Progressive Research – An International Journal
Vol. 4 (Special Issue) : 510-514 (2009), ISSN : 0973-6417

Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) INDIA

CRITICAL REVIEW ON INTEGRATED NUTRIENT MANAGEMENT IN BLACK GRAM FOR MAXIMIZING YIELD AND SOIL HEALTH

Diwakar Paswan[1] and Govind Kumar[2]*

[1]*Regional Research Station, Agwanpur, Saharsa (RAU, Pusa, Samastipur, Bihar-848 125)*

[2]*KVK, Rahgopur, Supaul (RAU, Pusa, Samastipur, Bihar-848 125)*

**Corresponding Author (Govind Kumar) Email : drgovindsri@gmail.com*

ABSTRACT

Integrated nutrient management is an integral part of the sustainable agriculture which requires the management of resources in a way to fulfill the changing human needs without deteriorating the quality of environment and conserving vital natural resources. It comprises of application of organic manures, green manures, blue green algae, bio-fertilizers and crop rotation with legumes along with minimum use of chemical fertilizers to produce optimum crop yields without deteriorating the soil health. Organic nutrient management is proving as a remedy to cure ills of modern chemical agriculture. Therefore, application of organic manure has received great attention. Among organic sources as supplemental fertilizer, seaweed extracts have been used. More than 15 million tons (MT) of seaweed products are used annually as nutrient supplements and bio stimulants in agriculture and horticultural crop production. Seaweed fertilizer could be absorbed by plant within several hours after application and safe to humans, animals and the environment. Seaweed liquid fertilizers will be useful for achieving higher agricultural production.

Pulses play an important role in Indian Agriculture and India is the largest producer and consumer of pulses in the world. These contain a high percentage of quality protein nearly three times as much as cereals (Upadhayay *et al*., 1999). Thus, they are cheaper source to overcome protein malnutrition among human beings. For vegetarian diet, pulses form the major source of protein. In fact, lysine is the most limiting essential amino acid in cereals which is very well supplemented by the protein of pulses. The pulses are known to improve the physical characteristics of soil through tap root system which opens the soil into the deeper strata and their ability to use atmospheric nitrogen through biological nitrogen fixation which is economically sound and environmentally acceptable.

Black gram (*Vigna mungo* L.) Hepper] is a major leguminous crop of India having 23.9% of protein. It is grown all over the country during *kharif* and summer seasons. It is cultivated in India over an area of about 3.33 million hectare with total production of 1.41 million tones and productivity of 423 kg ha^{-1}. There are numerous reasons for low yields of black gram. These reasons are non- availability of quality seeds of improved and short duration varieties, growing under marginal and less fertile soil with low inputs and without pest and disease management, growing under moisture stress conditions, unscientific post harvest practices and storage under unfavourable conditions. Hence, there is a scope for improving the production potential of this crop by use of organic manures, inorganic manures and biofertilizers.

Sea weeds are marine algae, salt water dwelling, and simple organisms that fall into the rather outdated general category of “plants”. Most of them are red (6000 species), brown (2000 species) or green (1200 species). Seaweeds are primitive non flowering plants without root, stem and leaves. They comprise one of the commercially important marine renewable resources. Seaweed fertilizer is a natural bioactive material, water-soluble derived from marine macro algae. Seaweed extract contains major and minor nutrients, amino acids, vitamins, cytokinins, auxin and abscisic acid like growth promoting substances. Numerous worker (viz. Zhang and Schmidt, 2000; Zhang et al., 2003; Turan and Kose, 2004) have reported that these extracts stimulate the growth and yield of plants ,develop tolerance to environmental stress, increase nutrient uptake from soil and enhance antioxidant properties finally enhance the yield potential of crops (pulses, cereals, vegetables, flowers, and fruits) without

impairing the soil health. Keeping above facts in view, the present paper analyzed critically with titled.

