IMPACT ASSESSMENT OF INTEGRATED PLANT NUTRIENT MANAGEMENT IN BRINJAL (*SOLANUM MELONGENA* L.), THROUGH FARMERS PARTICIPATORY APPROACH

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Abstract : Adoptive experiments on the integrated plant nutrient management (IPNM) with farmer's participatory approach were conducted during Rabi 2008 and Rabi 2009 by Krishi Vigyan Kendra, Chandauli at farmer's field in two villages to assess the technological gap in Brinjal production and potential. Eight numbers of technological gaps including application of fertilizers and pesticides for commercial Brinjal production were identified. The package of IPNM includes application of 10 tons FYM ha^{-1} + 150:80:60 kg ha^{-1} NPK respectively +Soil application of Azospirillum biofertilizers @ 10kg ha^{-1} + foliar spray of Zn and Bo@ 50 ppm at 30, 45 and 75 days after transplanting were applied at farmers field. Findings of experiment revealed that maximum marketable fruit yield 404 q ha^{-1} in Rabi 2008 and 390 q ha^{-1} in rabi 2009 were obtained from IPNM plots and subsequently 25.72 and 24.00 per cent increase in total yield were recorded over farmers practice in respective seasons. The per cent loss of yield from total production due to diseased and inferior quality fruits were observed nearly double (13.07 & 12.00) in farmer practice when compared with IPNM plot (7.67 & 7.17%) respectively. Partial budget analysis revealed that the net returns obtained from IPNM plot in Rabi 2008 and Rabi 2009 were higher i.e. Rs. 1, 24,110 and Rs. 1, 16,114 respectively than the farmers practice (Rs. 76,740 and Rs. 71,235) in respective years. Reduction in cost of cultivation of Rs. 8,170 and Rs. 8,879 were also reported in IPNM plot in comparison with farmers practice . B:C ratio were found maximum 4.25 in Rabi 2008 and 4.23 in Kharif 2009 respectively in IPNM plot, whereas , in farmers practices it were 2.98 and 2.82 in respective seasons. Minimization in hazardous use of pesticide was also appreciated.

Keywords : Brinjal, IPNM, OFT, Participatory approach

INTRODUCTION

Brinjal is one of the most important vegetable widely grown in all over the country due to its wide adoptability and versatility. The fruits of brinjal are an excellent remedy for those suffering from liver disorders. White brinjal is well known medicinal use in blood sugar control (Varmudy, 2011). Processing of brinjal as prickles and in form of chilled brinjal for export purpose opened door to generate employments for rural people. Being a remunerative cash crop its commercial cultivation is widely adopted by progressive farmers in an area of 0.612 million hectares with production 10.563 million tones and productivity in India is 17.3 t ha^{-1} (NHB database, 2010). Cultivation of brinjal in eastern plain region of U.P. is followed commercially round the year, but productivity is very low (13.9 mt ha^{-1}) as compared to national average (NHB database 2010).

Intensive cultivation of brinjal in peri urban areas of Chandauli district is very common as it is an important segment of famous traditional dish "Bati-Chokha" in eastern U.P. and is in continuous demand and market opportunity in Varanasi city. This is resulted in decline in soil fertility due to depletion of plant nutrients in larger quantity as Brinjal is heavy nutrient feeder. Unawareness and injudicious use of chemical fertilizers by the farmers for harvesting higher yield not only created imbalances in buffer stock of soil nutrients but adversely affect the plant growth and development with inviting severe attack of disease and pest. Injudicious use of chemical pesticide to control pest and diseases also causes environmental disturbances as well. Seeking the problems, emphases on balanced nutrients management were made through trainings and Gosthi but the farming communities were not very aware about the technologies. The major reasons of non adoption of these technologies are non participation of farmers in technology development, assessment and demonstration.

Keeping the problems into considerations adoptive trials on integrated plant nutrient management (IPNM) in brinjal were conducted after specifying the location specific needs with the active participation of farmers. The module of IPNM on tomato given by IIVR Varanasi (Nirmal de *et al.* 2004) adopted after small modification accordingly.

METHODOLOGY

The On Farm Testing (OFT) on IPNM in brinjal was carried out by Krishi Vigyan Kendra Chandauli (U.P.) during Rabi, 2008 and Rabi, 2009 at the five farmer's field in two villages i.e. Kanta Vishunpura and Rema in Chandauli district. Technological gap between improved management package and farmers practices were studied based on survey and group discussion with farmers interactive group (FIG) of brinjal growers in the selected villages. The brinjal growers of these villages had small land holdings. The total numbers of farmers were 100. Out of these 20 farmers were selected randomly from selected villages and discussion were made on eight improved management package to study the technological gap. A list of constraints experienced by farmers was prepared and shortlisted. It was observed that majority of problems were directly or indirectly related with use of imbalanced fertilizer applications.

