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RESEARCH PAPER

Field evaluation of productivity of gobhi sarson (*Brassica napus*) under cluster frontline demonstrations in Faridkot district of South-western Punjab

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Abstract : One hundred fifty three front line demonstrations (FLDs) were conducted on farmers' fields to demonstrate the effect of improved technologies on the productivity of canola type gobhi sarson var. GSC-7 using cluster approach in district Faridkot of Punjab during *Rabi* 2016-17 and 2017-18. The productivity of gobhi sarson under demonstration plots ranged between 19.2 to 20.4 q and 19.9 to 20.8 q/ha, respectively, for year 2016-17 and 2017-18, whereas, under farmers' practice, the productivity varied from 14.1 to 14.2 q and 16.6 to 17.1 q/ha for the respective years. The maximum value of extension gap to the tune of 5.10 q/ha was recorded in cluster IV followed by cluster III and V (4.75 q/ha), cluster II (4.65 q/ha) and the least was in cluster I (4.10 q/ha). The technology gap in the demonstration plots over potential yield was the lowest *i.e.* 1.80 q/ha in cluster IV, whereas, the highest technology gap was recorded in cluster I (2.70q/ha). The technology index was 8.09 per cent for cluster IV and the highest (12.13%) for cluster I while the mean technology index was 9.48 per cent. The value of net returns per ha under demonstration plots was Rs. 71594 and Rs. 72170, whereas, farmers' practice gave net returns per ha of Rs. 40626 and Rs. 52626 for the year 2016-17 and 2017-18, respectively. The benefit: Cost ratio varied between 3.76 to 4.05 for 2016-17 and 3.73 to 4.04 for 2017-18 under demonstration plots while the value of same under farmers' practice varied between 2.46 to 2.55 and 2.80 to 2.93, respectively, for year 2016-17 and 2017-18.

Key Words : Front line demonstration, Canola gobhi sarson, Economic evaluation

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INTRODUCTION

India occupies a prominent place in global oilseed scenario with 12-15 per cent of area, 6-7 per cent of vegetable oil production and 9-10 per cent of the total edible oil consumption and 13.6 per cent of vegetable oil imports (Kumar, 2017). Oilseed crops are the second most important determinant of agricultural economy, next to cereals only. India is the 5th largest vegetable oil economy in the world next to USA, China, Brazil and Argentina accounting for 5.8 per cent vegetable oil

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production (Anonymous, 2015). However, the domestic production of oilseeds is still insufficient to meet the edible oil demand in the country and more than 50 per cent of domestic edible oil demand is being met through costly imports. India imported about 11.06 million ton of edible oil in 2013-14 (Kumar, 2017). Oil seeds are rich source of fat and edible oils, have various uses for human being and animals. About 90 per cent of the total edible oil produced in the country comes from two oilseed crops namely rapeseed-mustard and groundnut. The oil cakes are used as cattle feed and manures.

In India, rapeseed and mustard is an important source of edible oil followed by ground nut (Panday *et al.*,1999). They are cultivated on 5.791 m ha in a wide range of agro- ecological conditions in India, resulting in the production of 7.87 m tones of seed mustard in 2013-2014 and our productivity was 13.04 q/ha (Anonymous, 2015).

During 2017, Punjab witnessed a considerable increase in area under cultivation of rapeseed and mustard. The area under rapeseed and mustard has increased from 32,000 hectares to 42,000 hectares during the year which is an increase of around 31 per cent over last year. The programme "Technological Mission on Oilseeds" has made tremendous progress in oilseed production, but still there remain gaps between production potential of oilseed crops and its performance on farmers' field. The oilseed crops are generally cultivated on marginal lands having low soil fertility and under rainfed conditions. Moreover, faulty agronomic practices, selection of unsuitable variety, injudicious nutrient and irrigation management etc. are responsible for low productivity of oilseed crops in India. The available agricultural production technology does not serve the very purpose until it reaches and adopted by its ultimate users, the farmers. The extent of adoption of improved agricultural technologies is a crucial aspect under innovation diffusion process and the most important for enhancing agricultural production at a faster rate. Large numbers of technologies evolved in the field of agriculture are not being accepted and adopted to its fullest extent by the farmers. The gap between recommendations made by the scientists and actual use by farmers is frequently encountered. To address these challenges, there is dire need to transfer the effective farm technology to the end users for wider adoption among farmers to raise their productivity, farm gains and livelihood (Choudhary *et al*., 2009).

