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RESEARCH ARTICLE

Boosting mustard production through integrated nutrient management front line demonstrations

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SUMMARY

Mustard is an important *Rabi* oilseed crop of India. It occupies about 24.20 per cent of area and 48.28 per cent of production of the total oilseed production in India. A majority of the farmers in Rajasthan do not apply balance fertilizer of NPK and S in this sequence, mainly because of their ignorance about its role as well as high cost. The oilseed based cropping system and application of continuous profit motivated imbalanced nutrient application is the matter of great concerned for sustainability. In spite of heavy inputs, the net result in such a system is the decline in crop productivity because of limitation of one or more nutrients. To overcome the yield gap 30 integrated nutrient management front line demonstrations of recommended package of practices involving balance fertilizer (@ 60 kg N_2+ 40 kg P_2O_5 + 250 kg gypsum or 40 kg S ha^{-1}) at adopted farmers fields were laid out during *Rabi* 2008-09 to 2009-10 in two villages of two tehsils. Existing farmer's practices as control were taken for the comparison. Integrated nutrient management front line demonstrations on mustard variety Vasundhara and Bio-902 (Pusa Jai Kisan) were conducted at farmers fields in district Chittorgarh (Rajasthan) during *Rabi* seasons of the years 2008-2009 and 2009-2010. On two years overall average basis about 28.41 per cent higher grain yield was recorded under demonstrations than the farmers' traditional practices. The extension gap, technology gap and technology index were 4.53 qha^{-1}, 3.37 qha^{-1} and 14.04 per cent, respectively. On two years overall average basis incremental benefit: cost ratio was found as 2.79. The trend of technology gap reflected the farmer's cooperation in carrying out demonstrations with encouraging results in subsequent years. By conducting integrated nutrient management (INM) front line demonstrations of proven technologies, yield potential of mustard crop could be enhanced to a great extent with increase in the income level of the farming community.

Key Words : Mustard, INM- front line demonstration, Technological gap, Extension gap, Technological index

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Oilseeds together occupy about 27.5 million ha which accounts for 14 per cent of total cropped area in the country with a production of 24.7 million tones, accounting for nearly 5 per cent of the gross national product and 10 per cent of the value of all the agricultural products. The per hectare productivity of crop is low in the country (900 kg/ha) against the world average of 1400 kg/ha in world (Piri and Sharma, 2006).

Edible oilseed crops have significant contribution in Indian agriculture. Oilseeds form the second largest agricultural commodity in India after cereals sharing 14 per cent of the gross cropped area and accounting for nearly three per cent of gross national product and 10 per cent value of all agricultural products. The continuous increase in import of oilseeds crops, mustard occupies a prominent position in Indian oilseeds scenario. It occupies about 24.20 per cent of area and 48.28 per cent of production of the total oilseed production in India. Its area, production and productivity in the country are 5.9 M.ha, 6.6 M.tones and 1121 kg ha^{-1},

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respectively (Anonymous, 2012). In Rajasthan state the total area under mustard cultivation is 2.84 M.ha with the estimated production of 3.5 M. tones and average productivity of mustard in the state is 1234 kg ha^{-1} (Anonymous, 2010). The yield levels also have been variable ranging from 1001 kg ha^{-1} (2002-03) to 1142 kg ha^{-1} (2009-10) during the past eight years. Though rapeseed-mustard group of crops occupy prominent position in the state oilseeds scenario but vast yield gap exists between potential yield and yield under real farming situation. The available agricultural technology does not serve the very purpose until its reaches and adopted by its ultimate users the farmers. Technology transfer refers to the spread of new ideas from originating sources to ultimate users. Conducting of integrated nutrient management front line demonstrations on farmer's field help to identify the constraints and potential of the mustard in specific area as well as it helps in improving the economic and social status of the farmers. The aim of the front line demonstration is to convey the technical message to farmers that if they use recommended package and practices then the yield of this crop can be easily doubled than their present level. The improved technology packages were also found to be financially attractive. Yet, adoption levels for several components of the improved technology were low, emphasizing the need for better dissemination. Several biotic, abiotic and socio-economic constraints inhibit exploitation of the yield potential and these needs to be addressed. The reasons for low productivity are poor knowledge about newly released crop production technologies and their integrated nutrient management practices in the farmers' fields.