IPNM module given by IIVR, Varanasi viz. 5 tons press mud + 120:60:60 kg ha^{-1}NPK + Application of Azospirillum biofertilizers @ 10kg ha^{-1}. + foliar spray of Zn and Bo @ 50 ppm at 30, 45 and 75 days after transplanting was modified on the basis of soil testing report and availability of organic matter and fertilizers. Finally module of IPNM was designed with the active participation of selected farmers as 10 tons FYM + 150 :80:60 kg ha^{-1} NPK +Soil application of Azospirillum biofertilizers @ 10kg ha^{-1} + foliar spray of Zn and Bo @ 50 ppm at 30, 45 and 75 days after transplanting and assessed at selected farmers field. All the participants raised their nurseries on raised bed with following improved nursery raising techniques jointly. The variety popular in the area Navkiran was selected for the trials. The area of each trial was 1000 m^2. Recommended basal dose of NPK 75:80:60 kg ha^{-1} and Azospirillum biofertilizers @ 10kg ha^{-1} along with FYM @ 10t ha^{-1} were applied before the last ploughing and making of layout. Scientific cultivation practices were followed for the raising good crop. Top dressing of remaining nitrogen @ 75 kg ha^{-1} was applied in two split doses at 30 and 75 DAT. Recommended IPM practices as per need and availability were followed strictly. The data were recorded on different parameters and calculated accordingly. The per cent increase in yield over farmers practice was calculated using following formula as given below:

$$\text{Increase (\%)} = \left(\frac{\text{Demo yield} - \text{farmers yield}}{\text{Farmers yield}}\right) \text{x } 100$$

RESULTS AND DISCUSSION

The data presented in Table-1 revealed that farmers involved in brinjal production in the district, didn't aware about recommended crop production technology i.e. nursery raising seed rate, seed treatment, sowing and transplanting methodology, balanced nutrition and plant protection measures. They were using disease susceptible hybrid varieties along with high dose of nitrogen and phosphorus (300:200 kg ha^{-1}) respectively in anticipation to harvest maximum yield. Imbalanced fertilizer application not only reduces the proper development of plants and its potentiality to provide quality yield, but also invite higher incidences of disease and pest resulting in reduced marketable yield and unhealthy soil. To control incidence of disease and pest, farmers used higher doses of pesticides in injudicious way which adversely affects the ecology and environment. The lack of knowledge and skill about production technology and plant protection measures in brinjal crop were the important reason behind it.

The experimental findings summarized in Table 2, exhibited that increased plant height in both the seasons were recorded with farmers practice during the course of study as compared to IPNM plot of experiment. The differences in plant height were much higher between T_1 and T_2 in Rabi, 2009 than the Rabi 2008. It is observed that higher dose of nitrogenous fertilizer application by farmers was the major cause of increased plant height. However, maximum number of primary branches was found in IPNM plot in comparison with farmers practice**.** Balanced application of fertilizer and use of Azospirillum may be cited as principal cause of the better branching ultimately resulted in higher yield as also suggested by Satesh Kumar and Sharma (2002).

The highest average yield 435q ha^{-1} and 418 q ha^{-1} were found in T_2 (IPNM plot) during Rabi 2008 and Kharif 2009 respectively as compared with T_1(FP) as 346 q ha^{-1} and 336 q ha^{-1} respectively in Rabi 2008 and rabi 2009 and subsequently 25.72 and 24.00 per cent increase in total yield were recorded over farmers practice in respective years. The actual marketable yield after shorting and grading of commodity were 410 q ha^{-1} and 390 q ha^{-1} from T_2 in both the years respectively while the marketable yield of farmers practice reported only 346 q ha^{-1} and 300 q ha^{-1} in both Rabi 2008 and Rabi 2009 respectively. The data also showed that the per cent loss of yield from total production due to diseased and inferior quality fruits were observed nearly double (13.07 & 12.00) in farmer practice when compared with IPNM plot (7.67 & 7.17%) respectively. It may be correlated with higher incidence of disease and pest in farmers practice in comparison with IPNM plots. It was due to application of higher dose of nitrogenous fertilizers and mismanaged plant protection practices in brinjal in respective years. The present findings are in conformity with Shashidhara, G. B. (2000).

