ISSN 2278- 4136

ZDB-Number: 2668735-5

IC Journal No: 8192

Volume 1 Issue 3

Online Available at www.phytojournal.com

Journal of Pharmacognosy and Phytochemistry

Yield gap analysis in mustard crop through front line demonstrations in Faizabad District of Uttar Pradesh

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Front Line Demonstration is one of the most powerful tools for transfer of technology. The present study was undertaken to find out the yield gap through FLDs on mustard crop. Krishi Vigyan Kendra conducted 80 demonstrations on mustard since 2005-06 to 2008-09 in five adopted villages of Faizabad district. Prevailing farmers' practices were treated as control for comparison with recommended practices. The average four year data observed that an average yield of demonstrated plot was obtained 17.59 q/ha over control (14.04 q/ha) with an additional yield of 3.55 q/ha and the increase average wheat productivity by 25.52 per cent. The average technology gap and index were found to be 4.40 and 20.02 per cent. The extension gap ranged between 2.45 q to 4.72 q/ha indicating the need to educate the farmers through various extension approaches for the adoption of improved technologies. The lower value of technology index indicated the feasibility of the demonstrated Mustard crop technology.

Keyword: Mustard, Front line demonstration, technology gap, extension gap, technology index

Introduction

The oilseeds contributes second largest agricultural commodity in India after cereals sharing 14 per cent of gross cropped area which accounts for nearly 3 per cent of the gross national product and 10 per cent of value of all agricultural products. These crops are grown under a wide range of agro-climatic conditions. Among the edible oilseeds crops, Rapeseed & mustard occupies an important position in Indian oilseeds scenario. Indian mustard is the most important member of the group, accounting for more than 70% of the area under rapeseed-mustard, followed by *toria*, yellow *sarson* and brown *sarson*. Rapeseed and mustard are the third most important edible oilseed crops of the world after soybean and oil palm. Rapeseed and mustard are grown in 53 countries of the world on 26.09 m ha area with a production of 46.84 m tonnes. India is the third largest rapeseed-mustard producer in the world after China and Canada with 12 per cent of world's total production. In India, it is grown in 26 states and union territories. Of the total production (5.08 m tonnes) of the country, Rajasthan, Uttar Pradesh and Haryana accounts for over 71 per cent.

This crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. Due to the gap between domestic availability and actual consumption of edible oils, India has to resort to import of edible oils. Rapeseed-mustard is the major source of income especially even to the marginal and small farmers in rain-fed areas. Since these crops are

cultivated mainly in the rain-fed and resource scarce regions of the country, their contribution to livelihood security of the small and marginal farmers in these regions is also very important. Due to its low water requirement (80-240 mm), rapeseed-mustard crops fit well in the rain-fed cropping system. Cultivated in 26 states in the northern and eastern plains of the country, about 6.8 m ha is occupied under these crops. Nearly 30.7% area under rapeseed mustard is under rain-fed farming.

Despite the high quality of oil and meal and also its wide adaptability for varied agro-climatic conditions, the area, production and yield of rapeseed-mustard in India have been fluctuating due to various biotic and abiotic stresses coupled with India's domestic price support programme. Nevertheless, the crop has potential to ensure the nutritional security and contribute to livelihood security. The highest productivity is in Gujarat (1396 kg/ha), Haryana (1343 kg/ha) and Rajasthan (1185 kg/ha) with overall national yield of 1151 kg/ha. In Faizabad district of Uttar Pradesh, the productivity of Mustard was 1156 kg/ha during 2011-2012. Mustard is an important food crop of the district and has been considered as productively potential region of mustard crop due to assured irrigation facilities and favourable soil and climate conditions. Though Mustard occupies important position in the district still a vast yield gap exists between potential yield and the yield obtained under real farming situation. This may be due to partial adoption of recommended package of practices by the mustard growers. Technology gap is a major problem in increasing mustard production in the region of the State. So far, not much systematic effort was made to study the technological gap existing in various components of mustard cultivation. With the available improved latest technologies, it is possible to bridge the yield gap and increase the existing production level up to certain extent. Keeping this in view, front line demonstrations were organized in participatory mode with the objective to analyze the yield gaps in mustard cultivation on the newly recommended package of practice.

Materials and Methods

The present study was carried out by Krishi Vigyan Kendra, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad during *Rabi* seasons from 2005-06 to 2008-09 (four consecutive years) in the farmers field of five adopted villages (Patupur, Dohari, Malethu Bujurg, Anjana and Madhupur) of Faizabad district. During this four year of study, in area of 32.0 ha was covered with plot size 0.4 ha under front-line demonstration with active participation of 80 farmers. Before conducting FLDs, a list of farmers was prepared from group meeting and specific skill training was given to the selected farmers regarding package of practices of mustard. The difference between demonstration package and existing farmers practices are given in Table 1.

