) to 113mm (NJ72) while RS depicted a variation of 0.14% (ANP462) to 3.25% (ANP546). Correlation analysis among the traits revealed a significant negative correlation of GC with AAC (r= -0.52; p= 0.012) as well as RS (r= -0.56; p= 0.006) while a significant positive correlation was observed between RS and AAC (r=0.45; p=0.03). The study revealed the existence of immense variation for rice ECQs and depicts the scope of its utilization in breeding programs. A representative subset of these accessions will be re-sequenced for the granule bound starch synthase 1 (GBSS1) gene to identify the allelic variants associated with the ECQs.

IMPACT AND ECONOMIC ANALYSIS OF FRONTLINE DEMONSTRATIONS ON WEED MANAGEMENT IN WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

The study was conducted under on Farm Testing (OFT) at the farmer's field of adopted village Fatehgarh of District Mandsaur (Madhya Pradesh) in rabi season of 2015-16, 2016-17 and 2017-18 to assess the effect of weed management treatments on yield of wheat (*Triticum aestivum* L.) and its weeds. The weed management treatment clodinafop 15% + metsulfuron methyl 1% WP @ 64 g ai/ha as post emergence gave 27.87 percent higher grain yield as compare to farmer's practice. Further, application of clodinafop 15% + metsulfuron methyl 1% WP @ 64 g ai/ha as post emergence treatment gave significantly higher tillers per plant, net return and B:C ratio as compared to all other treatments tested and significantly reduced the weed count and weed dry matter recorded at 60 DAS as compared to all other treatments tested. In spite of increase in yield of improved technology the technological gap, extension gap and technology index existed which were 7.47 q ha^{-1}, 10.36 q ha^{-1} and 13.58 % respectively.

INDUCED SYNTHESIS OF DEFENCE MOLECULES IN TOMATO AGAINST FUSARIUM WILT THROUGH PLANT EXTRACTS

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Abstract

The potentiality of different plant extracts like bark of *Eucalyptus lanceolotus*, leaves of *Azadirachta indica,* bulb of *Allium cepa*, cloves of *Allium sativum,* tubers of *Cyperus rotundus*, rhizome of *Zingiber officinale* and *Parthenium hyterophrous*, as inducers were assessed on physiological and biochemical activities in tomato against Fusarium wilt. Pre-application of inducers provided protection of tomato plants and reduced the disease incidence. from 84.46 to the minimum with 8.40% was recorded from garlic extract treated seedlings followed by neem extract and zinger extract treated seedlings with disease incidence of 10.70% and 11.90%, respectively. Treatment with plant extracts as inducers prior to challenge inoculation sensitized the seedlings to produce increased levels of soluble protein. The maximum increase in protein content was found in garlic extract treated seedlings representing 29.5, 32.40, and 31.6 mg/gm of fresh leaves of 5, 10 and 15 days of pathogen inoculation whereas, in case of control-1 and control-2 the values are 21.80, 22.50 and 22.00 mg/g and 18.98, 20.90 and 19.90 respectively. A high content of phenol, which is an indicator of first stage of defence mechanism, was also recorded in treated

leaves with maximum in garlic extract treatment as 2.09, 2.26 and 2.18mg/gm of fresh leaves against 1.50, 1.59 and 1.58 mg/g and 1.40, 1.50 and 1.46 mg/g in case of control-1 and control-2 at 5, 10 and 15 days of pathogen inoculation. Co-relation co-efficient between disease incidence with the soluble protein content (r=-0.572) and total phenol content (r=-0.533) both showed a negative correlation with disease incidence.

ROLE OF AGRO-ADVISORIES FOR OPTIMIZING PRODUCTION OF VEGETABLE CROPS IN MOUNTAINOUS NICHES OF INTERMEDIATE ZONE OF J&K

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Abstract

Vegetables play a vital role in human nutrition as a source of essential vitamins, minerals, proteins and dietary fibers. It has emerged as one of the most important component of crop diversification for improving socio-economic status of the farmers of hilly region. There is immense scope for off season cultivation, seed production and exotic vegetable cultivation in this zone. Vegetables, being succulent herbaceous annuals/biennial plants, are most sensitive to climatic variations. A slight change in temperature, relative humidity or erratic rainfall (high/low) affects vegetable crops to a greater extent as compare to other field crops. Moreover, agro-climatic diversity plays a major role not only interms of improving productivity but also quality. A precise and advance weather forecast is always be of great importance in planning and executing various agricultural operations in vegetable fields besides taking preventive measures to minimize losses from biotic and abiotic stresses to make it a more profitable enterprise. In this direction Agro-meteorological Field unit (AMFU) - Rajouri plays a key role in sensitizing the farmers of hilly tracts of Jammu & Kashmir regarding weather and climate information well in advance for utilization in their farm operations by providing them medium range weather forecast based crop advisories biweekly on every Tuesday and Friday in collaboration with India Meteorological Department (IMD).These advisories includes advance forecasting of weather elements like cloud amount, rainfall, maximum temperature, minimum temperature, wind speed, wind direction and relative humidity. The information provided by AMFU is vital in decision making of farmers regarding sowing time, fertilizer application and most importantly providing amount and frequency of irrigation at critical growth stages to vegetable crops. The mode of communication adopted for dissemination Agro-meteorological advisories are print, electronic and mass media. Advance intimation on impending weather isproving helpful and widely utilized by farmers of mid to high altitude intermediate zone. Besides this vegetable growers are also profited by Short Message Service (SMS) started by Ministry of Agriculture through m kisan portal. More than 200 agro-meteorological SMS were sent by AMFU, Rajouri in english, urdu and hindi languages till date through which near about 1.5 lakh farmers and stake-holders were benefitted.

HORTICULTURAL BIODIVERSITY AND ITS CONSERVATION IN BUNDELKHAND REGION OF U.P.

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Abstract

Bundelkhand lies between the Indo-Gangetic Plain to the North and Vindhya Range in South. It is a gently sloping upland, distinguished by barren hilly terrain and it has undergone an ecological succession from predominant forest land to grassland, because of acute ecological degradation. The Flora of this region is rich in grasses, under- utilized fruits as well as vegetable herbs. Horticultural crops form as well as a subset of agro-biodiversity, which include horticultural plant species or their wild gene pool, having genetic material of actual or potential value.The Horticultural genetic resources also include obsolete varieties , populations , landraces , genetic stocks and breeding materials of crop plants. Introduction of improved varieties over a period of time has replaced innumerable local varieties and land races, which results in genetic erosion and genetic vulnerability to biotic and abiotic stresses, which leads to crop losses. So extensive survey has been done to collect wide information regarding the horticultural biodiversity of Bundelkhand region of U.P. During this survey 68 horticultural plant species were recorded which are used as fruits, vegetables, dry fruits, drinks, pickles and chutney. Such region we need to

involve local people to horticultural biodiversity conservation, educating them highlighting its significance and degraded ecosystem need to restore and stimulate greater public support for horticultural biodiversity conservation.

CONSERVATION OF ENERGY : NEED OF HOUR

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Abstract

Biomass is used to generate electric power by direct burning, using gasification systems, or mixingbiomass with coal in coal-fired electrical generation facilities. The primary feedstocks includewood waste used by the pulp and paper industry for industrial heat and steam production.Inaddition, forest residues and municipal solid waste are used to generate electricity. Anotherpotentially large source of renewable energy is animal waste which can be turned into methanegas through anaerobic digestion. Anaerobic digesters are being adopted by commercial livestock operations not only to produce energy, but also to meet new state and Federal regulations forcontrolling animal waste. Currently, there are over 90 anaerobic digester projects, either inoperation or under construction, located throughout the United States. Nearly all the anaerobicdigesters are associated with dairy operations, with a few associated with swine or poultryoperations. Another emerging approach to reducing U.S. fossil energy use is to replace petroleumbased products with products made from biomass. There are many industrial and consumerproducts that have been traditionally made from biomass, including yarns and fabrics, soaps anddetergents, pulp and paper, lubricants and greases, and adhesives and paints. However, agriculturalfeedstocks can be used to produce non-traditional products such as chemicals, plastics, hydraulicfluids, and pharmaceuticals. There are many agricultural feedstocks that can be used to makebioproducts, including a variety of crops, wood and plant oils, and agricultural and forestryresidues.

ENRICHMENT OF VERMICOMPOST BY BIOAGENT *TRICHODERMA HARZIANUM* FOR MANAGEMENT OF SOIL BORNE DISEASES IN KASHMIR VALLEY

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Abstract

In disease management, the indiscriminate use of chemicals have caused negative impact on environment and resulted in resistant strains of microbes to these chemicals. The chemical pesticides has undoubtly enhanced the food production, but has also adversely affected the environment and non-target beneficial organisms. Keeping in view these global problems, effective alternatives to chemical control is the need of hour. Biological control is one of the potential, cheap, ecofriendly and alternative approach for managing plant diseases and to combat the above said problems. Chilli (*Capsicum annuum L.*) one of the important commercial spices and solanaceous vegetable is encountered by many diseases and fungal wilt caused by *Fusarium* spp. has which is causing severe crop losses in chilli productivity throughout the world as well as in Kashmir valley. *Trichoderma harzianum* and *Trichoderma viride* are the widely exploited species and have been used against about 70 soil borne plant pathogens. Looking towards need for cost effective production of ecofriendly biopesticide, present study was undertaken to evaluate different substrates like cereals, pulses and vermicompost, for development of stock cultures, fast biomass production of *Trichoderma harzianum* and their utilization in management of chilli wilt disease. The results revealed that the vermicompost inoculated with *Trichoderma harzianum* were having maximum colony forming units, hence are suitable for stock culture development and biomass production. The stock culture was further added in the ratio of 1:10 kg of vermicompost for mass multiplication. The mass multiplied vermicompost was used in field for management of chilli wilt, and results confirmed that the wilt incidence was very low as compared to control plot. This indicates that vermicompost is not only a good substrate for multiplication, shelf-life and maintenance of *T. harzianum* but also has the capacity to reduce disease incidence and improve plant growth parameters.