Effect of seaweed sap on growth and yield : Venkataraman *et al.* (1993) studied the effect of Seaweed liquid fertilizers from Sargassum wightii, Gracilaria corticata and Caulerpa scalpelliformis on Vigna radiata and observed a gradual increase in seedling height with increasing seaweed extracts application. Venkataraman and Mohan (1997) reported that the increase in yield was mainly due to increase in number of pods as well as weight of pods plant^{-1} and number of seeds pod^{-1} in black gram with foliar application of Liquid seaweed fertilizer which is extracted from *Kappaphycus alverezii*. Anandharaj and Venkatesalu (2001) studied the effect of seaweed liquid fertilizers (SLF) of *Caulerpa recemosa* and *Gracilaria edulis* on growth and biochemical constituents of *Vigna catajung* and found that the 10% concentration of aqueous extract promoted the seedling growth, fresh and dry weight, chlorophyll content, protein, amino acid and reducing and total sugar content. Sivasankari Ramya *et al.* (2006) studied the effect of seaweed liquid fertilizer (SLF) prepared from *Sargassum wightii* on biochemical constituents of *V. radiata* and reported that the 10% concentration increased the pigment content, protein, amino acid, total sugar content, catalase, peroxidase and polyphenol oxidase activities. Vinuba *et al.* (2008) studied the effect of seaweed liquid fertilizer (SLF) at 5, 10, 15 and 20% prepared from *Gracilaria corticata* on the seedling growth and biochemical parameters of *Vigna mungo* (black gram). SLF at 20% concentration increased the morphological parameters such as the length of shoot and root as well as fresh and dry weights of shoot and root, the pigment and protein contents. The other concentrations showed declining trends. According to Bai *et al.* (2008) foliar application of *K. alvarezii* extract (10.0%) resulted in increased yield of *Phaseolus aureus* over control to the extent of 30.11%, which was maximum and significant as compared to increase in the yield (16.78 and 26.30%) in plants treated with 5.0 and 15.0% extract, respectively. The increase in yield was mainly due to increase in number of pods as well as weight of pods plant^{-1} and number of seeds pod^{-1}. Sethi and Adhikary (2008) evaluted the effect of liquid extracts of *Gracilaria verrucosa* and *Chaetomorpha linum* on vegetative growth and yield of black gram, brinjal and tomato. These liquid extracts were applied at 1.0% as foliar spray five times during crop cycle. Height of plants, leaf number, flower number, fruit number, dry weight of shoot and root increased in the liquid extracts over control. Pod number of *Phaseolus mungo* increased to 26.6% and 9.8% under the treatments comprising the liquid extracts of *C. linum* and *G. verrucosa,* respectively.

Effect of npk on growth and yield : While studying the grain yield response of black gram to the various treatments combinations of N (0 and 15 kg ha^{-1}), P (0, 30 and 60 kg ha^{-1}) and K (0 and 20 kg ha^{-1}), Singh *et al.* (2002) observed the highest yield was obtained from the application of 15:60:20 kg $N:P_2O_5:K_2O$ ha^{-1} which was at par with control and this might be due to higher values of organic carbon, N, P_2O_5 and K_2O contents in the soil. Shrinivas and Mohammad (2002) indicated that it was not beneficial to fertilize green gram with 40 or 60 kg N ha^{-1} as the yield was at par with 20kg N ha^{-1} at Rajendranagar (Hyderabad). According to them the most productive and profitable level of fertilizer was 38 kg N ha^{-1} and 54 kg P_2O_5 ha^{-1}. From the studies during Kharif season at Rajendranagar (Hyderabad), Yakadri *et al.* (2002) observed that application of 20 kg N ha^{-1} along with 60 kg P_2O_5 ha^{-1} resulted in significant differences in leaf area ratio indicating better partitioning of dry matter and increased number of pods and seed yield in respect to green gram (cv. – 267). Malik *et al.* (2003) reported that fertilizer combination of 25 kg N + 75 kg P_2O_5 ha^{-1} led to register maximum seed yield of green gram and net income, while protein content was maximum in plots treated with 50 kg N + 75 kg P_2O_5 ha^{-1} in Pakistan. From the field experiment at Pura, (Uttar Pradesh), Gupta *et al.* (2007) indicated that the seed yield was maximum (1254 kg ha^{-1}) with 22 kg N ha^{-1} + 60 kg P ha^{-1} + 60 kg K ha^{-1} + 20 kg S ha^{-1} + 15 kg Zn ha^{-1} + 5 kg B ha^{-1} (complete treatment). This was 123% higher than that of the control. Treatments with 15 kg N ha^{-1} + 60 kg P ha^{-1} + 60 kg K ha^{-1} + 20 kg S ha^{-1} + 15 kg Zn ha^{-1} + 5 kg B ha^{-1} (T8) and 22 kg N ha^{-1} + 60 kg P ha^{-1} + 60 kg K ha^{-1} + 20 kg S ha^{-1} + 0 kg Zn ha^{-1} + 5 kg B ha^{-1} (T11) both provided yields that were statistically equivalent to the complete treatment. The net returns was highest in the complete treatment (Rs. 9480 ha^{-1}), followed by T8 (Rs. 8864 ha^{-1}) and T11 (Rs. 8795 ha^{-1}).

