INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 10 | ISSUE 1 | APRIL, 2017 | 106-110

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/10.1/106-110

Integrated crop, nutrient and pest management for improving tomato, brinjal and chilli productivity in acid soils

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Received : 23.02.2017
Revised : 13.03.2017
Accepted : 18.03.2017

KEY **W**ORDS :
Integrated crop, Nutrient, Pest management, Improving tomato, Brinjal, Chilli productivity, Acid soils

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ABSTRACT

Vegetable production is an important component of agriculture and also an essential part of a balanced human diet. In recent years, vegetable production has also become an income generating enterprise for those farmers who are located close to markets and road sides. Local varieties and practices are of low productivity, prone to pests and grown without proper fertilizer management resulting in poor yield and poor soil fertility. Modern technologies are often inappropriate for them due to lack of knowledge and training. However, a combination of traditional and appropriate modern technology like INM, IPM and improved variety can reap the good harvest of vegetables and support livelihood and nutritional security of farmers. Considering the importance of vegetable production and to meet the market demand of tomato, chilli and brinjal, on-farm research trials on INM and IPM system were conducted in acid soils of South Tripura (India).

How to view point the article : Singh, A.K. (2017). Integrated crop, nutrient and pest management for improving tomato, brinjal and chilli productivity in acid soils. *Internat. J. Plant Protec.*, **10**(1) : 106-110, **DOI : 10.15740/HAS/IJPP/10.1/106-110**.

INTRODUCTION

Vegetable growing is a production system involving a wide range of component factors. Vegetable farmers carry out a large number of management activities, including development and maintenance of the vegetable field infrastructure, selection of variety and seed source, determination of the sowing and cropping calendar suitable to market demand, land preparation practices, plant establishment techniques, protection from weeds, insects, diseases and other pests, nutrition supply to meet growth needs, management of water supply and depth control and harvesting, storage, packaging and marketing. All these activities, singularly and collectively, affect the production of vegetables in all phases of plant development, which ultimately determines the parameters of growth and yield components (AVRDC, 2005). Crop development phases include germination, seedlings, vegetative development and reproduction through flowering to fruit development. Vegetable crop management programmes involve the formulation and transfer of technological recommendations throughout the entire growing season.

Consumption of chemical fertilizers has been increasing in India during the past thirty years at a rate of almost half a million tons on an average a year. Experts point out that the efficiency of fertilizer use in India is only 30-35 per cent as the balance 65-70 per cent reaches the underground water. It is true that the increasing use of fertilizer at high rates has boosted agricultural production in the country. But it has also caused adverse impact on soil and water as well as environment (Hegde *et al.*, 1995). Increasing application of fertilizer also leads to increasing use of pesticides to control pests and diseases. Almost all pesticides are toxic in nature and pollute the environment leading to grave damage to ecology and human life itself. The Indian Institute of Horticulture Research (ICAR-IIHR) has reported contamination of 50 per cent of the fruits and vegetables with the residues of DDT and HCH (Prakash, 2003).

Integrated crop management (ICM) is a combination of the traditional methods with appropriate modern technology, balancing the economic production of crops with positive environmental management (Mishra, 2013). Basic components of ICM are crop management, nutrient management and pest management. Through the process of ICM, farmers make better use of on-farm resources. One of the main objectives of ICM is the reduction of external farm inputs, such as chemical fertilizers and chemical insecticides or pesticides (Kumar and Singh, 2014). Total replacement is not possible without significant loss of yields, but partial substitution of inputs can be achieved by the use of organic inputs. This would then lead to reduced production cost and less food contamination and environmental degradation. The major components of ICM strategies and approaches are seedling establishment, integrated nutrient management (INM), integrated pests and disease management (IDM/IPM) and integrated weed management (IWM) (Kumar and Shivay, 2008). There is increasing pressure on vegetable producers in the country to intensify their production. For the local farmers, information on sustainable and profitable permanent vegetable production systems is of high value.