The study also exhibited in Table 3 that adoption of IPNM module for production of brinjal not only gives the opportunity of higher yield, but also provide higher benefit cost ratio 4.31 to 3.91 in IPNM Plot in respective years with minimal cost of production from Rs. 8,170 to Rs. 8,879 per hectare as compared to farmers practice. It also opens a way for sustainable production of brinjal by improving soil structure, reduces the chemical concentration in soil and as reduced pesticides application. The similar findings were also reported by Ramanathan, K. M.(2006 **).**

CONCLUSION

There were technological gaps between the improved management packages and farmers practices in brinjal productions in Chandauli district of Uttar Pradesh. The present on form testing conducted at the formers field, produced significant positive results and provides potentials and profitability of improved technology under real situation, which they have been advocating for a long time. The IPNM module assessed during the study proved as an effective tool in changing attitude, skill and knowledge of integrated nutrient management in eco-friendly brinjal production which gives better yield

due to proper utilization of plant nutrient, improved soil health and minimizing disease incidences. The farmer`s feedbacks were noticed that the use of IPNM module in brinjal is highly acceptable, easily compatible in existing production and cropping system in Chandauli district. Moreover, steps should be taken to popularized technology in entire brinjal growers in the district to bridge the gaps on technology between potential and in actual practices to promote the INM to enhance the yield, quality with maximum economic benefit in sustainable manner.

Table 1: Technological differences between improved production technology and farmers practice

S.No.	Particulars	Technological interventions	Farmers practices
1.	Variety	Navkiran	Navkiran
2.	Seed treatment	Overnight dip in Solution of Captan 0.2%	No seed treatment follows
3.	Seed rate	200-250 g ha^{-1}	300-350 g ha^{-1}
4.	Nursery raising	Raised bed techniques, line sowing	Conventional flat bed techniques
5.	Situation	Upland sandy loam irrigated	Upland sandy loam irrigated
6.	Irrigation facility	Private tube well	Private tube well
7.	Fertilizer application	Integrated nutrient management 10 tones FYM + 150:80:60 kg ha^{-1} NPK +Soil application of Azospirillum biofertilizers @ 10kg/ha. + foliar spray of Zn and Bo @ 50 ppm at 30, 45 and 75 days after transplanting	Application of 300 kg N and 200 Kg P_2O_5 ha^{-1}
8	Plant Protection	Need based application of pesticides	Use of Pesticides at higher doses

Table 2: Impact of IPNM on yield and yield attributing characters in brinjal crops as compared to farmers practices.

Year	Treatments	parameters				Average Yield q ha^{-1}	% increase in yield q ha^{-1}	Marke-table Yield q ha^{-1}	%of yield from total Production
		Plant height (m)	No. of primary branches	Avg. fruit wt. (g)	No. of fruit $plant^{-1}$				
Rabi 2008	T_1 - (F.P.) No use of organic matter and 300 kg N + 200 kg P ha^{-1}	90.31	6.89	90.00	23.67	346.00	-	306	13.07
	T_2-(IPNM Module) 10 tones FYM + 150:80:60 kg ha^{-1}NPK +Soil application of Azospirillum biofertilizer @ 10kg/ha. + foliar spray of Zn and Bo @ 50 ppm at 30, 45 and 75 DAT	85.90	7.15	105.00	31.65	435.00	25.72	404	07.67
Rabi 2009	T_1 - (F.P.) No use of organic matter and 300 kg N + 200 kg P ha^{-1}	99.41	7.32	95.00	22.05	336.00	-	300	12.00
	T_2-(IPNM Module) 10 tones FYM + 150:80:60 kg ha^{-1}NPK +Soil application of Azospirillum biofertilizers @ 10kg ha^{-1} + foliar spray of Zn and Bo @ 50 ppm at 30, 45 and 75 DAT	90.71	7.77	100.00	28.76	418.00	24.40	390	7.17

Table 3: Economic performance of brinjal production using IPNM modules in Chandauli districts.

Year	Treatments	Marketable yield q ha^{-1}	Gross Return * (Rs.)	cost of cultivation (Rs.)	Effective saving over cost of cultivation (Rs.)	Net returns (Rs.)	BCR
Rabi 2008	**T_1** - (F.P.) No use of organic matter and 300 kg N + 200 kg P ha^{-1}	306	122400	45660.00	-	76740.00	**2.68**
	T_2-(IPNM Module) 10 tones FYM + 150:80:60 kg ha^{-1}NPK +Soil application of Azospirillum biofertilizers @ 10kg ha^{-1}+ foliar spray of Zn and Bo @ 50 ppm at 30, 45 and 75 DAT	404	161600	37490.00	8170.00	124110.00	4.31
Rabi 2009	**T_1** - (F.P.) No use of organic matter and 300 kg N + 200 kg P ha^{-1}	300	120000	48765.00	-	71235.00	2.46
	T_2-(IPNM Module) 10 tones FYM + 150:80:60 kg ha^{-1}NPK +Soil application of Azospirillum biofertilizers @ 10kg ha^{-1}+ foliar spray of Zn and Bo @ 50 ppm at 30, 45 and 75 DAT	390	156000	39886.00	8879.00	116114.00	3.91

*Rate Rs400 q^{-1}; DAT =Days after transplanting

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