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An assessment of frontline demonstrations on rapeseed in southeastern Punjab

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ABSTRACT

The productivity of mustard in India is quite low owing to adoption gaps in recommended technologies and application of critical inputs. Farmers grow non-canola local varieties with lower seed rate, delayed sowing, low plant population, improper nutrient management and inadequate plant protection in Patiala district of Punjab. It is imperative to demonstrate high yielding mustard varieties with resistance against biotic and abiotic stresses to increase the overall production and productivity under close supervision of the scientists. Frontline demonstration is the long-term educational activity conducted by agricultural scientists in a systematic manner on farmers' fields to show the worth of new practice/technology under the micro-farming situation. Krishi Vigyan Kendra, Patiala, Punjab conducted frontline demonstrations (FLDs) during rabi 2019-20 to 2022-23 with improved technologies including better variety (GSC 7), optimum seed rate and spacing, line sowing, soil test-based nutrient management and need-based plant protection to show the productivity potential and profitability under farmers' situations and to collect feedback information for further improvement in research and extension programmes. The results obtained from four years' data revealed that average yield of mustard varieties under FLDs was 1,784.5 kg per ha as against 1,689 kg per ha observed under farmers' practice, thereby, recording an average yield increase of 5.71per cent under FLDs as compared to farmers' practice. Moreover, during the four year period, higher average gross return was recorded in demonstration plots (71,998.75/ha) as compared to farmers' practice (68,182/ha).

Keywords: Rapeseed; FLDs; extension gap; canola; B-C ratio

INTRODUCTION

Rapeseed-mustard is the third most significant group of oilseed crops with Gobhi Sarson as the most important crop of rapeseed group. Oilseed crops play an important role in the agrarian economy of India. The oil content in the rapeseed-mustard varies from 36-39 per cent (Yadav et al 2013).

Being the crop with low water requirement, rapeseed-mustard fits well in the traditional cropping pattern of rice-wheat. Additionally, low cost of production of rapeseed-mustard fetches higher return in the market and has potential to meet the domestic production of edible oils of the country. Among conventional rapeseed varieties, the presence of erucic acid (about 50%) and glucosinolates (>100 ìmoles/g defatted seed meal) is considered undesirable. Erucic acid is feared to cause the human health problems and high glucosinolates in the oil cake are anti-nutritional for animal feed.

Canola oil has the lowest level of saturated and highest level of mono- and poly-unsaturated fatty acids which are nutritionally desirable for human health. Canola is only a quality standard and not a classification based on biological attributes. It is a registered trade mark of Canadian Oil Association which denotes the seeds having less than 2 per cent erucic acid in its oil and less than 30 micromoles of glucosinolates per gram of its de-oiled meal, making it suitable for human health as well as animal feed. Canola cultivars of oilseed rape (*Brassica napus*) have been recently developed by the Punjab Agricultural University, Ludhiana, Punjab. These cultivars have comparable yields with non-canola rapeseed-mustard and are resistant to white rust (Kaur et al 2018). In past few years, the concept of canola oil in rapeseed mustard has gained importance. The best way to increase the productivity of mustard is by improving crops' nutrition through right methods and time of sowing, adoption of appropriate cultivars and proper disease and pest management (Hashimoto and Kameoka 1985). Frontline demonstration (FLD) is an efficient approach for reducing gap between potential yield and farmers' yield, dissemination of technology, generation of primary data and collection of feedback for subsequent use in the process of large scale adoption of technology in farmers' fields under different agro-ecological and farming situations. This paper captures the productivity potentials by evaluating yield gap and economic profitability of improved rapeseed-mustard production technologies under FLDs in Punjab.

MATERIAL and METHODS

The study was carried out in operational area of Krishi Vigyan Kendra, Patiala, Punjab located in southeastern part of Punjab that lies between 29°49' and 30°47' North latitude and 75°58' and 76°54' East longitude. During rabi 2019-20, 2020-21, 2021-22 and 2022-23, fifty FLDs each were conducted with improved technologies. Before conducting FLDs, farmers were selected on the basis of their knowledge level. Also, the gaps in adoption of recommended technology were found out through personal interview of farmers selected for demonstrations. The selected farmers were guided to raise the Gobhi Sarson crop as per recommendations of the Punjab Agricultural University, Ludhiana, Punjab (Table 1).