The front line demonstration programme in oilseeds, a noble outcome of "Technological Mission on Oilseeds" may prove an effective tool to demonstrate newly released crop production and protection technologies and its management practices in the farmers' fields. Keeping this in view, cluster frontline demonstrations on gobhi sarson (canola) were conducted to demonstrate not only the production potential of canola sarson based intervention, but also to encourage the farmers to diversify the farming to enhance monetary benefits for sustainable livelihood.

MATERIAL AND METHODS

One hundred fifty three Front Line Demonstrations (FLDs) were conducted on farmers' fields to demonstrate the effect of high yielding varieties, sole crop drill sowing and fertilizer application on the productivity of gobhi sarson canola var GSC-7. The demonstrations were conducted under irrigated conditions in five clusters of two blocks *i.e.* Faridkot and Kotkapura blocks in district Faridkot of Punjab during *Rabi* 2016-17 and 2017-18. The soils of the farmers' fields were sandy loam to loamy sand in texture, neutral to slightly alkaline in reaction

Table A : Comparison between demonstration package and existing farmers' practices in gobhi sarson (canola)

Particulars	Demonstration package	Farmers' practice
Farming situation	Irrigated/ medium soil	Irrigated/ medium soil
Varieties	Recommended variety of PAU (GSC 7)	local
Time of sowing	10-30th October	End of November- December
Seed rate (kg/ha)	3.75 kg	2.0 kg
Sowing method	Drill at 45 cm row to row spacing	Broadcast/Drill
Fertilizer application	As per recommendations of PAU or on soil test based (Urea@225 kg/ha in two splits along with drilling of SSP @ 187.5 kg/ha at the time os sowing	Urea (60-75 kg/ha)
Plant protection	Need-based use of recommended pesticides	Blanket sprays of chemicals for insect pest management

with medium soil organic carbon, medium to high in phosphorus and high in potassium. Each demonstration was conducted on an area of 0.2-0.3 ha and adjacent plot (0.1-0.2 ha) to the demonstration plot was kept for assigning farmers' practices. The crop was sown during second fortnight of October in 45 cm wide lines. The practices adopted for front line demonstrations and farmers' practice are given in Table A.

For conducting the front line demonstrations, the farmers were identified/ selected through proper survey of the area as suggested by Choudhary (1999). Regular visits by the KVK scientists to demonstration fields were ensured and made to guide the farmers. The critical inputs were duly supplied to the farmers by the KVK. Field days and group meetings were also organized at the demonstration sites to provide the opportunities to other farmers to witness the benefits of demonstrated technologies. Yield data were collected from control (Farmer's practice) and demonstration plots and net returns and Benefit: Cost ratio were computed and analyzed. The Extension gap, Technology gap and Technology index were calculated using the formula as suggested by Samui *et al*. (2000).

Extension gap (q/ha) = Demonstration yield (q/ha)- Farmer's yield (q/ha)

Technology gap (q/ha)= Potential yield (q/ha)- Demonstration yield (q/ha)

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

$$\text{Increase in yield (\%)} = \frac{\text{(Demonstration yield} - \text{Farmer's yield)}}{\text{Farmer's yield}} \times 100$$

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Seed yield:

The productivity of gobhi sarson (canola) under improved production technology ranged between 19.2 to 20.4 q/ha and 19.9 to 20.8 q/ha during year 2016-17 and 2017-18, respectively, whereas, under farmers' practice, the seed yield varied from 14.1 to 14.2 q/ha and 16.6 to 17.1 q/ ha for the year 2016-17 and 2017-18, respectively (Table 1). The data advocated that over the clusters, cluster IV in Kotkapura block of the district Faridkot produced the highest average yield (20.45q/ha) under technology demonstrated which was 33.22 per cent higher than farmers' practice (15.35 q/ha) in the cluster