SOIL HEALTH MANAGEMENT AND PRACTICES: KEY FACTOR FOR CROP PRODUCTIVITY

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Abstract

Soil is an important component of terrestrial ecosystems that support life on the earth. A healthy soil is fundamental for sustained agricultural productivity, environmental resiliency and the maintenance of vital ecosystem processes. Currently, the growing population has many implications but most of all it requires an increase in agricultural production to meet food demand. For accomplishing that we began to ruin the soil. Our plows compacted the lower levels of the soil profile, causing surface runoff, poor aeration and affecting mobility of certain nutrients. The soil is exploited for crop production without restoring the organic matter and nutrient contents, the nutrient cycles are broken, soil fertility declines and the balance in the agro-ecosystem is destroyed. In addition to this, the rampant use of agro-chemicals, under the adage, "if little is good, a lot more will be better" has played havoc with soil health and other life forms. These chemicals jeopardized the biology of the soil also. Now the time has come to stop punishing our soils and to adopt holistic production management systems that promote and enhance soil health that are socially, ecologically and economically sustainable. Numerous and diverse farming approaches promote the sustainable management of soils with the goal of improving productivity. For instance, maintaining suitable habitat for the myriad of creatures that comprise the soil food web. This can be accomplished by disturbing the soil as little as possible, keeping living plants in the soil as often as possible, and keeping the soil covered all the time. Agriculture productivity can be made sustainable by integrated use of manures, fertilizers and bio-fertilizers in judicious combinations. At last, all above mentioned management practices also enriches soil with organic matter and cycle nutrients.

TO ASSESS THE SOYBEAN, FORTIFIED WHEAT FLOUR CHAPATTI

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Abstract

Two third of world population particularly children in developing country suffer from protein calorie mal nutrition, even cereals are the main source of protein content but are also deficient in one other essential amino acids therefore supplementation of legume with cereals is an important step to ensure the supply of adequate calorie with quality protein is desirable. Soya bean have potential eliminate to these problems because it is rich protein and energy content, and the cheapest source of protein rich food. However soybean have gain place in the diet of rural people. To keep these point in view the investigation has been selected on nutritional study of soya glycaemic max L. enriched wheat flour chapatti was conducted at FSN department CSAU Kanpur. Six varieties of soybean and one variety of wheat collected for the development of chapatti. The three different ratio were taken T_1 (80:20) T_2 (85:15) and T_3 (90:10) chapatti quality as well as organoleptic soya blended wheat flour were recorded acceptable at these three blending level.

WATER MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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Abstract

Irrigation would continue to play an unquestionable role in achieving food self-sufficiency, sustaining agricultural growth, absorbing labour force in rural areas, and alleviating rural poverty; all of which are vital for food security. Given India's unique food security policy, there is agrowing need to manage water for agriculture. The study aims to examine the water resources foragriculture sustainability and food security in India. For fulfilling the above said objectivessecondary sources of

data have been used. The study shows that managing water for food securityneeds a multipronged approach. At the aggregate level, the irrigation water supplies and thedemand for irrigation need to be balanced. At the next level, greater equity needs to be ensured inaccessing and controlling water from aquifers and public systems. At the third level, farmersshould maximize production from available land and water resources with the least environmentalconsequences. The study suggests that Micro irrigation technologies can greatly enhance theproduction from limited water supplies they have access to. Integrated land and water managementpractices such as organic farming and agronomical activities would be the key to enhancing landand water use productivity on a sustainable basis; but small and marginal holders would face severeconstraints in adopting them. The study also suggests that privatization of water resources willlead to overall enhancement in the economic efficiency of water use and higher productivity inagriculture. The enforcement of tradable private property rights will ensure equitable access towater in water scarce regions for agriculture, and also for all classes but it is critical from the pointof view of local and domestic food security.

PHYSIO-CHEMICAL AND FERTILITY CHARACTERISATION OF APPLE GROWING SOILS OF JAMMU AND KASHMIR, INDIA

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Abstract

The favorable agro-ecological potential of Jammu and Kashmir state offers the advantage of growing different temperate fruit crops like apple, pear, peach, almond etc. However, the fruit production and soil managements greatly differ with kind of soil and their physico-chemical behavior. Since soil physio-chemical characterization relates to elemental distribution pattern, therefore it provides useful information for assessment and monitoring the fertility status. Soil samples collected from twelve major apple growing orchards in three physiographic altitudes viz., high, mid and low altitudes to study the various soil physico-chemical properties and fertility parameters. After due laboratory processing the composite soil samples were analysed as per the prescribed standard procedures for various physico-chemical properties and nutrient status in these apple orchards. The soils were moderately deep to very deep, predominantly clay loam to clay in texture, normal electrical conductivity, slightly acidic to slightly alkaline in reaction and low to high in organic carbon (0.17 to 2.01%). Almost all the apple orchards were low in calcium carbonate content ranging from 0.38 to 4.20%. The cation exchange capacity (CEC) values were moderate (12.27cmol kg^{-1} to 16.02 cmol kg^{-1}). Analysis of the soil revealed that the surveyed apple orchards were medium to high in available N (297.90-477.64 kg ha^{-1}) medium in P (11.09-18.64 kg ha^{-1}), medium to high in K (256.70-290.40 kg ha^{-1}) and Ca (2042-2415 ppm), low to medium in Mg (254.25-304.80 ppm) and S (9.14-13.25 ppm) status respectively. Most of the apple orchards were rated medium to high in available Zn, Cu, Mn and Fe except B (0.21 – 0.65) and Mo (0.08 and 0.10 ppm).

SOIL BIOLOGICAL PROPERTIES UNDER DIFFERENT SPACING OF *EUCALYPTUS* BASED AGROFORESTRY SYSTEM

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Abstract

The present study was carried out in already established 8 years old Eucalyptus plantation at 17×1×1 m, 6×1.5 m, 3×3 m and control at Research Farm of the Department of Forestry, CCS Haryana Agricultural University, Hisar during the year 2016-2017. The biological properties of soil were estimated for surface depth (0-15 cm). Different biological properties increased significantly under different spacing of eucalyptus based agroforestry system as compared to devoid of trees. Incorporation of trees with crops leads to increase in organic matter inputs through litter fall; this in turn enhances the amount of nutrients for soil micro flora, which ultimately leads to an increase in microbial activities. The NH_4^+– N and NO_3^- – N decreased significantly with increase in spacing and were minimum in field with no Eucalyptus tree. Mineralization increased significantly by incorporating trees with crops. The dehydrogenase and alkaline phosphatase activity increased from 88.6 to 183.5 mg TPF/kg soil/24 h and 70.8 to 124.7 mg PNP/kg soil/h, respectively due to Eucalyptus-based agroforestry system. The MBC and urease

activity increased from 146.7 to 276.1 mg/kg soil and 45.5 to 64.4 µg NH_4^+-N/g/h, respectively due to the Eucalyptus plantation at 3× 3 m spacing. This was due to observed higher microbial activity under plantations in the upper surface of soil due to presence of higher organic carbon content. The various biological properties found maximum under closer spacing and thereafter a decrease was observed. Therefore it may be concluded that Eucalyptus-based agroforestry system enhanced soil biological properties which results in more microbial activity and organic matter and ultimately in improved soil fertility.

SOIL HEALTH MANAGEMENT AND PRACTICES: KEY FACTOR FOR CROP PRODUCTIVITY

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Abstract

Soil is a critical resource and its manipulation can improve or degrade the quality of this resource. Soil health is the continued capacity of soil to function as vital living system sustaining the agricultural productivity for plant, human and animal survival and health. A healthy soil is important for plant growth, nutrient cycling, and biocontrol of pests and regulation of water and air supply. In present day agro-ecosystems, monocropping, intensive tillage and use of chemical fertilizers is prevalent, which deteriorates the overall soil health. Lack of biodiversity in monocropping systems limits the potential and increases disease and pest problems. Increasing crop diversity and planting cover crops increases soil health and soil function, reduces input costs and increases profitability. As new technologies have been developed, the reliance on tillage to kill weeds, incorporate crop debris and amendments, and prepare seedbeds has been diminished. Reducing tillage intensity improves soil health and reduces production costs due to saved labor, equipment wear and fuel. Physical soil disturbance by tillage results in bare and/or compacted soil that is detrimental to soil microbes. Providing plenty of easily accessible food to soil microbes in form of sugars from living plant roots, crop residues and soil organic matter helps them cycle nutrients that plants need to grow. Keeping the soil covered conserves moisture, reduces temperature, intercepts raindrops, suppresses weed growth and provides habitat for members of the soil food web. Understanding soil health means assessing and managing soil so that it functions optimally now and is not degraded for future use. By monitoring changes in soil health, a land manager can determine if a set of practices is sustainable or not. Management practices affect the amount of soil organic matter, soil structure, soil depth, water and nutrient holding capacity and ultimately the crop productivity.