All the critical inputs, including seed of canola Gobhi Sarson variety GSC 7 and recommended pesticides were provided by KVK, Patiala, Punjab. Each demonstration plot was laid out in 0.40 ha for comparison with farmers' practice plots. Soils from each demonstration plot were collected and analysed for pH, EC, OC and available P and K. Among all demonstrations, the soil texture was loamy sand to loam. However, the soil was medium in OC and available P and high in available K at the entire demonstration site. The improved technology in the frontline demonstrations included introduction of latest canola varieties, recommended package of practices including maintenance of optimum plant population and plant protection measures.

During study period, sowing was done between 10 October and 30 October with 3.75 kg seed per ha and 45 cm row to row spacing. Whole N, P and K was applied according to soil test results. To realize the integrated approach of demonstrations, regular monitoring visits to demonstration plots were conducted by the KVK scientists. Valuable feedback was also taken from farmers to bring further refinement in research and extension programmes. Apart from this, various other extension activities like training programmes, exhibitions, group meetings and field days were organized at the demonstration sites to create awareness among the farming community about the advantages of demonstrated technologies. Different parameters were calculated to find out technology gaps (Yadav et al 2004). Recommended weed control measures were taken up and irrigation was given according to the requirement of the crop. The crop was harvested at perfect maturity and yield data were collected. Gross return was estimated based on the prevailing market prices and the yield obtained by the farmers during the four years. For obtaining input cost, the sum of expenditure on land preparation, planting method, fertilizer, insecticide, fungicide, herbicide, irrigation, labour, harvesting cost etc was calculated from each plot. The return over variable cost and benefit-cost ratio were calculated from these data. To estimate the technology gap, extension gap and technology index, following formulae as suggested by Samui et al (2000) were used:

Extension gap = Demonstration yield – Farmers' practice yield

Technology gap= Potential yield – Demonstration yield

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

RESULTS and DISCUSSION

Seed yield: A comparison of yield performance between demonstrated practices and local checks is shown in Table 2. It was observed that during 2019-20, improved technology gave higher seed yield (1,657 kg/ha) as compared to farmers' practice (FP) plots (1,544 kg/ha). The increase in the yield over FP plots was 7.32 per cent. Similar results were obtained in 2020-21, 2021-22 and 2022-23 with improved technology. The FLD plots gave 7.32, 6.0, 5.14 and 4.40 per cent higher seed yield during 2019-20, 2020-21, 2021-22 and 2022-23 respectively as compared to FP plots. The FLD plots recorded higher mean seed yield (1,784.5 kg/ha) as compared to FP plots (1,689 kg/ha). The average increase in seed yield in demonstration plots was 5.71 per cent higher than FP for the four years. Similar yield enhancement in different crops in frontline demonstration has been documented by Ajrawat et al (2013). Meena et al (2012) reported increase in yield under improved practices over farmer's practice. These results are also in conformity with the findings of other workers (Singh et al 2007, Katare et al 2011, Singh et al 2011, Dhaliwal et al 2018).

Technology gap: The technology gap is the difference between the demonstration yield and potential yield. The technology gap was recorded 113, 101, 89 and 79 kg per ha during 2019-20, 2020-21, 2021-22 and 2022-23 respectively (Table 2). Technology gap was lower due to higher yield obtained under demonstrations. The average technology gap of mustard was 95.5 kg per ha during all four years. This gap might be due to the variation in soil fertility status. Mitra and Samajdar (2010) have also recorded extension and technology gaps in the technology that could be managed through specific interventions to increase the productivity of the technology.

Extension gap: The extension gap is the difference or gap between the demonstration yield and farmers' yield. The average extension gap of years was found to be 440.5 kg per ha. Extension gap was 568, 440, 404 and 350 kg per ha in 2019-20, 2020-21, 2021-22 and 2022-23 respectively (Table 2). The higher yield in FLDs over farmer's practice may be attributed to various factors including adoption of full package of practices viz timely sowing, application of balanced dose of fertilizers (N and P), weed management and need-based plant protection measures. However, lesser yield in farmer's practice over FLDs might be due to the use of local or old varieties as compared to recommended high yielding varieties. Extension gap showed the need of education of farmers about adoption of improved production technology in Gobhi Sarson. Extension gap is the indicator of lack of awareness about improved and recommended farm technologies by the farmers (Kadian et al 1997, Vedna et al 2007). On the basis of these gaps, more number of extension programmes were scheduled for the next year. There was a need to decrease this wider extension gap through implementation of latest techniques.