A major limitation in application of INM and IPM is the lack of trained personnel. Many farmers are not trained adequately in use of organic fertilizer and augmentative biological control, leading to misunderstanding of its potential efficacy. Farmers often believe that organic fertilizer and natural enemies do not work well. The use of biopesticides is limited due to moderate toxicity and slow action. Many farmers are not yet aware of the proper usage of biocontrol agents and biopesticides. A number of microbial consortium and botanicals such as *Neem*, karanj, pongmia, mahua, garlic and tobacco have been found to be effective against insect pests and diseases (Mamun and Ahmed, 2011). INM and IPM adoption is influenced by the cost versus efficacy of products, ability to integrate new products and techniques into existing farm management practices and managerial skills.

Balanced application of appropriate fertilizers is a major component of INM. Over application of fertilizers induces neither substantially greater crop nutrient uptake nor significantly higher yields. Rather, excessive nutrient applications are economically wasteful and can damage the environment. Under application, on the other hand, can retard crop growth and lower yields in the short term, and in the long term jeopardize sustainability through soil mining. Balanced fertilization should also include secondary nutrients and micronutrients, both of which are often most readily available from organic fertilizers. Application of only inorganic fertilizers creating nutrient imbalance in acid soil and as a result, farmers achieved lower yields and less annual return (Singh *et al.*, 2014). Improved application and targeting of inorganic and organic fertilizer not only conserves nutrients in the soil, but makes nutrient uptake more efficient (Ghosh *et al.*, 2015). However, higher plants can absorb mineral nutrients when applied as foliar sprays in appropriate concentrations (Fageria *et al.*, 2009). This fertilization mode has been recommended in integrated plant production system because it is environmentally friendly and provides the possibility of achieving high productivity and good quality yields (Wojcik, 2004). Foliar sprays of a given nutrient are most successful when applied at plant reproductive stage, when high amount of the nutrient is required (Alexander, 1986). There are new technologies emerging that allow farmers to increase yield and reduce chemical usage whilst lowering costs. Many of these products are environmentally safe and contain different bio-control agents. Such products (e.g. microbial consortium, micronutrient formulation, etc.) are beneficial substances for vigorous and healthy developments in both vegetative and generative respect (Kara and Sabir, 2010).

This paper contributes to reduce the use of chemicals fertilizer and pesticides without compromising yield of vegetables like tomato, brinjal and chilli using

Table A : Integrated crop management technology used in tomato, brinjal and chilli vegetables

Technology	No. of villages	No. of trials	Area (ha)	Details of technology used
Improved variety (Hybrid)	3	18	3	Tomato: Arka Samrat (disease resistance to leaf curl virus, bacterial and early blight) Brinjal: Arka Anand (resistance to bacterial wilt) Chilli: Arka Meghna (tolerant to powdery mildew and viruses)
INM in vegetable	3	18	3	Soil application of FYM @ 10 t/ha and 75% of recommended dose of NPK fertilizer Arka microbial consortium @ 20 g/lit (20-50 ml/plant) after 10 days of transplantation. Foliar spray of micro and secondary nutrient formulation (IIHR vegetable dpecial) @ 5g/lit of water to be applied after 30 days of transplantation followed by 15 days interval till flowering. Irrigation: @1-2 days interval during early stage and @ 4-6 days interval at later stage
IPM in vegetable	3	18	3	Seed treatment with Trichoderma @ 5g/kg of seed. Foliar spray of *Neem*/Pongamia soap @ 5-10g/lit of water at flowering stage or early stages larvae to control fruit borer, leaf webber, leaf minor, etc.

tools of ICM techniques like INM and IPM, leading to more sustainable production methods and higher farmer's incomes in acid soils of Tripura.