SOIL POLLUTION : A THREAT TO MODERN AGRICULTURE

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Abstract

Soil contamination or soil pollution as part of land degradation is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals, or improper disposal of waste. Russia, China and India are among the countries in the world where pollution of toxic land is spreading rapidly.The most common chemicals involved are petroleum hydrocarbons, polynuclear aromatic hydrocarbons (such as naphthalene and benzo(á)pyrene), solvents pesticides, lead, and other heavy metals.Household waste, industrial waste etc. contain residues of harmful toxic inorganic and organic chemicals. In these residues, radiation elements such as strontium, cadmium, uranium, ladders are found, which affect the vitality and fertility of the land. Fly ash is a major source of pollution surrounding the industrial area.The use of chemical pesticides and fertilizers has increased for cultivating more crops and these pollutants are making the soil poisonous and in many places the soil has become dead due to excessive use of it.In the chemical and nuclear power plants, a large amount of waste is released continuously and due to the absence of proper arrangements for their storage and disposal, these substances pollute the soil.The most dangerous pollutants are bioactive chemicals, due to which the micro-organisms of climates and other soil are being destroyed resulting in decreased quality of soil.Acid rain also carries dangerous levels of pollutants in the air.Polluted soil is also contaminating drinking water in the rivers and other sources of water through rain water. By polluting the soil, in a way, we are destroying the foundation of the food chain.

PHYTOREMEDIATION OF SOIL CONTAMINATED WITH HEAVY METALS

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Abstract

Phytoremediation is an effective and affordable technological solution used to extract inactivemetals and metal pollutants from contaminated soil. This technique is a cost effective, environmentally and ecologically friendly as it utilizes plants natural ability to suck the pollutant present in the soil. There are many plants having this natural ability to up take the heavy metalsand organic pollutants from soil as it heavy metal pollution is a serious environmental problemand has its negative impact on human health and agriculture. There are some Mechanisms used toremediate soils contaminated by heavy metal are phytoextraction, phytostabilisation, hytovolatilization and phytodegradation. The two first mechanisms are the most reliable.Thereare many factors which effects the choice of the suitable phytoremediation strategy for removal ofcontaminated soil. This review discuss on the factors affecting heavy metals uptake byplant species, the different phytoremediation strategies of heavy metal contaminated soils.

NEEM, THE WONDER TREE, UNDER ATTACK : A NEW MAJOR PEST *CLEORA CORNARIA*, NEEM LOOPER (LEPIDOPTERA: GEOMETRIDAE)

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Abstract

Azadirachta indica (Meliaceae), popularly known as neem, a tree with multifaceted applications has Sanskrit name, 'arishtha' means 'reliever of sickness' and it is considered as the 'kalpavriksh of kalyuga'. Neem provides shade, ornamental look, shelterbelt, fuel wood and construction material, and also helps in degraded land reclamation. It is used to cure malaria, and bacterial, viral, fungal and helminth infections and in storing food grains. The pest, *Cleora cornaria* (Geometridae, Lepidoptera) was noticed for the first time feeding mainly on green leaves and tender branches of neem trees in Talwandi Sabo (Bathinda), Punjab. Different life stages of the pest, namely egg, larva, pupa and adult, were studied and the results are reported here in. The life cycle of neem looper passed through four different stages i.e. egg, larva, pupa and adult. The egg duration ranged from 2 to 4 days. The larva passed through five instars and the average duration (days) of each instar was found to be 2.46±0.51, 2.66±0.48, 3.53±0.51, 4.26±0.59 and 6.4 ± 0.50 days, respectively. The adult longevity of male and female moths of the looper was observed to be 5.1±1.06, 8.2±0.94 days, respectively. The pupation took place underneath soil and plant debris near the bases of tree trunks of neem. The pupal stage was prolonged in winter and the pest stayed in hibernation from December to March. The next generation of adult moths started appearing in April as the day temperatures picked up. The adults were observed sitting on tree trunks in the early mornings, however, they were attracted to light traps during night hrs.In view of previously reported tendency of the genus to be a major pest of many trees and the increased incidence of its species *C. cornaria* on neem, we should consider revising its status from a minor to that of a potential major pest.

EFFECT OF IRON RICH FOOD PRODUCT IN ADOLESCENT GIRLS SUFFERING FROM IRON DEFICIENCY IN SURGUJA DISTRICT OF CHHATTISGARH

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Abstract

Iron deficiency is the most common micronutrients problem in tribal women. During 2015-16 almost 31% women of Surguja

district were found suffering from iron deficiency. Adolescent girls are highly vulnerable to nutritional deficiency disease, especially iron deficiency anemia, which severely affects their general health. The present study was conducted to ascertain the effect of Iron rich food product in adolescent girls suffering from iron deficiency between the age group of 13-15 years in different villages of Surguja district.The experiment was conducted by krishi Vigyan Kendra, Surguja during 2016-17. Treatment included iron based locally available low cost food product (50 gm laddoo twice in a day). 100 gm mix iron rich food product contents equal amount of Rajgeera, Mint leaves, Lotus stem, Gingelly & Jaggery (Per 100 gm product contains 16.1 mg Iron). Also use of seasonal fruits containing Ascorbic acid is enhancing the absorption of iron content. The result revealed that an average weight was increased to 40.8 kg, Height 153 cm and haemoglobin content 10.8 gm% as compare to local practice where an average weight was increased to 38.2 kg, Height 152 cm and 9.8 gm% haemoglobin content recorded after three months of observation period. On the basis of the result it is recommended to include 100 gm iron rich food per day to the iron deficient girls. This supplementary food is also helpful to reduce iron deficiency among women in rural areas.

STUDY ON POPULATION DYNAMICS OF BLACK BUG IN SUGARCANE ECOSYSTEM AT PANTNAGAR

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Abstract

The studies on diversity of insect fauna and the population dynamics of black bug in sugarcane ecosystem were carried out for two seasons during 2014-15 and 2015-16 at Norman E. Borlaug Crop Research Centre of G.B.P.U.A & T. Pantnagar, Uttarakhand, India. India is the original home of Saccharum species (*Saccharum barberi*) whereas the New Guinea is the centre of origin of *Saccharum officinarum (*class-monocotyledon; family-Gramineae or Poaceae). In India, it is suffering from more than 289 different pests, out of which 213 are insect pests. Of these, 20 species considered as major pests including black bugs. There are few species of black bugs infesting sugarcane among those the *Cavelerius sweeti* is the most predominant pest of ratoon crops in North India region. Both nymphs and adults found sheltering in the leaf whorls and under the sheathing bases of leaves and sucks plant juice leading to pale yellow with brown patches on leaves however, severe infestation causes drying of leaf tips and margins, stunted growth and finally affecting sucrose content of ratoon crop. The incidence of the black bug on sugarcane was observed from 17th to 27th SMW and 16th to 25th SMW during 2014 and 2015 respectively. The population attained its maximum in the 21st standard week in both the seasons. Simple correlation between the weather parameters and black bug population during 2014-15 revealed that there was positive highly significant correlation with T_{max} and positive non-significant correlation with T_{min} whereas, it is negative non-significant with RH_{max} RH_{min} and rainfall respectively. In subsequent year it was positive non-significant correlation with T_{max} and RH_{max} while, it was shown negative non-significant correlation with T_{min}, RH_{min}, and rainfall respectively.

CLIMATE CHANGE : ITS IMPACT ON RISING AVERAGE TEMPERATURES AND SHIFTING HABITAT RANGES.

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Abstract

As global warming increases the baseline temperature at most locations on our planet, those organisms or populations that are free to move in order to remain in their ideal temperature range. At the global level, this will produce mixed effects. Some food producers, especially those at higher latitudes and altitudes, to grow, raise, and harvest plants and animals in areas formerly too cool for that activity but in temperate climate zones will be forced to adopt new practices better suited to a more tropical environment. This phenomenon of range shifting can pose a real danger to fisheries, livestock, and agriculture. Temperature-induced range changes may render obsolete local cultures, economies, and infrastructure that had been uniquely shaped around specific food resources Global biodiversity will dwindle as some high altitude and polar climates simply cease

to exist. Some species will shift more readily and quickly, while others may experience almost no range shift. The range, migration habits, and life cycles between pollinators and plants, pests and their prey, and wild food-stocks and their predators, will all be affected. It is unlikely that these environmental services can be replaced by human means.

SOIL CARBAN SEQUESTRATION IMPACTS ON GLOBAL CLIMATE CHANGE AND FOOD SECURITY

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Abstract

The carbon sink capacity of the world's agricultural and degraded soils is 50 to 66% of the historic carbon loss of 42 to 78 gigatons of carbon. The rate of soil organic carbon sequestration with adoption of recommended technologies depends on soil texture and structure, rainfall, temperature, farming system, and soil management. Strategies to increase the soil carbon pool include soil restoration and woodland regeneration, no-till farming, cover crops, nutrient management, manuring and sludge application, improved grazing, water conservation and harvesting, efficient irrigation, agroforestry practices, and growing energy crops on spare lands. An increase of 1 ton of soil carbon pool of degraded cropland soils may increase crop yield by 20 to 40 kilograms per hectare (kg/ha) for wheat, 10 to 20 kg/ha for maize, and 0.5 to 1 kg/ha for cowpeas. As well as enhancing food security, carbon sequestration has the potential to offset fossil fuel emissions by 0.4 to 1.2 gigatons of carbon per year, or 5 to 15% of the global fossil-fuel emissions.

EFFECT OF CALCIUM, PHOSPHORUS AND VITAMINS SUPPLEMENTATION FEEDING ON BUFFALOES IN HAMIRPUR DISTRICT OF BUNDELKHAND (U.P.)