Technology index: The technology index shows the feasibility of new technology on the farmers' fields and the lower the value of technology index, more is the feasibility of the technology. The average technology index was 19.80 per cent in Patiala district during the study period (Table 2). The study showed that there was a lot of scope for improvement in production and productivity of oilseed crop in the district.

Economic return: The economics of Gobhi Sarson production under frontline demonstrations has been presented in Table 3. During the four year period, higher average gross return was recorded in demonstration plots (Rs 71,998.75/ha) as compared to FP plots (Rs 68,182/ha). During 2019-20 improved technology gave higher gross return (Rs 61,309/ha) compared to FP (Rs 57,128/ha). Similar results were obtained during 2020-21, 2021-22 and 2022-23 where demonstrations gave higher gross return in comparison to FP plots due to higher grain yield obtained. The average return over variable cost was also higher under demonstration plots (Rs 42,987.5/ha) as compared to check plots (Rs 37,960.75/ha). Higher net return among demonstrations could be due to higher grain yield obtained and lower cost of cultivation as compared to FP plots. Ajrawat et al (2013) and Sandhu and Dhaliwal (2015) also reported similar results. They observed that average additional gain in demonstration plots was Rs 19,480 per ha. A similar finding of higher net return from demonstration plots was also reported by Meena and Dudi (2018). The benefit-cost ratio during 2019-20 was 1.14:1 in demonstration plots as compared to FP plots (1.02:1). During 2020-21, 2021-22 and 2022-

Table 1. Details of the practices followed for cultivation of Gobhi Sarson under frontline demonstrations and farmers' practice

Component	Demonstration plots	Farmer's practice
Variety	GSC-7	Unrecommended local
Seed rate (kg/ha)	3.75	5.25
Spacing	45 cm × 10 cm	Row to row – 30 cm
Time of sowing	10-30 October	November
Fertilizer dose	Urea 225 kg/ha, SSP 187.5 kg/ha	Urea, no use of SSP
Weed management	One or two hoeings	Use of isoproturon 75 WP @ 1/ha
Plant protection measures	Spray of Actara 25 WG 100 g/ha	Application of unrecommended and over-doses of insecticides and fungicides

Table 2. Yield, technology gap, extension gap and technology index of rapeseed in Patiala district of Punjab

Year	Demonstrations		Yield (kg/ha)			Per cent increase over check	Technology gap (kg/ha)	Extension gap (kg/ha)	Technology index (%)
	Variety	Number	Potential	Demonstrations	Farmers' practice				
2019-20	GSC-7	10	2,225	1,657	1,544	7.32	113	568	25.53
2020-21	GSC-7	50	2,225	1,785	1,684	6.00	101	440	19.78
2021-22	GSC-7	50	2,225	1,821	1,732	5.14	89	404	18.16
2022-23	GSC-7	50	2,225	1,875	1,796	4.40	79	350	15.73
Mean			2,225	1,784.5	1,689	5.71	95.5	440.5	19.80

Table 3. Return over variable costs and B-C ratio of rapeseed in Patiala district of Punjab

Year	Gross return (Rs)		Cost of cultivation (Rs)		Net return (Rs)		B-C ratio	
	Demonstrations	Farmers' practice	Demonstrations	Farmers' practice	Demonstrations	Farmers' practice	Demonstrations	Farmers' practice
2019-20	61,309	57,128	28,700	28,900	32,609	28,228	1.14	1.02
2020-21	71,400	67,360	28,800	29,200	42,600	38,160	1.48	0.77
2021-22	74,661	71,012	29,000	31,000	45,661	40,012	1.57	0.77
2022-23	80,625	77,228	29,545	31,785	51,080	45,443	1.73	0.70
Mean	71,998.75	68,182	29,011.25	30,221.25	42,987.5	37,960.75	1.48	0.82

23, B-C ratio of 1.48:1,1.57:1 and 1.73:1 respectively was obtained. Similarly, average across years indicated that the demonstration plots gave higher (1.48:1) B-C ratio as compared to farmers practice (0.82:1).

The findings of the study revealed that gap existed in yields of FLD plots and FP plots due to technology and extension gaps. The increase in yield of rapeseed to the extent of 5.71 per cent in FLDs over the farmers' practice created greater awareness and motivated other farmers to adopt the improved package of practices of Gobhi Sarson. The recipient farmers of FLDs also played an important role as a source of information and quality seeds for further dissemination of the improved varieties of oilseed crop to the fellow farmers. Improved technology performed better in terms of yield and economics as compared to farmers' practice. These technologies have to be up-scaled by involving all the stakeholders in the district.

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