Effect of integrated nutrient management on growth and yield : Bhosle *et al.* (1975) observed that the seeds treated with low concentration (20%) concentration of both SLF alone and SLF with chemical

fertilizer showed better results in growth parameters such as shoot length, root length, number of lateral root and number of leaves of *Phaseolus vulgaris*. Reddy and Swamy (2002) reported that the Interaction of phosphorus with farmyard manure was significant with respect to seed yield of black gram. Economic analysis of the different treatments showed that the highest additional seed yield and net returns (Rs 3528 ha^{-1}) were associated with 26.2 kg P ha^{-1} + PSB inoculation + no farmyard manure. This treatment also gave a benefit:cost ratio of 2.69. Patil (2002) noticed higher germination (94.50%), root length (16.60 cm), shoot length (14.00 cm), viguor index (2889), seedling dry weight (59.84 mg), protein content (23.15%) and lowest electrical conductivity (0.731 dSm-1) in seeds of greengram (Cv. chinamung cultivar) treated with RDF + FYM @ 2.5 t ha^{-1} compared to RDF and organic manures alone. Rajkhowa *et al*. (2002) reported that the application of 100 per cent RDF along with vermicompost @ 2.5 t ha^{-1} in green gram recorded significantly higher plant height (52.7 cm), number of pods $plant^{-1}$ (12.67), seeds pod^{-1} (12.00), 100 seed weight (4.6 g), seed yield (5.35 q/ha) over control and it was on par with the application of 75% or 50% RDF + vermicompost (2.5 t ha^{-1}) over control in green gram. Tanwar *et al* (2003) reported that the crop yield of black gram, N and P contents, and N and P uptake increased with increasing P dose up to 80 kg ha^{-1}. Inoculation with the combination of the biofertilizers (Rhizobium sp. And Bacillus megaterium var. phosphaticum) resulted in higher yield, N and P content, N and P uptake by the grain and straw compared to no inoculation and individual inoculation. Abraham and Lal (2004) studied the effect of fertilizer levels, organic manures and biofertilizer along with organic spray on the yield of black gram under black gram-wheat-green gram system. Biofertilizer and organic spray helped in significant increase of the dry matter production and test weight. Vasanthi and Subramaniam (2004) evaluted the effect of organic manures with NPK fertilizer on the nutrient uptake and crude protein content in black gram. The combined application of vermicompost @ 2 t ha^{-1} with 100% NPK resulted the highest crude protein content, N, P, K contents and uptake. Gupta *et al.* (2006) reported that seed inoculation with phosphorus- solubilising bacteria showed a significant increase in seed yield of vigna mungo and its attributes as well as protein content and N and P uptake over uninoculated treatment. Response of crop to phosphorus fertilization was significant up to 60 kg P_2O_5 ha^{-1} for seed and straw yields. Joseph *et al* (2006) conducted a pot culture experiment to evaluate the efficacy of organic manures, and recorded that 12.5 t composted coir pith/ha + 100% NP (20 kg N ha^{-1} and 50 P kg ha^{-1}) gave the highest values for plant height (120.2 cm), plant fresh weight (84.1 g), plant dry weight (27.1 g), number of leaves (59.8), root volume (11 cc), number of nodules (85.8) and pod dry weight (31.1 g) of black gram. Das *et al.* (2007) reported that rabbit manure at 5 t/ha + 50% NPK (N:P:K kg 30:60:40 ha^{-1}) produced higher growth, yield attributes and seed yield (17.67 q ha^{-1}) of black gram compared to the control (7.69 q ha^{-1}). This treatment was produced equivalent results to that of NPK + FYM or pig manure. All organic manures applied alone produced superior pod and seed yields compared to the control. The manures alone, or in combination with NPK, improved or maintained the NPK status of the soil. Pannu *et al.* (2007) reported that the application of FYM as well as PM (pressmud) at 2.50 t/ha along with one fourth of the recommended dose of NP fertilizer (12 kg N and 40 kg P_2O_5 ha^{-1}) recorded the highest yield (6.90 and 6.60 q ha^{-1} respectively) of black gram and similar trend was observed for the various growth attributes, such as number of pods $plant^{-1}$, plant height and 100-grain weight. Hakeem *et al.* (2007) reported that the grain yield of black gram increased significantly with the application of neem cake and biofertilizers. During (2008) they further observed that the application of neem cake and biofertilizers showed marked response on 1,000-seed weight and the uptake of NPK in plants. Singh *et al* (2008a) reported that the highest seed yield (651 kg ha^{-1}) of black gram [*Vigna mungo* (L.) Hepper] was obtained with the application of 40 kg P2O5 ha^{-1} through DAP with PSB. The increase in seed yield was attributed mainly to the increase in nodulation, plant height, number of branches $plant^{-1}$, number of leaves $plant^{-1}$, and number of pods $plan^{-1}$t and the highest net return (2624 rupees ha^{-1}). Thus, this rate is recommended for general adoption for medium black soils in Madhya Pradesh. Singh *et al.* (2008b) reported that the grain yield was increased significantly with increase in the level of phosphorus (P). Application of 20 and 40 kg P_2O_5 ha^{-1} increased the mean yield of urdbean by 16.4 and 51.4%, respectively over the control and also found that the highest pooled yield (1361 kg ha^{-1}) was obtained with the incorporation of FYM in conjunction with 40 kg P_2O_5 ha^{-1}.