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Abstract

The present study was conducted under Front Line Demonstration (FLD) during 2017-18 NICRA adopted village Mankikhurd, block Kurara district Hamirpur (U.P.). Ten farmers were selected each two buffaloes animals were selected, animals were fed mainly on wheat strawand green fodder constituted the basal ration of the animals (Farmer's practice). In improved technology blend of Calcium, Phosphorus and Vitamins supplementary feeding @ 100 ml/d/animal were fed for two months the parameters for milk production, fat, SNF were recorded time to time. Results show that Calcium, Phosphorus and Vitamins supplementary feeding @ 100 ml/d/animal there was 20.84 percent increment in milk production through improved practice as compared to farmer practice i.e. roughages without supplementation of minerals (5.07 lit/day). It may be concluded in terms of gross return, net return and B: C ratio was found superior in improved practices was Rs 13440, Rs 6420 and 1.91 respectively. However, feed intake/day by animal increased with improved technology, because of increase percentage of palatability and digestibility. Hence, livestock keepers need to be advised for scientific feeding of their livestock for getting optimum productivity and benefits.

HONEYBEES AS EFFECTIVE POLLINATORS UNDER PROTECTED CULTIVATION

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Abstract

Green house technology has developed primarily in western world and developed countries. The major obstacle in greenhouse production is matching the optimum pollination requirement of the crops to realize maximum productivity. Honey bees as pollinators are the cheapest and the most effective option, as a honey bee colony is equal to 300 men doing the hand

pollination. Bees were also employed as agents of pollination in greenhouses/enclosures way back in 1911 but with mixed results. The major reasons included are honey bees' inability to forage effectively in greenhouses with opaque, UV absorbing sheets and covers , higher relative humidity diluting the nectar sugar in flowers, high temperature where honey bees have to lose heat through evaporative cooling; directed air flow and ventilation affecting honey bee activity and subsequent fruit set due to phenomenon explained by honey bees' tendency to fly "upwind", and most importantly limited food resources. Limited nectar and pollen in green houses is insufficient for long term maintenance of honey bee colonies especially mono-floral source leading to curtailed pollination activity, colony deterioration and eventually its collapse. Many natural solutions for nutritional deficit have been suggested (Dag, 2008) that allow honey bees to forage in open and in enclosures on alternate days; use of double entrance hives, artificial feeding of colonies, use of attractants etc. Bumble bees are thought to be the better alternative but the results to the contrary have also been reported where honey bees proved equal or even better alternatives. In a developing country like India, commercial use of bumble bees in green house pollination of crops is not undertaken and only a few primitive studies exist. Government of India's restriction on imports of animals/germplasm, due to quarantine and other considerations, does not allow import of commercial bumble bee species from developed countries or this technology as a readymade solution. It is therefore, necessary to initiate comprehensive studies to provide alternatives especially honey bees for typical Indian situation, to fulfill this vast pollination gap.

CORRELATION BETWEEN FARMERS' PERSONALITY TRAITS AND THEIR KNOWLEDGE LEVEL IN VALUE ADDITION OF HORTICULTURAL CROPS

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Abstract

It is a known fact that traits influence the knowledge level of farmers, however, the nature and extent of relationships vary from situation to situation. In the present study, an attempt was made to determine the relationship between farmer's personality traits as independent variables and their knowledge as dependent variables. The traits selected in the study were age, education, land holding, farming system, experience in value addition, farm implements, training attended, source of irrigation, farm power, extension contact, innovation proneness and mass media exposure. The data show that the relationship between the personality traits like age (r=0.903), education (r=0.831), extension contact (r=0.504), innovation proneness (r=0.624) and mass media exposure (r=0.555) with the knowledge level had positive and significant correlation (at 0.05 level of probability). This means that farmer having higher age, education, extension contact, innovation proneness and mass media exposure possessed higher level of knowledge of value addition in horticultural and vegetable crops. However, all the remaining factors namely, land holding, farming system, experience in value addition, farm implements, training attended, and source of irrigation and farm power did not show any significant association with knowledge level of farmers. Therefore, it can be inferred that these variables are not associated with the knowledge level of farmers.

EFFECT OF LEVELS OF NPK AND SULPHUR ON GROWTH AND YIELD OF ONION *(ALLIUM CEPA L.)*

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Abstract

An experiment entitled," Effect of levels of NPK. and sulphur on growth and yield of Onion *(Allium cepa L.)*." was conducted during 2014-15 in Randomized Block Design with ten treatments and three replications.Result revealed that application of 100 kg N+ 50 kg P_2O_5 +50 kg K_2O+ 45 kg Sper ha was found superior in respects to all growth parameters, yield attributing charactersand yield of onion in profitable manner as compared to control and other treatments. The various growth, yield and yield attributing characters i.e. plant height (40.03 cm), number of leaves per plant (11.93), diameter of stem (0.92 cm), length of longest leaves (28.57cm), neck thickness (0.91cm), shell thickness (0.23 mm), bulb diameter (5.15 cm), length of bulb (4.82cm), weight of bulb (52.40 g), fresh yield of bulb per plot (7.69 kg), marketable yield of bulbs (250.31 q per ha), TSS content in onion juice (14.65 %) were recorded with highest mean values and lowest mean value in control @ 90 DAP.

IMPACT OF AGERATUM PLANT COMPONENT RESIDUES ON MUNG AND MAIZE CROP PLANT

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Abstract

Ageratum conyzoides L. (hereafter Ageratum) is presently considered as one of the most problematic weeds in India. It is widely spread the world over, especially in the tropical and sub-tropical regions. Commonly known as billy goat weed (family Asteraceae), it is a polymorphic, aromatic annual herb, native to tropical America, naturalized in India up to an altitude of 1800 m. The plasticity of an ecologically important trait of Ageratum, such as biomass allocation strategy, is likely to facilitate the evolution of greater plasticity enabling higher invisibility. Despite recognizing this plant species as one of the most rapidly advancing exotic invasive weeds in India, interfering with local biodiversity and crop growth. The chemical profiles of its plant components e.g. leaf, stem, root and flower. However, investigations pertaining to the relative impact of these plant components on associated plants/crops separately have been highly inadequate, although they join the dead organic pool in nature that undergoes decomposition after plant death and decay. It is hypothesized that high phenotypic plasticity coupled with its growth retardatory influence on the associated plant/crop through modification of soil properties on entry into the soil system after the death and decay of Ageratum account for the aggressive invasibility of this exotic weed in low-nutrient anthropic ecosystems in Indian dry tropics.

BIOCHAR-IMPORTANCE IN AGRICULTURE

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Abstract

Biochar is a carbon enriched by-product of bioenergy production obtained during pyrolysis (heating under limited supply of oxygen) of plant-derived feedstock including organic matter. In more technical terms, biochar is produced by so-called thermal decomposition of organic material under limited supply of oxygen (O_2), and at relatively low temperature (<700^{0}C). It is heterogeneous in their properties due to the wide variety of feedstocks that can be used and pyrolysis technologies. Some common feedstocks include switchgrass, hardwoods, peanut hulls, corn hulls, pecan shells, bark, rice, sugarcane, leaves, paper sludge, cow manure, poultry manure, poultry litter, sewage sludge, and aquaculture waste. The thermochemical processes of biochar production are slow pyrolysis, fast pyrolysis, hydrothermal carbonization, gasification, flash carbonization and torrefication. Biochar is a kind of environmentally friendly, economic, and renewable material. Owing to its advantageous physical, chemical and biological properties, it improves soil health (physical, chemical and biological properties) and agricutural productivity. Besides, it can be used as waste management technique and to sequestration carbon in soil.

EVALUATION OF ELEPHANT FOOT YAM (*AMORPHOPHALLUSCOMPANULATUS* DECNE.) GENOTYPES UNDER AGRO-CLIMATIC CONDITION OF CHHATTISGARH PLAINS

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Abstract

The present investigation was carried out in the field of AICRP on tuber crops at Horticultural Research Farm, IGKV, Raipur (C.G.) during *Kharif* 2006-2007. The experimental material consisted of 12 genotypes of elephant foot yam with three replications under randomized complete block design. The data recorded on 20 quantitive was analyzed to work out the variability, heritability, genetic advance for the maximum plant height(87.73 cm,), number of stem/plant(87.73 cm,), girth of

stem(2.04 cm), no. of primary portion of leaf(2.44), no. of secondary portion of leaf(3.43), length of primary partition (17.44 cm), girth of primary partition(1.29), no. of leaf lets (primary partition)(3.26), length of largest leaflet (17.14), breadth of largest leaflet (5.47), height of corm (8.27) ,diameter of corm (13.00), no. of cormels per corm (8.57), weight of cormels /corm (0.428), total tuber yield/ plant (1.626), tuber yield (25.18).Mean performance of elephant foot yam genotypes for yield and its components revealed that the IGAM-5 was high yielding genotypes followed by AC-14, AC-28, NDA-2, IGAM-1 and IGAM-2. Highest length of largest leaflet and fresh weight of corm was also recorded maximum in IGAM-5. Analysis of variance revealed that the mean sum of squares due to genotypes was significant for all the characters except no. of leaf lets (primary partition), height of corm, and diameter of corm. Estimate of genetic parameters for various characters revealed that relative magnitude of genotypic coefficient of variation in general was higher for no. of stem/ plant, girth of primary partition, no. of cormels/ corm, weight of cormels/corm.