Table 1 : Productivity of gobhi sarson (*Brassica napus*) under cluster front line demonstrations

Cluster	Block	Demonstration plot (q/ha)			Farmer's practice (q/ha)			Extension gap (q/ha)	Technology gap (q/ha)	Technology Index (%)	Increase in yield (%)	Demonstration (Nos.)		Area (ha)	
		2016-17	2017-18	Pooled yield	2016-17	2017-18	Pooled yield					2016-17	2017-18	2016-17	2017-18
I	Faridkot	19.2	19.9	19.55	14.2	16.7	15.45	4.10	2.70	12.13	26.54	13	35	2.8	8.4
II	Faridkot	20.1	20.4	20.25	14.1	17.1	15.6	4.65	2.00	8.99	29.81	17	28	2.6	5.3
III	Faridkot	20.4	20.1	20.25	14.1	16.9	15.5	4.75	2.00	8.99	30.65	13	18	2.7	5.5
IV	Kotkapura	20.1	20.8	20.45	14.1	16.6	15.35	5.10	1.80	8.09	33.22	17	04	2.7	0.4
V	Kotkapura	20.1	20.3	20.2	14.1	16.8	15.45	4.75	2.05	9.21	30.74	04	04	1.2	0.4
	Average	19.98	20.30	20.14	14.12	16.82	15.47	4.67	2.11	9.48	30.19	64	89	12.0	20.0

Table 2: Economic performances of cluster front line demonstrations

Cluster	Demonstration plot								Farmer's plot							
	Gross cost (Rs.)		Gross returns (Rs.)		Net returns (Rs.)		B:C ratio		Gross cost (Rs.)		Gross returns (Rs.)		Net returns (Rs.)		B:C ratio	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
I	24500	25600	92160	95520	67660	69920	3.76	3.73	26750	27850	68160	80160	41410	52310	2.55	2.88
II	24500	24250	96480	97920	71980	73670	3.94	4.04	26500	28000	67680	82080	41180	54080	2.55	2.93
III	24250	25500	97920	96480	73670	70980	4.04	3.78	27500	27700	67680	81120	40180	53420	2.46	2.93
IV	23800	25500	96480	99840	72680	74340	4.05	3.92	27500	28500	67680	79680	40180	51180	2.46	2.80
V	24500	25500	96480	97440	71980	71940	3.94	3.82	27500	28500	67680	80640	40180	52140	2.46	2.83
Average	24310	25270	95904	97440	71594	72170	3.95	3.86	27150	28110	67776	80736	40626	52626	2.50	2.87

IV. It may be attributed to the fact that there is a niche for oilseed production due to improved soil health and adoption of site specific improved management practices. Higher weed infestation under farmers' practice as evident from the higher weed cover and reduced supply of nutrients and water under farmers' practice led to lower yield. The results corroborate with the findings of Imoloame *et al.* (2007) who reported the superiority of row planting over broadcasting to control weeds, which resulted in considerable yield increase. Moreover, Prasad *et al.* (2018) reported that the yield of the crop decreased with delay in sowing due to shortening of phenophases caused by higher temperatures that prevailed at seed filling and maturity phase, as, the same was observed under farmers' practice.

Extension gap:

The data in Table 1 purported that the highest extension gap of 5.10 q/ha was recorded in cluster IV. The extension gap was at par with cluster III and V *i.e.* 4.75 q/ha. It was 4.65 q/ha in cluster II and the least in cluster I (4.10q/ha). This might be attributed to adoption of improved technology practices such as proper seed rate, nutrient management, weed control and pest management etc. in demonstrated plots. This emphasized the need to motivate the farmers for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. The new technologies will eventually encourage the farmers to discontinue the old technology and to adopt new technology (Hiremath and Nagaraju, 2010).