CONCLUSION

Although, chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop. Persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the usage of chemical fertilizers and in turn increase in the usage of organics which is needed to check the yield and quality levels. Use of organics alone does not result in spectacular increase in crop yields. Therefore, the aforesaid consequences have paved way to grow pulses like Black gram and green gram using organic and inorganic manures along with biofertilizers.

REFERENCES

1. Upadhayay, R.G., Sharma, S. and Drawal, N.S. (1999). Effect of *Rhizobium* inoculation and graded level of P on the growth and yield of greengram, *Legume Research,* 22: 277-279.
2. Zhang, X. and Schmidt, R.E. (2000). Harmone-containing products impact on antioxidant status of tall fescue and creeping bentgrass subjected to drought. *Crop Sci*ence. 40:1344-1349.
3. Zhang, X., Ervin, E.H. and Schmidt, R.E. (2003). Plant growth regulators can enhance the recovery of Kentucky bluegrass sod from heat injury. *Crop Sci*ence. 43: 952–956.
4. Turan, K. and Kose, M. (2004). Seaweed extract improve copper uptake of Grapevine (Vitis vinifera) *Acta Agriculturae Scandinavica, Section B - Soil & Plant Science*. 54: 213-220.
5. Venkataraman, K., Mohan, V.R., Murugeswari, R. and Muthuswamy, M. 1993. Effect of crude and commercial seaweed extracts on seed germination oand seedling growth in green gram and black gram. *Seaweed Research Utilization Association.* 16(1&2): 23-27.
6. Venkataraman, K. and Mohan, V.R., 1997. The effect of liquid seaweed fertilizer on black gram. *Phykos.* 36: 43-47.
7. Anandharaj, M. and Venkatesalu, V. (2001). Studies on the effect of seaweed extract on *Dolichos biflorus*. *Seaweed Research Utilization Association.* 24(1): 129-137.
8. Sivasankari, S., M. Chandrasekaran, K. and V. Venkatesalu, (2006). Studies on the biochemical constituents of *Vigna radiata* (linn) treated with seaweed liquid fertilizer. *Seaweed Research and Utilisation Association*, 28(1): 151-158.
9. Vinuba A., Pinky, V.R. and Prakash, J.W. (2008). Effects of seaweed extract on growth and biochemical parameters of black gram. *Plant Archives*, 8(1): 211-214.
10. Bai, N. R., Banu, N.R.L., Prakash, J.W., and Goldi, S.J. (2008). Effect of seaweed extracts (SLF) on the growth and yield of *Phaseolus aureus* L, *Indian Hydrobiology* 11:113-119.
11. Sethi, S.K. and Adhikary, S. P. (2008). Effect of Seaweed Liquid Fertilizer (SLF) on vegetative growth and yield of black gram, brinjal and tomato. *Seaweed Research and Utilisation*; 30: 241-248.
12. Singh, R.K.K., Athokpam, H.S., Singh, L.N., and Nandini, C. (2002). Effect on nitrogen, phosphorus and potassium on the growth, yield and nutrient uptake of blackgram (*Vigna mungo,* L). *Journal of the Agricultural Science Society of North-East India*. 15(2): 175-177.
13. Shrinivas, M. and Mohammad, S. (2002). Performance of green gram [*Vigna radiata* (L.) Wilczek] and responce functions as influenced by different levels of nitrogen and phosphorus. *Crop Research*. 24(3): 458-462.