STUDY OF VARIOUS RENEWABLE BASED COOKING SYSTEMS

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Abstract

In India the cooking and heating applications are major energy consumers. Cooking is an integral part of each and every human being as food is one of the basic necessities for living. The problem arises when fuel is either scarce or highly expensive. Half of the world's population is exposed to indoor air pollution, mainly the result of burning solid fuels for cooking and heating. The World Health Organization (WHO) reports that in 23 countries 10% of deaths are due to just two environmental risk factors: unsafe water, including poor sanitation and hygiene; and indoor air pollution due to solid fuel usage for cooking. So it is necessarily required to use renewable energy sources for cooking namely Solar Energy, Biogas Energy and Biomass Energy (cook stove). Hence a comparative study has been made to evaluate energy and exergy efficiencies of renewable based cooking technologies.The thermal performance of box type solar cooker was calculated in term of F_1, F_2, energy efficiency and exergy efficiency and found to be 0.11, 0.58, 26.89 % and 2.61 % respectively. The thermal performance of biogas burner stove was calculated in term of energy efficiency and exergy efficiency and found to be 54.18 % and 3.18 % respectively. The thermal efficiency of biomass cookstove was found to be 32.58 % and overall average exergy efficiency was found to be 3.79%.The exergy analysis is the thermodynamic losses of the studied systems. For a given system process decreasing the exergy losses also decreases the need for exergy inputs and production costs. The embodied energy as total input energy required for the construction and working of a system was calculated and found to be 881.028 MJ, 22695.86 MJ and 3069.438 MJ respectively for cooking systems. A biomass cookstove shows the energy payback time is 2.57 years against embodied energy rather box type solar cooker and biogas burner stove found to be 6.64 years and 4.69 years respectively. The Net Present Value or Net Present Worth (NPV/NPW) was compare with conventional fuel (i.e. LPG, LPG-Stove) and found in box type solar cooker as Rs. 13494.9 which is maximum than biogas stove and biomass stove as Rs. 4239.76 and Rs. 10072.65 respectively. The payback period of biogas burner stove was found to be less as 0.37 years than solar cooker and biomass cookstove as 0.77 years and 1.11years respectively. Biogas burner stove shows the highest Benefit Cost Ration (BCR) as 2.72 than other cooking systems as 1.33 and 0.949 respectively.

OPTIMIZATION OF EDM PROCESS PARAMETERS FOR MRR OF INCONEL 600 USING TAGUCHI METHOD

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Abstract

Electrical discharge machining (EDM) process is convert electrical energy into heat energy between the work piece and tool electrode in the presence of dielectric fluid like, EDM oil, to process conductive difficult-to-machine materials. EDM process

is has been applicable in the machining of hard, brittle and all kinds of electric conductive materials. This process widely used for produces die making, mould making, complex shapes, deep holes and other geometrical shapes as per desire. Inconel 600 super alloy materials widely used in various types of industries such as: aerospace, aircraft, nuclear, food processing, pulp manufacturing, automobiles industry etc. In this study, investigations on the effect of process parameters on machining of Inconel 600 super alloy material. Tungsten carbide material used as tool electrode and EDM oil used as dielectric fluid. The effects of input process parameters such as pulse-on-time, peak current and gap voltage on performance measure material removal rate was investigated using Taguchi method. MRR is lineally increases with the increase in peak current during the EDM process. MRR is increases with the increase in gap voltage. Initially MRR increases with increase in pulse on time then decreases with the increase of pulse on time

SYSTEMATIC TRAIT BASED IDENTIFICATION AND QUANTIFICATION OF INDIAN WHEAT VARIETIES RELEASED DURING DIFFERENT TIME SCALES

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Abstract

Thirty four Indian wheat (*Triticum* spp.) varieties released during different time scales (1934-2015) were assessed for diversity through various approaches. The present study was carried out with the aim to identify the prevailing genetic variability among the genotypes on the basis of morphological, seed vigour, biochemical and molecular characterization. Considerable amount of variation was present in phenotypic traits like plant height, flag leaf length, flag leaf breadth, spike length, spikelets per spike, tillers per plant, peduncle length, awn length andnumber of grains per spike. Seed vigour parameters including test weight, seedling length, seedling dry weight, vigour indices and stress test (accelerated ageing) have shown significant variability among varieties. Dehydrogenase activity, tetrazolium test and electrical conductivity of seed leachates were also found worth studying for diversity. Molecular characterization included twenty-one SSRs which amplified 46 alleles, out of which 42 alleles were polymorphic. PIC value ranged from 0.1-0.65 and similarity coefficient ranged from 0.34-0.87. The genetic diversity pattern analysis of genotypes based on their geographical origin did not show any clear relation. But the characters like plant height, seed boldness and vigour parameters of varieties have somehow shown a trend with chronology of their release. The different perspectives used in the study have successfully categorized all the wheat genotypes into various groups. The breeders working with wheat improvement will surely be helped by the identification and quantification of diversity obtained among wheat varieties.

CROP IMPROVEMENT TECHNOLOGIES IN THE 21ST CENTURY

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Abstract

World population is increasing and it is projected to touch 7.6 billion mark in 2020 (United Nations Population Division). In view of increasing population particularly in developing countries, it is imperative to increase crop production. Agricultural land is shrinking, part of it is being used to develop infrastructure for increasing population. Therefore, the challenge is to produce more food from less land. Technological interventions shall increase food production many more folds. In agriculture, the success of a technology can be measured only when it gets transferred for increased crop production. Genetic improvement is the area in which to look for the major breakthroughs. The broad potential of recombinant DNA technology will provide the possibility of both molecular analyses of crop productivity and ways in which it may be possible to improve that productivity. The goal of analysis may be approached in three ways: starting at the beginning by generating complete sequences of the plant genome; starting at the end by genetic analysis of phenotypes using genetic marker technology; or starting in the middle, by metabolic analysis. Improvements may be obtained by re-assorting what has been achieved through enhanced breeding technologies, by randomly induced change, and by generation of totally new possibilities through biochemical engineering.

Dwarfing Rht genes were introduced in modern wheat varieties in 1960s by Dr. Bourlaugh from Norin 10 cultivars of wheat grown in Japan. FlavrSavr Tomato was the first Biotech crop commercialized in USA in 1994 by Calgene. Transgenic rice plants have been developed with tolerance to various biotic and abiotic factors. Regarding the nutritional traits, one of the most promising application of transgenic technology has been the development of vitamin A enriched varieties, popularly known as Golden Rice due to the slightly yellow colour conferred to the endosperm.

ESTIMATION OF PERCENT CONTRIBUTION OF PARENTS AND THEIR INTERACTION FOR GRAIN YIELD AND ITS CONTRIBUTING TRAITS IN BARLEY (*HORDEUM VULGARE* L.)

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Abstract

A study on estimation of percent contribution of parents and their interaction for fourteen yield traits was conducted by crossing three testers with ten female parents using line × tester design in barley. The significant differences from parents suggest that material possess good amount of genetic variability for traits studied. The female parents contributed more than the male parents for different traits. For grain yield, the greatest percent contribution was found from line × tester interaction than from line and tester alone.

GENETIC CHARACTERIZATION AND EXPLORING THE POTENTIAL OF ENDOPHYTES FROM MEDICINAL PLANTS AGAINST DRY ROOT ROT OF CHICKPEA

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Abstract

The study we report on in this paper provides molecular insights into the novel endophytes from *Azardica indica* and *Pongamia pinnata* for their broad spectrum antifungal activity against dry root rot of chickpea caused by *Rhizoctonia bataticola.* Out of 180 leaf endophytes screened, the endophytes *viz*., SLO29, STB06, OCT23 and ZTB04 proved best in combating the highly virulent pathogen both *in vitro* and *in vivo.* The potential endophytes further cloned, and identified by housekeeping 16S rRNA genetic marker. The RAPD profiles with 55 random primers delineated the genetic diversity and generated reproducible polymorphic bands ranging as low as 100 bp to as high as 5000 bp indicating high degree of polymorphism at nucleic acid level among the potential endophytes. The unique band of 450 bp amplified with the primer OPD-10 were earmarked for the identification of novel root endophyte can be developed as SCAR marker. Studies on 16S rRNA-RFLP with molecular scissors *viz., EcoR1, BamH1* and *HindIII* indicated diverged polymorphism in restriction banding pattern among the antagonistic endophytes. Among the four, the novel root endophyte SLO2910 was aggressive in combating the dry root rot disease and accelerated yield attributes and monetary return. The development of specific markers for the detection of novel root endophytes from medicinal plants and the recommendations of the specialized talc based formulations retaining higher biocontrol potential with maximum shelf life are worthy for further study on phytopathogen control.

MSP : HOW MUCH HELPING IN THE FARMERS' PROSPERITY

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Abstract

Recently, the cabinet committee on economic affairs (CCEA) announced substantial outstanding increment in the minimum support price (MSP)of 14 kharif crops (basically crops which are sowed during the rainy season) onlyfrom the year

2018-19.This basically means that all farmers (who grow other crops, fruits, vegetable etc.) do not across to the government MSP benefits.In honorable finance minister announcement, MSP will be set at 1.5 times over costs of production, or 50 per cent return.It has not clarified, this increase will be over the cost of cultivation (i.e. C2), which is the main demand of farmers. The governmentexcluded paid out component (A2) as well as family labour (FL) cost.The government generally does not purchase the entire produce of the farmer under MSP; but a quota is fix based on holding size. Farmers are forced to sell the extra produce in the opinion market/between middle mean for a lower price, since the price of agricultural produce fall coinciding with harvesting time.According to Dr. Swaminathan report, it is necessary to conciliator a fixed sum as nominal monthly salary for the farmer and it should be added cost component under A_2 +FL.Cost of production per unit (Quintal or Tones) of any crop depends on average yield per unit area (Acre or Hectare).Without implementing proper measures to save farmers from distress sale (e.g. providing ware house facility, processing unit etc.) to give hyper for MSP is to mislead farmers and the general public. Keeping these above views, on the ground level in the implementation of MSP may be helping in the prosperity of farmers.