Table 1: Comparison between demonstration packing and existing practices under mustard crop

S. No.	Particulars	Mustard Crop	
		Demonstration	**Farmers Practice**
1.	Farming situation	Irrigated	Irrigated
2.	Variety	NDR 8501	Varuna
3.	Time of sowing	October	Late of Oct. -Nov.
4.	Method of sowing	Line sowing	Broadcasting
5.	Seed treatment	Thiram @2.5 g/kg of seed	Without seed treatment
6.	Seed rate	4-6 kg/ha	6-8 kg/ha
7.	Thinning	15-20 DAS	No thinning practice
8.	Fertilizer dose	NPKS (120:40:40:25)	NPK (150:60:00:00)
9.	Irrigation	Requires 2 irrigations, first at branching stage (30 DAS) and the second at pod formation stage (60-65 DAS)	Irrigation applied not taken in account of critical stages
10.	Weed management	2 hand weedings at 25 and 40 DAS or application of pre-em herbicide pendimethalin @ 1.00 kg/ha. If the weeds	No weeding

		emerge after planting, isoproturon @ 0.75 kg/ha may be sprayed 30 days after sowing.	
11.	Plant protection	Approaches of Integrated pest and disease management for the management of pest and diseases.	Injudicious use of pesticides and fungicides
12.	Harvesting and threshing	Harvested as soon as the pods turn yellowish and moisture content of the seed is around 40%. Moisture content of the seed must be less than 8% at the storage time.	Harvested of over-matured crops causes shattering of grains. Not considered of seed moisture content at harvesting and storage.

The improved technology included modern high yielding varieties, seed treatment, timely sowing, line sowing, maintenance of optimum plant population, recommended fertilizer management, plant protection measures, etc. The sowing was done in the month of October. The spacing was 45x15-20 cm apart and the seed rate of mustard was 4-6 kg/ha. The fertilizers were given as per soil testing value; however, the average recommended dose of fertilizer applied in the demo plots was 100-120 kg N, 30-50 kg P_2O_5, 30-40 kg K_2O and 15-25 kg S per hectare. The NPK & S fertilizers were applied through urea, DAP, MOP & elemental S respectively. Half dose of N and full dose of P_2O_5, K_2O and elemental S were applied at the time of sowing and the remaining N was applied at first irrigation. Thinning and first hand weeding within lines was done at 15-25 DAS and second hand weeding was done at 45-50 DAS, if necessary. The crops were harvested at perfect maturity stage with suitable method.

In general the soils under study were silty loam in texture with a pH range of 6.8 to 7.5. The available nitrogen, phosphorous and potassium varied between 125-210, 16-32, 150-300 Kg/ha, respectively. However, the soils were deficient in other macro & micro nutrients particularly sulphur, zinc and ferrous. In demonstration plots, critical inputs in the form of quality seeds of improved varieties, timely weeding, need based of pesticides as well as balanced fertilization, irrigation at critical stages were emphasized by the KVK and comparison has been made with the existing practices (Table 1). The necessary step for the selection of site and farmers, lay out of demonstration, etc. were followed as suggested by Chaudhary (1999) [1]. The traditional practices were maintained in case of local check. The data output were collected from both FLD plots as well as control plot and finally the extension gap, technology gap, technology index along with the benefit-cost ratio were calculated as suggested by Samui *et al.* (2000) [7].

Technology gap = Potential yield - Demonstration yield
Extension gap = Demonstration yield - Farmers yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

Results and Discussion

The data showed in Table 2 that the yield of mustard fluctuated successively over the years in demonstration plot. The maximum yield was reported (18.56 q/ha) during the year 2008-09 and minimum yield was reported in the year 2007-08 (16.25 q/ha) and the average yield of four year was reported 17.59 q/ha over farmer's practice (14.04 q/ha). During four years of study, the per cent increase over farmer's practice was ranging between 17.75 to 36.73. On an average, there was 50.8 per cent increase in yield under FLD plots over farmers' practices followed for cultivation of Mustard. The results are similar with the findings of Tomer *et al.* (2003) [10], Tiwari and Saxena (2001) [8] and Tiwari *et al.* (2003) [9]. The data indicated that the positive effect of front line demonstration over the existing practices towards

increasing the yield of mustard in Faizabad district of Uttar Pradesh.