14. Yakadri, M., Thatikunta, R and Rao, L. M. (2002). Effect of nitrogen and phosphorus on growth and yield of green gram [*Vigna radiata* (L.) Wilczek]. *Legume research.* 25(2): 139-141.
15. Malik, M. A., Saleem, M.F., Ali, A. and Mohmood, I. (2003). Effect of nitrogen and phosphorus application on growth, yield and quality of Mungbean (*Vigna radiata* L.) *Pakistan journal of Agricultural Sciences.* 40 (3/4):133-136
16. Bhosle, N.B., Untawale, A.G. and Dhargalkar, V.K. (1975). Effects of seaweed extract on the growth of *Phaseolus vulgaris* L. *Indian Journal of Marine Science*, 4: 208-210.
17. Reddy, B.P. and Swamy, S.N. (2002). Effect of farmyard manure, phosphate solubilising bacteria and phosphorus on yield and economic of blackgram (Phaseolus mungo). *Indian Journal of Agricultural Sciences*, 70(10): 694-696.
18. Patil, T., (2002). Influence of organics on seed yield, quality and storability studies on greengran Cv. Chinamung. *M.Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).
19. Rajkhowa, D.J., Saikia, M. and Rajkhowa, K.M., (2002). Effect of vermicompost with and without fertilizer on Greengram. *Legume Res.,* 25(4): 295-296.
20. Tanwar, S.P.S., Sharma, G.L. and Chahar, M.S. (2003). Effect of phosphorus and biofertilizers on yield, nutrient content and uptake by black gram [Vigna mungo (L.) Hepper]. *Legume Research*, 26(1): 39-41.
21. Abraham, T. and Lal, R.B. (2004). Performance of blackgram (*Vigna mungo* L.) under integrated nutrient management (INM) in a legume based cropping system for the inceptisols of NEPZ. *Indiaqn Journal of Dryland Agricultural Research and Development.* 19(1): 81-87
22. Vasanthi, D. and Subramaniam, S. (2004). Effect of vermicompost on nutroent uptake and protein content in black gram. *Legume research,* 27(4): 293-295.
23. Vasanthi, D. and Subramaniam, S. (2004). Effect of vermicompost on nutroent uptake and protein content in b;ack gram. *Legume research,* 27(4): 293-295.

24. Joseph, R., Kalpana, C.V. and Padmaja, C.K. (2006). A study on the effective utilization of ecofriendly organic manures on the growth and yield of black gram (Vigna mungo (L.) Hepper.). *Advances in Plant Sciences*, 19(2): 535-538.
25. Das A., Tomar, J.M.S., Patel, D.P. and Munda, G.C. (2007). Effect of organic manures on the productivity of black gram (*Phaseolus mungo)* with and without fertilizer. *Environment and Ecology*, 25(1): 15-18.
26. Pannu, R.P.S., Chopra, S. and Kaur, N. (2007). Effect of combined application of FYM, pressmud and fertilizers on the yield and growth characteristics of summer mash (*Vigna mungo*). *Agricultural Science Digest*; 27(3): 216-218.
27. Hakeem, S.A., Thomas, T. and Shagufta, W. (2007). Effect of different levels of neem cake and biofertilizer on properties of soil, nutrient status and grain yield of black gram (*Vigna mungo* L.) type - 9. *Plant Archives*, 7 (2): 847-849.
28. Singh, R.P., Gupta, S.C. and Yadav, A.S. (2008a). Effect of levels and sources of phosphorus and PSB on growth and yield of black gram (*Vigna mungo* L. Hepper). *Legume Research*, 31(2): 139-141.
29. Singh, V.K., Sharma, B.B. and Sahu, J.P. (2008b). Effect of organic and inorganic sources of nutrients on black gram productivity. *Journal of Food Legumes*, 21:(3) : 173-174.