ROLE OF WOMEN IN AGRICULTURE AS AN ENTREPRENEUR

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Abstract

Women play a significant and crucial role in agricultural development and allied fields. India is a developing country engaging about 60% of its population in agriculture sector. In the past, women were treated as mere showpiece, engaged only in household chorus like clothing, cooking, cleaning etc. But with the passage of time, women earned their right to be treated equal to men. As per Census 2011, out of total female main workers, 55 percent were agricultural labour and 24 percent were cultivators. However, only 12.8 percent of the operational holdings were owned by women, which reflect the gender disparity in ownership of landholdings in agriculture. India as a developing nation needs entrepreneurs to utilize its scare resources. Government schemes are influencing more and more women to become an entrepreneur by providing proper training to acquire entrepreneur skills and traits to face the challenges in the business. Women are coming up with innovative ideas to transform the small entrepreneurship ventures into economically sound business. The foreign direct investment policy, technological innovation, manufactured export have brought a wide range of economic and social opportunities for women entrepreneurs. Women are facing hurdles in terms of limited resources such as land, credit, inputs, transport, proper knowledge etc. which prevent them to adopt new technology. Due to lower education level, the women have greater tendency to remain in the agriculture sector. Women play a crucial role in agriculture development and allied field such as crop production, livestock production, horticulture, fisheries etc. Factors such as education and training are important in enhancing the role of rural women.

MOLECULAR VARIABILITY OF DIFFERENT *ALTERNARIA ALTERNATA* (FR.) KEISSLERISOLATES OF POMEGRANATE IN MAHARASHTRA

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Abstract

Pomegranate (*Punicagrantum* L.) is a high value commercial horticultural crop grown extensively throughout Maharashtra affected by Alternarialeaf and fruit spot caused by *Alternaria alternata* (Fr.) Keissler. Genetic variability in *Alternaria alternata*(Fr.) Keisslercausing leaf and fruit spot of pomegranate was analysed using twelve isolates collected from major pomegranate growing districts of Maharashtra state in India. The genomic DNA of each isolates of *A. alternata* was subjected for PCR amplification by using RAPD primers. Initially twenty random primer ofOPD series were screened. Among these, twelve primers produced large number of reproducible amplicons, which were employed for molecular characterization of the each test isolates. Result revealed that 100 per cent polymorphism was found. The dendrogram analysis revealed two clusters, In the Cluster I, there were eleven isolates of *A. alternata* from Solapur (AaSI), Pune (AaPU), Satara (AaST), Nashik (AaNS),

Aurangabad (AaAB), Jalana (AaJI), Latur (AaLT), Osmanabad (AaOB), Beed (AaBD), Parbhani (AaPB) and Hingoli (AaHI) districts of Maharashtra state and similarity coefficient of this group was 58.2 percent. Cluster II comprised of only one isolates from Ahmadnagar (AaAN) district of Maharashtra state and similarity coefficient of this group was 56 per cent.

ROLE OF LIBRARIES IN FARM UNIVERSITY

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Abstract

Library and Information science profession has a great deal to learn, if they are to effectively meet the information needs of indigenous people and manage indigenous knowledge in an appropriate way. This calls for a fundamental rethinking with regard to strategies on how best to exploit indigenous knowledge to realize the goals of sustainable development. It is common knowledge that, the world over modern science has begun to recognize the constructive role that indigenous knowledge of the local ecosystem can play in the formulation and implementation of sustainable development policies and projects in developing countries. Agriculture has been a part of human life since the beginning of the human race and the need for agricultural information is probably almost as old as agriculture itself. From various sources to capture useful information in different formats is really a tough work. By using knowledge capture techniques, knowledge managers can organize knowledge for users to use. In establishing digital knowledge resources, coordination and collaboration is very much needed within agricultural information system to avoid duplication and time waste. To understand the future of agricultural information integration and access, one must understand present-day information networks in the proper context, i.e., how information networks evolved as a result of new digital technologies; how end users have affected the design of information networks; and how the increased demand for technology transfer and evolving role of information systems in this knowledge transfer process have influenced the structure of national, regional, and international information networks. A viable digital library network is an association of research organizations with sufficient common objectives to share current research programs and invest resources in digital library network activities. Library and information Centres, are the centres of knowledge and considered it as power but never a commodity, need to change mindset. The library professionals have skills to organize published knowledge using ICTs.

AGRICULTURAL LIBRARIES IN INDIA: AN OVERVIEW

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Abstarct

A library is considered as a storehouse of knowledge. Major part of the knowledge of a library is engaged to record books, journals, newspapers, patents, standards, theses, reports, and other documents in the form of data and information. Majority of these are procured from outside and rest are generated locally from annual reports of the organizations, trip reports, committee reports, budget proposal, case descriptions of successful projects, audited statement of income and expenditure, and locally compiled databases. Well-established rules and procedures are followed to record these items in any library. Among these rules, some rules are framed locally by the library staff for the proper management. Directorate of knowledge management in agriculture (DKMA) The Directorate of Knowledge Management in Agriculture is aimed at promoting the ICT driven technology and information dissemination system to all the stakeholders in agriculture in an easy and cost-effective way. Keeping pace with the current knowledge diffusion trends, Directorate is delivering and showcasing ICAR technologies, policies and other activities through print, electronic and web mode. The Directorate acts as the nodal center for design, maintenance and updating of ICAR website along with facilitation of network connectivity across ICAR institutes, SAUs and KVKs. Besides. The Directorate provides public relation and publicity support to the council and its constituents in the country. Dissemination and sharing of agricultural knowledge and information are done through value added information products in print, electronic and web mode. To develop e-resources on agricultural knowledge and information for global exposure. To facilitate strengthening e-connectivity among ICAR institutes State Agricultural Universities and KVKs. To assist in capacity building for agricultural knowledge management and communication.

AN OVERVIEW OF DIGITAL LIBRARIES IN INDIA

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Abstract

Library and Information science profession has a great deal to learn, if they are to effectively meet the information needs of indigenous people and manage indigenous knowledge in an appropriate way. This calls for a fundamental rethinking with regard to strategies on how best to exploit indigenous knowledge to realize the goals of sustainable development. The information revolution in rapidly widening the horizon of application of upcoming technology promising the accessibility of relevant information to the users on one hand and enhancing the productivity of information work and services on the other. The revolution of digitization is not instantaneous; it is likely to start with slow pace and accelerates over the time. But it is clear that the emergence of digital libraries will severely affect the traditional functions of libraries, publishers, book sellers etc. A digital library is popularly viewed as an electronic thought replacing the conventional archival and print media by electronic version with the inclusive sense of greater information. In attempting to define the infrastructure and the rationale for the creating of the digital library following point are to be noted. A "shared vision is essential." A business plane must be created. The implementation must be based on present organization structure. Realistic funding models are required to sustain the infrastructure. The definition of technical standards is an essential step. Technical capabilities should be carefully assessed and designed. Tools are required for the searching, organizing storage and retrieval of information. Leverage should be sought from existing legancy system. Authentication mechanisms are a key to successful implementation.

ENHANCING FARMERS INCOME THROUGH DIVERSIFIED CROPPING SYSTEMS

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Abstract

Monocropping of rice has led to the heavy withdrawal of nutrients from the soil. The imbalanced and indiscriminate use of chemical fertilizers has reduced the yield and deteriorated the soil health. Diversification of the existing monocropping system especially under the organic condition is an alternative to sustain the yield besides ensuring the ecosystem balance and farm income. Therefore, present investigationwas carried outduring May 2015 to May 2017 at Department of Agronomy, College of Horticulture, Thris to enhance the farmer's income by diversifying the existing rice monocropping under organic management. The experiment was laid out in randomized block design and replicated thrice. Rice was grown under four different cropping systems with and without foliar spray of liquid organic manures (LOMs) along with traditional cropping system (rice-rice-fallow) keeping as control. The rotations followed were rice-rice-njavara rice, rice-rice-salad cucumber, rice-rice-vegetable cowpea, rice-rice-amaranthus andrice-rice-fallow. Themanagement practices were followed as per the Package of Practices Recommendations: (*Adhoc*) for organic farming: Crops of the Kerala Agricultural University. *Jeevamrurtham*, *Panchagavyam,* green leaf extractand *fish amino acid* were the liquid organic manures sprayed at 15 days intervals afterplanting/transplanting.Rice-rice-salad cucumber with and without LOMs enhanced the system productivity by registeringhighest rice equivalent yield, system productivity, sustainability yield index, gross return and net return whilerice-rice-vegetable cowpea with and without LOMs showed highest B:C ratio.

ROLE OF RICE BASED CROPPING SYSTEMS IN SOIL HEALTH MANAGEMENT

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Abstract

Deterioration of soil fertility is the main drawback of monocropping of rice where the system is highly nutrient exhaustive and thus, has depleted inherent soil fertility, causing deficiency of several nutrients. Crop diversification, especially under organic

management is an alternative to restore the fertility in the soil and sustain it. The present investigationwas conductedduring May 2015 to May 2017 at Department of Agronomy, College of Horticulture, Thrissur to study the effect of crop diversification to sustain the soil health under organic management. The experiment was laid out in completely randomized block design and practiced less than three replication. Rice was grown under four different cropping systems with and without foliar spray of liquid organic manures (LOMs) along with traditional cropping system (rice-rice-fallow) keeping as control. The rotations followed were rice-rice-njavara rice, rice-rice-salad cucumber, rice-rice-vegetable cowpea, rice-rice-amaranthus andrice-rice-fallow. Themanagement practices were followed as per the Package of Practices Recommendations: (*Adhoc*) for organic farming: Crops of the Kerala Agricultural University.*Jeevamrurtham*, *Panchagavyam,* green leaf extractand *fish amino acid* were the liquid organic manures sprayed at fifteen days intervals afterplanting/ transplanting.The results further indicated that introduction of leguminous crop in the existing rice-rice-rice/fallow not only increased the system yield but also improved the physical, chemical and biological properties of the soil. It improved the physical characters like bulk density, porosity and water holding capacity, decreased pH, increased organic carbon, available NPK and total microbial biomass.