During the period of study emphasis the need to educate the farmers through various techniques for adoption of improved agricultural production reverse the trend of wide extension gap. An extension gap between demonstrated technology and farmers practices ranges from 2.45 to 4.72 q/ha during different four years and on average basis the extension gap was 3.55 q/ha (Table 2). This gap might be attributed to adoption of improved technology in demonstrations which resulted in higher grain yield than the traditional farmers' practices. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and to adopt new technology (Table 2). The findings were in line with the findings of Goswami *et al.* (1996) [2] and Hiremath and Nagaraju, (2010) [3].

Wide technology gap were observed during different years and this was lowest (3.44 q/ha) during 2008-09 and was highest (5.75 q/ha) during 2007-08. The average technology gap found was 4.40 q/ha. The difference in technology gap during different years could be due to more feasibility of recommended technologies during different years. Technology gap imply researchable issues for realization of potential yield, while the extension gap imply what can be achieved by the transfer of existing technologies. Similarly, the technology index for all the demonstrations during different years were in accordance with technology gap. Higher technology index reflected the inadequate proven technology for transferring to farmers and insufficient extension services for transfer of technology. The technology index shows the feasibility of the evolved technology at the farmer's fields and the lower the value of technology index more is the feasibility of the technology. The results were in conformity with the findings of Jeengar, *et al*. 2006 [4] and Mitra and Samajdar (2010) [6]. The probable reason that could be attributed to the high feasibility of mustard production technology was that the participant farmers were given opportunity to interact with the scientist and they were made to adopt recommended practices and skills during the process of demonstration.

Different variables like seed, fertilizers, labourers and pesticides were considered as critical inputs for the demonstrations as well as farmers practice. The inputs and outputs prices of commodities prevailed during the study of demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio (Table 3). Economic returns as a function of grain yield and MSP sale price varied during different years. Maximum returns (Rs. 56,608/- ha) during the year 2008-09 was obtained due to higher grain yield and MSP sale rates as declared by Government of India. The higher additional returns and effective gain obtained under demonstrations could be due to improved technology, nonmonetary factors, timely operations of crop cultivation and scientific monitoring. The highest benefit: cost ratio (BCR) was 2.61 during the year 2007-08 might be due to higher MSP sale rate declared by Government of India. It depends on grain yield and MSP. Overall average BCR was found to be 2.45:1 among the demonstrated plots. The results confirm the findings of frontline demonstrations on oilseed and pulse crops by Yadav *et al.* (2004) [11] and Lathwal (2010) [5].

It was thus, concluded that the use of scientific method of Mustard cultivation can reduce the technological gap to a considerable extent thus leading to increase productivity of mustard in Faizabad districts of Uttar Pradesh. On the basis of the result obtained in present study it can be concluded that use of improved method of mustard cultivation can reduced the technology gap to a considerable extent thus leading to increase productivity of mustard in the district. Extension gap ranged between 2.45 to 4.72 q/ha which emphasis the need to educate the farmers through various means like village level training, on campus training, method demonstration, front line demonstration, etc. Technology index which shows the feasibility of the technology demonstrated has depicted good performance of the intervention. The farmers where improved

technology was demonstrated also acted as primary source of information for other farmers on the improved practices of mustard cultivation and also acted as source of good quality pure seeds in their locality for the next crop. The concept of 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.

Table 2: Grain yield and gap analysis of front line demonstrations on mustard crop (var NDR 8501) at farmers field

Year	Area (ha)	No. of farmers	Seed yield (q/ha)		Increase (%)	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
			Demon.	Control				
2005-06	6.0	15	18.0	14.70	22.45	4.00	3.30	18.18
2006-07	6.0	15	17.57	12.85	36.73	4.43	4.72	20.14
2007-08	10.0	25	16.25	13.80	17.75	5.75	2.45	26.13
2008-09	10.0	25	18.56	14.83	25.15	3.44	3.73	15.64
Total/Average	32.0	80	17.59	14.04	25.52	4.40	3.55	20.02

Table 3: Gross return (Rs./ha), Cost of cultivation (Rs./ha), net return (Rs./ha) and B:C ratio as affected by improved and local Technologies

Year	Gross return		Cost of cultivation		Net Return		B: C ratio	
	Improved technologies	Farmer's practices	Improved technologies	Farmer's practices	Improved technologies	Farmer's practices	Improved technologies	Farmer's practices
2005-06	33300	27195	14025	12827	19275	14368	2.37	2.12
2006-07	43925	32125	16875	15210	27050	16915	2.60	2.11
2007-08	48750	41400	18700	17237	30050	24163	2.61	2.40
2008-09	56608	45231	25455	23420	31153	21811	2.22	1.93
Average	45646	36488	18764	17173	26882	19314	2.45	2.14

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