Technology gap :

The technology gap was the lowest *i.e.* 1.8 q/ha in cluster IV (Table 1), whereas, the highest technology gap was recorded in cluster I (2.7q/ha). The technology gap was observed at par in cluster II and III. The technological gap may be attributed to the heterogeneity of the soil fertility status and weather conditions (Mukherjee, 2003).

Technology index:

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 (Jeengar *et al.*, 2006). The technology index was recorded 8.09 per cent for cluster IV, 8.99 for II and III, 9.21 for V and the highest (12.13%) for cluster I while the mean technology index was 9.48 (Table 1). As such variations in technology index may be attributed to variation in soil fertility status, non- availability of quality irrigation water, weed infestation and pest – disease attack in different clusters during period of study. Similar results were also recorded by Anuj *et al*. (2014) in different oilseeds crops.

Economic performance:

The economic analysis of CFLDs is presented in Table 2. The data reported that the technology demonstrated gave average gross returns to the tune of Rs. 95904/ha and Rs. 97440/ha for the year 2016-17 and 2017-18, respectively, whereas under farmers' practice, the average gross returns/ha were Rs. 67776 and Rs. 80736, respectively, for the year 2016-17 and 2017-18. The data revealed the highest net returns/ ha to the tune of Rs. 73670 (2016-17) in cluster III and Rs. 74340 (2017-18) in cluster IV. The average values of net returns per ha under demonstration plots were Rs.71594 and Rs.72170 while under farmers' practice, net returns per ha were Rs. 40626 and Rs. 52626 for the year 2016-17 and 2017-18, respectively. The value of benefit: cost ratio ranged from 3.76 to 4.05 for 2016-17 and 3.73 to 4.04 for 2017-18 under demonstration plots while the value of same varied between 2.46 to 2.55 and 2.80 to 2.93 for year 2016-17 and 2017-18, respectively. The higher monetary benefits under demonstration plots over farmers' practice may prove the worth of improved technological interventions. These results were in line as reported by Balai *et al.* (2012).

Table 3 : Cluster wise analysis of soil properties under cluster front line demonstration

Cluster	pH	EC (dsm^{-1})	OC (%)	P_2O_5 (kg/ha)	K_2O (kg/ha)
I	8.15-8.21	0.45-0.57	0.38-0.42	13.2-14.5	135-261
II	7.85-8.05	0.24-0.37	0.44-0.65	17.4-20.5	185.7-223.8
III	7.80-8.13	0.35-0.65	0.42-0.55	15.2-17.5	152.2-184.5
IV	7.95-8.11	0.15-0.24	0.47-0.68	18.2-22.2	215.2-314.7
V	8.01-8.12	0.35-0.48	0.41-0.62	18.0-19.5	205.2-300.1

Productivity of gobhi sarson canola as affected by soil fertility:

The highest yield of gobhi sarson was observed in cluster IV (20.45 q/ha) in demonstration plots. This increase in yield may be attributed to the fact that clusters IV had well drained loamy soils with higher organic carbon content (Table 3) in comparison to cluster I leading to improvement in yield.

As under demonstrations, crop was fertilized with P_2O_5, ample supply of phosphorus in soil provided a congenial environment in rhizosphere for mineralization, resulting in increased availability of nitrogen and phosphorus leading to enhanced yield in demonstration plots over farmer's practice. Kapila *et al.* (2012) reported an increase in seed yield of mustard due to increased availability of nutrients.

Conclusion:

It was observed that improper land preparation, delayed sowing, selection of unrecommneded seeds, indiscriminate use of fertilizers and pesticides are the factors restricting to tap the potential of improved variety. Non existing application of balanced fertilizer, particularly S, leading to poor productivity. This results in a big gap between requirement and production of oilseeds in India. Therefore, optimum crop geometry, intercultural operations, inclusion of organic manures, integrated approach to plant-water, nutrient and pest management and extension of rapeseed-mustard cultivation to interior areas under different cropping systems will play a key role in further increasing and stabilizing the productivity and production of rapeseed-mustard in the district. The front line demonstrations prove an effective tool to motivate the masses to adopt the improved package of practices of gobhi sarson.

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