ROLE OF HEAT SHOCK FACTORS (HSFS) IN ABIOTIC TOLERANCE MECHANISM IN PLANTS

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Abstract

Climate changes specially heat, drought and chilling are adversely affecting the plants growth and development ultimately reduced the crop productivity. Stresses trigger a wide range of plant response which altered gene expression, cellular metabolism and changes in growth and crop yields. HSFs are a family of winged helix-turn-helix DNA binding transcription factors that are activated by stress and protect cell homeostasis by chaperoning protein folding and degradation or blocking stress associated apoptosis. Hsfs play a regulatory role under various abiotic stresses like heat, cold, drought, salinity, etc. and biotic stresses like pathogens. They are classified into three main classes (i.e class A, class B and class C) and affect the expression of each other within the classes as well as the other classes. They are activated by homo-trimerization and oligomerization by post translational modification (PTMs). The expression, amount and quantity of Hsfs vary with organism, conditions, their regulators and repressors, organs and developmental stage in which they are expressed. Despite their different roles and availability in different plants they have a conserved structure with only little differences. Oxidative stress (ROS and H_2O_2) also utilize Hsfs for their functioning. Hsfs also play a role in ABA cycle, Ethylene pathway and Jasmonic acid pathway expanding its functioning not only in case of heat shock but also other abiotic stresses. The negatively regulated pdf genes by Hsfs give first evidence for the interconnection of Hsf in the regulation of biotic and abiotic stress responses.

ROOT DISTRIBUTION PATTERN OF YOUNG *SWIETENIA MACROPHYLLA* KING. STANDS IN CENTRAL KERALA, INDIA

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Abstract

The major constraints to intercropping in woody ecosystems are the belowground competition for water and nutrients which are in short supply. The spatial spread of the roots of the trees play major role in this context. The root distribution pattern was examined in a seven-year-old mahogany (*Swietenia macrophylla* King.) plantation established at 2.5 x 2.5m spacing by following logarithmic spiral trench technique. The root intensity steadily declined with increase in root diameter classes. The small roots (<2.5 cm size class) represented the major share of the total root intensity (7566 number m^{-2}) followed by medium sized roots (4713 number m^{-2}; size class >2.5 to<5.00 cm) and lowest for the coarse roots (406 number m^{-2}; size class>5.0 cm). Significant variation in root intensity was observed for different soil depths and lateral distances sampled. The roots generally followed decline in intensity with increasing lateral distance from the tree as well as with increasing soil depth. The small root count at the proximal end of the trench (closest to the tree base; 0.39 m) was 2266 while the corresponding count at farthest lateral distance (2.99 m) was only 133. The shallow soil depth of 0-20 cm represented almost 41% of the total small root count. The soil zone lying within 2.17 m lateral distance from the base of the tree and at 50 cm soil depth accounted for almost 84 per

cent of the total roots for the *S. macrophylla* tree studied. This forms the zone of root activity for most of the field intercrops hence could lead to intensive competition with field crops. The observed root distribution for *S. macrophylla* at 7 year age indicates that the probable safer spacing for effective intercropping would be nearest to 5.34 meters between trees.

EFFECT OF FERTILIZER REGIME APPLICATION ON GROWTH AND YIELD OF BLACKGRAM (*VIGNA MUNGO*) UNDER GUAVA (*PSIDIUM GUAJAVA*) BASED AGRI-HORTI SYSTEM

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Abstract

A field experiment was conducted to find out optimum fertilizer regime for blackgram under guava based agri-horti system which was carried during kharif season 2017-18 in 10 years old guava which was planted in August, 2007 at the spacing of 5.4 x 5.4 meters at farm house, Vivekananda Global University, Jaipur. The experiment was laid out in a split plot design and treatments comprised fertility level (control, 50 percent RDF, 75 percent RDF and 100 percent RDF) and four treatment of farm yard manure (control, 2 ton, 4 ton, and 6 ton ha^{-1}). There were sixteen treatment combinations which were replicated thrice. The growth attributes *i.e.* plant height, no. of leaves $plant^{-1}$, number of nodules $plant^{-1}$ and dry matter production $plant^{-1}$ were significantly influenced with increasing fertility levels. Yield attributes *i.e.* number of pods, number of grain per pod and test weights of blackgram were also increased with increasing levels of fertility and it was the highest under 100%, RDF. The highest protein content in grain and straw was 28.91 and 7.44 percent, respectively was also recorded at 100 percent fertility level. Nitrogen, phosphorus, potassium and protein contents increased with use of FYM level. The maximum NPK content in grain and straw was recorded at 6 t FYM ha^{-1}. It is concluded that 100 percent fertility level (25 kg N + 50 kg P_2O_5 + 25 kg K_2O ha-1) + 6 tha^{-1} FYM can be applied to blackgram for obtaining maximum yield and return under guava based agri-horti system. Since the experiment was conducted for one year only thus need further investigation to confirm the more precious result.

CHANGE THE CROPPING PATTERN AND TREND CROP DIVERSIFICATION IN SIRSA DISTRICT

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Abstract

Agricultural sector is significant role in India's economy. The agricultural sector dependent upon the monsoon and many others factor depend upon the seasonal variation. Like as this the agricultural sectors depend upon this soil of fertility, and soil health, and facility of irrigation management system. Besides the others factor affected the agricultural productivity natural calamities, as drought, flood, or famine. Secondly the increasing of the population in India because the pressure of the agricultural land. As the industrialist developed the land acquisition law came existence 1894 in India. For the economic development and infrastructural the govt acquired the land. As a result this the size of the land holding became a small day by day. Further the farmer's income declined. On the other hand the farmers of distress the farmers commit suicide. Haryana is geographical area find in different districts the total geographical area 44.21 lakh hectare Cultivated area 38.09 lakh hectare and net sown area 35.56 lakh hectare of Haryana state. The govt to start increase the farmers income to be adopt of the crops diversification in Haryana. Agricultural sector provides livelihood to 65 to 70 per cent of the total population and 54.6 per cent population engaged in agricultural and allied sector activities. Gross capital formation in agriculture and allied sector in India is 17.4 per cent during 2011-12. The contribution of the agricultural sector in National income had 18.5 in 2013-14 but it had been decreased from 18.5 per cent to 13.9 per cent in 2015-16. The total geographical area of the country is 328.7 million hectares and 139.9 million hectare is reported as net sown area. Out of total, 194.4 million hectare is the gross cropped area with a cropping intensity of 138.9 per cent. The total net irrigated area is 66.1 million hectare in 2012-13. Agriculture sector does not only provide direct income to population, but it also supports the industrial sector by providing raw material to it. To increase the agriculture production the most important role in the chemical and fertilizer to use of the agriculture sector to be the prompted of the agriculture sector the govt gave the subsidy of the chemical and fertilizer in a 1950-51 the consumption of the fertilizer in India 70,000 tons in 1990-91 the fertilizer consumption was very rapidly 12.5 million tons in 2011-12 the

consumption of the fertilizer 27.6 tones (Sources economics survey 2012) to be prompted in the chemical and fertilizers the centre govt has established national project and development of fertilizer to use of low consumption. land reform and tenancy reform to improve the agriculture productivity the centre govt set up the primary agriculture credit society . Initially in the year of 1950-51 this society gave the loan 23 Rs in advance for the agriculture purpose. In the year of 2000-2001 to gave the loan raise 34500 for the productivity of agriculture to gave the advance loan for the marginal and semi marginal farmers. Various industries in India based on agriculture for their raw material. Cotton, jute, textile, sugar, pear industries are directly depends on agricultural sector and handloom, spinning, oil, mining, rice etc are various small scale industries which depend on the agriculture sector for their raw material. India's foreign trade is also deeply associated with the agricultural sector. Agriculture and related goods contribute 38 percent of total exports of the country Secondly role of agricultural sector supply to the raw material for industries like as sugar industries, Dairy farming, multi-fiber industries, jute and floor industries. These industries directly depends on agricultural sector, few industries are indirectly depend on agricultural sector. Like as Bakery industry, Handloom industries, and rural small scale industries oils industries etc. Agricultural sector significant role and contribution to the export some commodities like as a tea, coffee, sugar, Cotton, rice, oilseeds etc (Economic Survey; 2016). The total population of the state is 211.45 lakh as per 2011 census data. Out of total population 67.3 per cent resides in rural areas and agriculture is the main stay for majority of them. Haryana has an area covered just 1.3 per cent of the country. Haryana contributes nearly 3.58 per cent to India's GSDP during the year of 2012-17. Haryana is the first position in the production of the Basmati Rice during the period of 2011-12 year. At current prices the total GSDP of Haryana was about US$ 85 billion in 2016-17 (Haryana State Report; February, 2018).