MATERIAL AND METHODS

A study was undertaken in Northeastern states of Tripura where potential for horticulture development (Singh *et al.*, 2009) is very good. The natural factors of production including soil and water are slowly degrading and affecting the vegetable production. The major reasons of gaps in yield of vegetable crops are imbalance use of major (N and P) and secondary nutrients (Ca, Mg and S) including some micronutrients, indiscriminate use of chemical pesticides, use of older crop varieties, limited availability of irrigation water during dry periods, climate change stresses during the growth period of crops, etc. The new technology and knowledge are lacking and need to be implemented for development of profitable horticulture. Most of the farmers realize low yield and income due to their age old traditional package of practices. Considering the importance of vegetable production and to meet the market demand of tomato, chilli and brinjal crop, on-farm research trials were conducted under IIHR-NE component programme during the year 2013-15. The vegetables were grown during late *Rabi* season (Dec.-April). The details of technology used are presented in Table A.

RESULTS AND DISCUSSION

The yield of hybrid varieties of tomato, brinjal and chilli was observed under conventional, INM, IPM and ICM (INM+IPM) and presented in Table 1. On an average, the yield of all vegetables under study was comparatively higher in ICM system followed by IPM and INM system. The lowest yield was observed under conventional system (100% NPK). The yield was about

Table 1 : Effect of conventional, INM, IPM and ICM system on vegetable yield

Crop management system	Tomato	Green chilli	Brinjal
Yield under conventional method (t/ha)	60.40	32.30	35.30
Yield under INM method (t/ha)	69.90	34.60	35.90
Yield under IPM method (t/ha)	71.35	35.15	38.70
Yield under ICM method (t/ha)	72.50	36.57	42.00
Yield under farmer's practice (FC) (t/ha)	25.50	16.00	20.40
Per cent change of ICM over FC	+190	+128	+106
Net profit of ICM (Rs. in Lakh)	5.39	4.64	3.12
Cost of cultivation of ICM (Rs. in Lakh)	0.65	0.48	0.41
B:C (ICM)	8.29	9.67	7.61

20 per cent higher in tomato, 13 per cent higher in chilli and 19 per cent higher in brinjal over conventional practices. As per yield potential of hybrid variety, it was maximum in tomato (99.9%) and chilli (98.9%).

Results obtained also showed that not only vegetable yield, but also the efficiency of fertilizer application in vegetable production were improved with the application of the INM system. The increase in fertilizer efficiency due to the application of the INM technology not only reduced production costs but also the negative effects of nutrient losses on the environment (Reddy, 2011). Microbial consortium contains N fixing, P and Zn solubilizing and plant growth promoting microbes as a single formulation and helped in reducing N and P fertilizer requirement by 25 - 30 per cent and also increases yield of 13-20 per cent in vegetables. Foliar application of secondary and micronutrient formulation supplied essential nutrients other than NPK and increases resistance to diseases (Magdoff and Van, 2000; Sarwar, 2011 and Yeboah *et al.*, 2003). These nutrients are also necessary for enhancement of fruit appearance, fruit keeping quality and taste of vegetables (FAO, 2004). The soap spray of *Neem*/Pongmia reduces the insect-pests problem to a great extent. Seed treatment with *Trichoderma harzianum* manages fungal pathogens such as *Fusarium* species and *Phytophtora* species as well as nematodes (Venkateswarlu *et al.*, 2008). The ICM system provided recommendations the 'best management practices' for vegetable growing, based on results from this on-farm trial and farming experiences. The output recommendation serves as a criterion for the evaluation of farmers' success in managing profitable vegetable crop establishment. ICM system with improved crop variety, INM and IPM paid more dividends with BC ratio more than 7.0 in all the three vegetable crops.

Conclusion :

After the observation of negative effects of the green revolution on natural resources, the call arose for new systems of management. The anthropologists and sociologists studied age-old practices again as they survived the test of time and stated that these methods have something to offer due to their sustainability. The recently developed systems of integrated management which includes both traditional and modern technology are required to be adopted at large-scale after its evaluation in all agro-ecological situations. The future of success of vegetable production lies in the growth of crops with less environmental stress. Thus, emphasis needs to be placed on practical aspects of such simple techniques.

REFERENCES

Alexander, A. (1986). *Optimum timing of foliar nutrient sprays.* Kluwer Academic Publishers, The Netherlands, pp. 44–60.

AVRDC (2005). *Annual report.* AVRDC – The world vegetable center. Shanhua, Taiwan.