Recognizing the importance of oilseeds in Indian Agriculture and urgent need to encure household nutritional security, the Ministry of Agriculture, Govt. of India has taken the innovative methodology to boost up the production of oilseeds crops by establishment of technology mission on oilseeds in 1986 which paved the way to meet different challenges and complexities in the oilseed sector (Hegde, 2005).

A wide gap exists in oilseeds production between the available techniques and its actual application by the farmers which is reflected through poor yield in the farmer's fields. There is a tremendous opportunity for increasing the production and productivity of mustard crop by adopting the improved technologies. There are so many appropriate technologies generated at agricultural universities and research stations but the productivity of mustard is still very low due to poor transfer of technology from the points of its development to the points of its utilization and only a little new knowledge percolates to the farmers fields, hence, a vast gap has been observed between knowledge production and knowledge utilization. To achieve target of additional production of oilseeds, it is necessary to concentrate efforts on scientific cultivation of mustard, the most important oil seed crop of India. Keeping the above point in view, the integrated nutrient management FLDs on mustard using improved production technologies were conducted with the objective of showing the productive potentials of the new production technologies under actual farm situation.

MATERIAL AND METHODS

Front line demonstrations on mustard were conducted a farmer's field in two adopted villages *viz.*, Luhariya and Mohammadpura of two tehsils of district Chittorgarh (Rajasthan) to assess its performance during *Rabi* seasons of the year 2008-2009 and 2009-2010. The soils of the district was generally clay loam in texture which was low to medium in nitrogen, medium in phosphorus and medium to high in potash. To manage the low yield problem, recommended package of practices of agro climatic zone IV a (Sub Humid Southern Plains) of Rajasthan were followed in integrated nutrient management (INM) front line demonstration programme. Each demonstration was of 0.2 ha area and using recommended package of practices and the farmers were provided quality seed of mustard variety Vasundhara and Bio902 (Pusa Jai Kisan) during both the year of the study. The sowing was done during mid October to last week of October under assured irrigated conditions and harvested during first fortnight of March. Before conduction of integrated nutrient management-front line demonstrations, trainings to the farmers of the respective villages were imparted. The necessary steps like selection of site and farmers lay out of demonstrations were followed with standard procedure. For integrated nutrient management front line demonstration critical inputs like seed, DAP, urea and gypsum fertilizers were provided by Krishi Vigyan Kendra. Non-monetary inputs like timely sowing and fertilization through drills were performed. The beneficiary farmers were facilitated by KVK scientists in performing field operations like sowing, broad casting of urea, harvesting etc. during the course of training and visits. The yield data were collected from both the demonstrated and control plots (farmers practices) by crop cutting experiment. The grain yield of demonstration crop was

Table 1: Productivity, technology gap, extension gap and technology index (%) in mustard cv. Vasundhara and Pusa Jai Kisan

Years	Area (ha)	No. of demonstration	Potential yield (qha^{-1})	Demonstration yield (qha^{-1})	Farmers practice yield (q ha^{-1})	Increase over farmers practices (%)	Extension gap (qha^{-1})	Technology gap (qha^{-1})	Technology index (%)	B:C ratio
2008-09	03	15	24.0	20.40	15.30	33.33	5.10	3.60	15.00	2.89
2009-10	03	15	24.0	20.86	16.89	23.50	3.97	3.14	13.08	2.70
Total	06	30	-	-	-	-		-	-	-
Mean	03	15	24.0	20.63	16.09	28.41	4.53	3.37	14.04	2.79

recorded and analyzed. Different parameters as suggested by Samui *et al.* (2000) and Yadav *et al.* (2004) were used for calculating gap analysis, costs and returns. The detail of different parameters is as follows:

Extension gap= Demonstration yield- Farmers practice yield

Technology gap=Potential yield- Demonstration yield

$$\text{Technology index} = \left\{ \frac{\text{(Potential yield – Demonstration yield)}}{\text{Potential yield}} \right\} \text{x} \, 100$$

RESULTS AND DISCUSSION

Table 1 reveals that under demonstration plots, mustard yield was found substantially higher than that under control plots during all the years. Under different locations, the mustard yield in demonstration plots ranged between 20.40 to 20.86 qha^{-1} over observation period, which was 33.33 and 25.50 per cent higher over farmers practice (local check). On over all basis, 28.41 per cent increase in yield was recorded. These results are in conformity with the findings of Mishra *et al.* (2007) in other crops. However, the variation of yield from location to location can be accounted for varying climatic conditions, prevailing micro climate and variation in agricultural practices followed. More or less similar reasoning was provided by other workers like Sagar and Chandra (2004); Mitra and Samajdar (2010); Katare *et al.* (2011) Tomar *et al.* (2003) and Dhaka *et al.* (2010).

Technology gap:

The technology gap, the difference between potential yield and demonstration yield were found 3.60 and 3.14 qha^{-1} during, 2008- 2009 and 2009- 2010, respectively. On an average technology gap during two years integrated nutrient management front line demonstration programmes was 3.37 qha^{-1}. The technology gap observed may be attributed to dissimilarity in the soil fertility status, agriculture practice and local climatic conditions. The technology gap observed may be attributing to the dissimilarity in soil fertility status and weather conditions. Mukharjee (2003) have also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing system productivity. Similar finding was recorded by Mitra *et al.* (2010) and Katare *et al.* (2011).

Extension gap:

Extension gap, which is difference between demonstration yield and farmers yield was observed 5.10 qha^{-1} and 3.97 qha^{-1} during, 2008-2009 and 2009-2010, respectively. However, the average extension gap was observed 4.53 qha^{-1}, which emphasized the need to evaluate the farmers about integrated nutrient management practices through various extension programs like FLD, training to revert the trend of wide extension gap. Similar results were obtained by Dubey *et al.* (2010) in blackgram.

Technology index:

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The lower value of technology index, more is the feasibility of the technology demonstrated (Sagar and Chandra, 2004). The technology index varied from 13.08 to 15.00 per cent (Table 1). On an average 14.04 per cent during the two years of integrated nutrient management FLDs showed the good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of mustard and lower down the losses meant by deficiency of nutrient in mustard crop.

Conclusion:

Front line demonstration revealed that the losses made by deficiency of nutrient in terms of yield 15.30 and 16.89 qha^{-1} increased by 33.33 and 23.50 per cent. The technology gap ranged between 3.60 and 3.14 qha^{-1} and can be attributed to dissimilarity of the soil fertility and local climatic situations. Extension gap ranged between 5.10 and 3.97 qha^{-1}, while the study of yield gap analysis of integrated nutrient management (INM) through which emphasized on the need to educate the farmer about use of chemical balance fertilizers control through various extension programmes like training, FLDs. The technology index shows the feasibility of the technology demonstrated which shows the good performance of intervention point made to reduce the yield gap in mustard crop. Front line demonstration programme was effective inchanging attitude, skill and knowledge of improved / recommended practices of mustard cultivation including adoption. This also improved the relationship between farmers and scientists and built confidence between them. The demonstration farmers acted also as primary source of information on the improved practices of mustard cultivation and also acted as source of good quality pure seeds in their locality and surrounding area for the next crop. The concept of integrated nutrient management (INM) front line demonstration may be applied to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community. This will help in the removal of the cross-sectional barrier of the farming population.

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