SOIL HEALTH MANAGEMENT AND PRACTICES : KEY FACTOR FOR CROP PRODUCTIVITY

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Abstract

Soil health is presented as an integrative property that reflects the capacity of soil to respond to agricultural intervention, so that it continues to support both the agricultural production and the provision of other ecosystem services. The major challenge within sustainable soil management is to conserve ecosystem service delivery while optimizing agricultural yields. It is proposed that soil health is dependent on the maintenance of four major functions: carbon transformations; nutrient cycles, soil structure maintenance and the regulation of pests and diseases. Each of these functions is manifested as an aggregate of a variety of biological processes provided by a diversity of interacting soil organisms under the influence of the abiotic soil environment. Analysis of current models of the soil community under the impact of agricultural interventions particularly those entailing substitution of biological processes with fossil fuel-derived energy or inputs) confirms the highly integrative pattern of interactions within each of these functions and leads to the conclusion that measurement of individual groups of organisms, processes or soil properties does not suffice to indicate the state of the soil health Increased the cation exchange capacity, reduced pH and electrical conductivity, increased organic carbon content, available nitrogen, phosphorous, potassium and microbial population and activity in all the soil types, particularly clay loam soil. On the contrary, the application of inorganic fertilizers has compaction of soil, reduced organic carbon and reduced microbial activity, for as soil amendment and soil quality improvement.

STUDIES ON HATCHING PERIOD OF EGGS LAYING OF *HELICOVERPA ARMIGERA* (HÜBNER) IN FIELD CONDITION AND THEIR RELATION WITH NEONET POPULATION IN CHICKPEA

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Abstract

Hatching period of egg of of *H.armigera* was studied by various works in past (Patil *et. al.* 2018, Gaykwad *et. al.* 2010) they reported hatching days. During 2015-16 and 2016-17 in present investigation hatching period of *H.armigera* in chickpea was

studied in open field of chickpea .Light trap collected gravid female moths were released in field cages 1.0 X1.0 X 1.0 meter size white as well as dark cage to provide normal environment condition with scotopic light and dark cage as a control. Next morning eggs laid on chickpea plant were counted and tagged. Such set of experiment were repeated in five Lunar cycle during 2015-16 and 2016-17 cropping season .Hatching period was recorded for Subquint days of egg laying .Daily field observation on neonet larvae were also recorded from 1 meter row length cropped area. Data indicated that in ascending phase of lunar cycle the gradual degrease in egg laying was observed in consecutive days of the cycle, while in descending phase the trend was just reverse it shows increasing trend in descending phase of lunar cycle .Trend of egg laying in field condition was observed that it was increasing gradually approaching either no moon or full moon that is waxing gibbous or waning gibbous and show gradually decreasing trend in the binging of ascending as well as descending phase of lunar cycle that is waxing crescent or waning crescent. The mean hatching period was significantly correlated with maximum temperature (r=-0.800) .Hatching period and difference of temperature (r=-0.780) and mean temperature (r=-0.680) in waxing crescent. The larval population was not directly correlate with hatching period and neonet larval population indicated that varieties in larval population in filed was not only influenced by ovipostion but also regulated by some other factor exist of the field.

STUDIES ON EFFECT OF DIFFERENT MULCHES ON GROWTH AND YIELD OF CHILLI (*CAPSICUM ANNUUM* L.) CV. PHULE JYOTI

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Abstract

An experiment entitled “Studies on effect of different mulches on growth and yield of chilli (*Capsicum annuum* L.) Cv. Phule Jyoti” was conducted during *summer,* 2013 at Horticulture Farm, College of Agriculture, Kolhapur. The experiment was laid out in randomized block design with 7 treatments *viz*; black-black polyethylene mulch, silver-black polyethylene mulch, yellow-black polyethylene mulch, rice straw mulch, sugarcane trash mulch, dry grasses and an unmulched control replicated three times. Maximum plant height (30.60 cm, 58.33 cm and 67.09 cm) and plant spread in east-west direction 21.10 cm, 42.04 cm and 60.12 cm) and north-south directions (19.17cm, 45.10 cm and 58.73 cm), number of branches, at 45, 90 and 135 days after transplanting respectively, minimum days to first flowering (46 days) and 50 *per cent* flowering (67.67 days), maximum number of fruits per plant (252.20), fruit girth (1.23cm), fruit length (8.19 cm), average yield, fresh shoot weight (329.60 g), dry shoot weight (77.20 g), fresh root weight (143.97 g), dry root weight (31.60 g) was recorded in treatment silver-black polyethylene mulch. However, minimum days for first picking (66.0) were recorded in black-black polyethylene mulch and maximum days for last picking (161.33) was recorded in silver-black polyethylene mulch. The lowest pest infestation of thrips and aphids (0.27% and 0.34% respectively) and leaf curl incidence (0.67%) was recorded in treatment silver-black polyethylene mulch.

COMPRATIVE STUDIES OF POTASSIUM HUMATE WITH FERTILEZER AND VERMICOMPOST ON LATE SOWN WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

A field experiment was conducted during Rabi season of 2016-17 at student instruction farm Chandra shekhar Azad University of agriculture and technology Kanpur. To find out effect of chemical fertilizer and vermicompost on growth and productivity of the late sown wheat.The field experiment soil having (pH 7.5), normal salt concentration, medium organic carbon, medium in available phosphorus and potassium, eight treatment consisting viz. control, 100% RDF, 75% RDF, 100% RDF + vermicompost @ 3.0 tone/ha, 75% RDF + vermicompost @ 3.0 tone/ha, potassium humate @ 3.0 tone/ha, potassium humate @ 2.5 tone/ha and potassium humate @ 2.0 tone/ha on the basis of results. It was observed that the significantly highest total productivity of wheat in terms of grain yield (44.34q/ha.) and straw yield (49.75q/ha.) were recorded with the application of 100% recommended dose of fertilizer (120:60:40 kg NPK/ha) and vermicompost 3.0 tone/ha as compare to other treatment followed by with the application of 100% recommended dose of fertilizer (120:60:40 kg NPK/ha) with

respect of grain yield (36.59q/ha) and straw yield (40.98q/ha) and the minimum grain yield (33.50q/ha) straw yield (37.52q/ha) were recorded under the treatment of control plot. The maximum net return (Rs 2336.8/ha) and BC ratio were recorded (1:1.46) under the application of 100% recommended dose of NPK (120:60:40 kg NPK/ha) and vermicompost @ 3.0 tone/ha followed by with the application of 100% recommended dose of NPK with respect of net income (Rs 17368/ha) and CB ratio (1:1.39), 100% recommended dose of fertilizer with 3.0 tone/ha vermicompost production and profitable under late sown variety of wheat followed by other treatment.

ROLE OF CROP RESIDUE MANAGEMENT IN SUSTAINABLE AGRICULTURE DEVELOPMENT IN NORTH WESTERN INDIAN PLAINS

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Abstract

Crop Residue Burning is a major cause of air pollution and has been identified as a major health hazard. Mechanized harvesting leaves residues in the field that are burnt by the farmers to clear the field for the next crop. It causes loss of vital components from the topsoil layer, making the land less fertile and unviable for agriculture in the long run. Biomass burning after harvesting for wheat (during April-May) and rice (during October-November) is a recurring problem, in the northern states of Punjab, Haryana and Uttar Pradesh. The problem becomes severe in winters when large parts of northern India choke on smog and haze triggered by large scale crop residue burning. Crop residue, the largest product of agricultural harvests, contains large amounts of assimilated carbon (C) and nutrients such as nitrogen (N), phosphorus (P), and potassium (P); these elements must be recycled for the sustainable development of agriculture. Crop residue management serves both as confronting global warming and food security by increasing carbon sequestration in agriculture and increasing grain yields. Crop residue management helps in controlling loss of water through runoff by increasing infiltration and decreasing evaporation of water. It controls weeds, soil temperature through radiation shielding. It improves mineral solubility, soil structure, soil biological regimes through organic matter addition. With the development of the economy, technology, and supporting policy, crop residue management can play an increasingly important role in sustainable agricultural development.

EFFICACY OF JUDICIOUS USE OF INSECTICIDES AND IPM MODULE AGAINST MAJOR INSECTS AND THEIR EFFECT ON NATURAL ENEMIES FOUND IN RICE

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Abstract

Field experiments were conducted to demonstrate the efficacy of rice IPM Modules for ricein farmers' fields managed by farmersof villages of district Hapur, Uttar Pradesh during *kharif* 2017 and 2018. Two treatments in the form of module were compared with farmers' practices to validate the efficacy of them in rice. The treatments were: (1) IPM module (Pheromone traps @ 5/acre, Straw Bundles charged with spiders and egg masses @ 10/acre, Bird perches @ 10/acreand need based use of insecticides), (2) Chemical module (Cartap hydrochloride 50% SP, imidacloprid 17.8% SL, and thiafluzamide 24% SC application) based on monitoring (3) Farmers' practice (Chlorpyrifos 50% + cypermethrin 5% EC, fipronil 3 G, carbendazim12% + mancozeb 63% WP and imidacloprid 17.8% SL) routine-based applicationand (4) control (devoid of any application). The range of per cent dead heart, white ear head, leaf damage and number of hopper population among all the treatments and control (03.43 to 11.96% dead hearts, 01.25 to 05.19% white ears, 03.61 to 12.34% leaf damage and 01.99 to 11.90 hoppers/hill in *kharif* 2017 and 03.75 to 10.18% dead hearts, 0.83 to 04.12% white ears, 0.95 to 10.22% leaf damage and 0.93 to 13.04 hoppers/hill in *kharif* 2018) was recorded. Among all, the best module for controlling insect population was the chemical module, followed by the IPM module which was however at par with the chemical module in both 2017 and 2018. Average number of spider populations/5 hillswere maximum (0.81 to 03.26/hill in kharif 2017 and 0.67 to 03.95/hill in kharif 2018) in control treatment and followed by that in IPM module. Higher mean grain yield and cost benefit ratio (1:8 and 1:9) was recorded in IPM module in both the years.