Fageria, N.K., Barbosa, Filho, M.P., Moreira, A. and Guimarães, C.M. (2009). Foliar fertilization of crop plants. *J. Plant Nutr.*, **32** (6): 1044-1064.

FAO (2004). Improving the quality and safety of fresh fruits and vegetables: a practical approach. Food and Agriculture Organization of the United Nations, ROME, ITALY.

Ghosh, B.N., Singh, Raman Jeet and Mishra, P.K. (2015). Soil and input management options for increasing nutrient use efficiency. A. Rakshit *et al.* (Eds.) Nutrient Use Efficiency: from Basics to Advances, Springer. pp 17-27.

Hegde, B.R., Krishnegowda, K.T. and Parvathappa, H.C. (1995). Organic residue management in red soils under dryland conditions. K. Shivashankaar (eds.) Alternatives to Fertilizers in Sustainable Agriculture, University of Agricultural Sciences, Bangalore (KARNATAKA) INDIA.

Kara, Z. and Sabir, A. (2010). Effects of Herba green application on vegetative developments of some grapevine rootstocks during nursery propagation in glasshouse. In: 2nd International Symposium on Sustainable Development. Sarajevo, pp. 127–132.

Kumar, Dinesh and Shivay, Y.S. (2008). Integrated crop management. Modern concepts of Agriculture. Indian Agricultural Research Institute (IARI), NEW DELHI, INDIA.

Kumar, S. and Singh, A. (2014). Biopesticides for integrated crop management: Environmental and regulatory aspects. *J. Biofertil. Biopestici.* **5**:e121. doi:10.4172/2155-6202.1000e121.

Magdoff, F.H. and Van, E. (2000). Building soils for better crops. SARE, Washington, D.C., U.S.A.

Mamun, M.S.A. and Ahmed, M. (2011). Prospect of indigenous plant extracts in tea pest management. *Int. J. Agril. Res. Innov. & Tech.*, **1**(1&2): 16-23.

Mishra, Mandavi (2013). Role of eco-friendly agricultural practices in Indian agriculture development. *Int. J. Agric. Food Sci. Techn.*, **4** (2): 2249-3050.

Prakash, T.N. (2003). A theoretical framework to promote organic produce marketing in India. *Indian J. Agric. Market.* Special Issue, pp. 1-16.

Reddy, Suresh B. (2011). Dynamics of soil fertility management practices in semi-arid regions: A case study of AP. *Econ. Pol. Weekly,* **46** (3) : 56-63.

Sarwar, M. (2011). Effects of zinc fertilizer application on the incidence of rice stem borers (*Scirpophaga species*) (Lepidoptera: Pyralidae) in rice (*Oryza sativa* L.) crop. *J. Cereals Oilseeds,* **2**(5) : 61-65.

Singh, A.K. (2007). Evaluation of soil quality under integrated nutrient management. *J. Indian Soc. Soil Sci.* **55** (1) : 58-61.

Singh, A.K., Singh, N.P. and Ngachan, S.V. (2009). Resource support system in agriculture and allied sectors, South Tripura district, Krishi Vigyan Kendra (ICAR), SOUTH TRIPURA, INDIA.

Singh, A.K., Chakraborti, M. and Datta, M. (2014). Application of only inorganic fertilizers creating nutrient imbalance in soil and as a result, farmers achieved lower yields and less annual return from such rice ecosystem. *Rice Sci.,* **21**(5): 299-304.

Venkateswarlu, B., Balloli, S.S. and Ramakrishna, Y.S. (2008). Organic farming in rainfed agriculture: opportunities and constraints. Central Research Institute for Dryland Agriculture, Hyderabad. pp. 185.

Wojcik, P. (2004). Uptake of mineral nutrients from foliar fertilization. *J. Fruit Ornam. Plant Res.,* **12**: 201–218.

Yeboah, S., Berchie, J.N., Asumadu, H., Agyeman, K. and Acheampong, P. (2003). Influenced of inorganic fertilizer products on the growth and yield of tomatoes. *J. Exp. Biol. Agril. Sci.,* **1**: 500-506.