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Impact of Cluster Frontline Demonstrations on Yield and Net Returns of Gobhi Sarson (Canola) in district Sangrur of Punjab

Sunil Kashyap[1*] and Mandeep Singh[2]

[1]Plant Pathologist, Punjab Agricultural University, Regional Research Station, Gurdaspur, (Punjab), India.
[2]Associate Director (Trg), Krishi Vigyan Kendra, Sangrur, (Punjab), India.

(Corresponding author: Sunil Kashyap)*
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ABSTRACT: The concept of frontline demonstration (FLDs) creates direct interface between scientists and farmers, in which innovative technologies are demonstrated at farmer's fields and in turn feedback is received. Most often farmers lack in scientific knowledge of new production and protection technologies at field level. Thus, FLDs provide an excellent opportunity to demonstrate the modern practices at their fields to bridge the gap between recommended and farmer practice. The present study was carried out by Krishi Vigyan Kendra, in the different villages of district Sangrur during 2015-16 to 2017-18. A total of 130 frontline demonstrations were conducted on gobhi sarson in 40-hectare area at farmers' fields. The modern crop production and protection technologies with improved high yielding variety (GSC 7 canola type), proper spacing, irrigation, method of sowing, weed management and timely management of plant protection measures on the basis of economic threshold level of pests were demonstrated to farmers' to achieve potential productivity and net returns. It was revealed that the FLD plot recorded higher yield as compared to farmer's practice. The mean increase in yield of demonstrated plots was found to be higher (17.10%) over the farmer's practice (16.72%). The technology gap in the demonstrated yield over potential yield was recorded to be 3.53, 3.77 and 0.75 q/ha during 2015-16, 2016-17 and 2017-18. The improved technologies ended up with higher gross returns (Rs.77104/ ha), net returns (Rs 51261/ha) as well as higher benefit-cost ratio (11.75) as compared to farmer's practice. Hence, the study clearly showed that the positive effects of FLDs over the farmer practice.

Keywords*:* Impact, Frontline demonstrations, Gobhi sarson, Technology gap, Net returns.

INTRODUCTION

Rapeseed (*Toria, Gobhi sarson and Taramira*) and Mustard (*Raya and African sarson*) are important *Rabi* oilseeds (Anonymous 2021-22); that belongs to family Cruciferae and genus Brassica. Mustard seed is the world's second leading source of vegetable oil, after soybean (Ghintala *et al.,* 2018). The total oilseeds production of our country accounts for 13% of the Gross Cropped Area, 3% of the Gross National Product and 10% value of all agricultural commodities. Although, India is a major producer of oilseeds but per capita oil consumption in India is only 10.6 kg/annum which is low as compared to 12.5 kg/annum in China, 20.8 kg/annum in Japan, 21.3 kg/annum in Brazil (Anonymous, 2018-19). Rapeseed and mustard were grown on 31.0 thousand hectares area with total production of 46.5 thousand tonnes and an average yield of 14.82 quintals per hectare in Punjab during 2019-20 (Anonymous, 2021-22).

In early 1970s, the "canola", oil a registered trade mark was introduced in India from Europe. Canola gobhi sarson (*Brassica napus* L.) is an improved version of rapeseed and is low in both erucic acid (less than 2%) and glucosinolates (30 micro moles/g) which distinguish it from ordinary rapeseed. Besides, it has the lowest level of saturated and highest level of mono and poly-unsaturated fatty acids, which reduces cholesterol level. The oil rich in erucic acid is not desirable for edible purposes as it causes thickening of arteries and leads to heart problems. The canola oil is very healthy for human consumption. Therefore, canola type varieties of gobhi sarson like GSC 7 are becoming popular amongst farmers in Punjab (Singh and Gill, 2012).

With an objective to increase area and production under oilseed crops the Cluster Frontline Demonstrations project was launched by National Mission on Oilseeds, Oil Palm (NMOOP) during 2015 in India. Under this project the ICAR- ATARI, Zone-I, Ludhiana started Cluster Frontline Demonstrations (CFLDs) programme

in various states i.e. Punjab, Haryana, Delhi, Himachal Pradesh and Jammu & Kashmir. The concept of frontline demonstration (FLDs) is to create a direct interaction between scientists and farmers, involved in planning, execution and monitoring of demonstrations for the technologies developed and get feedback from the farmer's field about the production potential (Anonymous, 2018-19). The Krishi Vigyan Kendras (KVKs) of Punjab have played a dynamic role to demonstrate and popularize, cultivation of oilseed crops with an improved package of practices and latest technologies for better yield and profit. Similarly, Krishi Vigyan Kendra, Sangrur conducted a total of 130 demonstrations on gobhi sarson for promotion of oilseed production during 2015-16 to 2017-18 and also made an attempt to study the impact of CFLDs of rabi oilseeds on yield and net returns of beneficiary farmers through the present study.

MATERIALS AND METHODS

The study was carried out in operational area of Krishi Vigyan Kendra, district Sangrur falling under southern zone of Punjab (30.24°N latitude, 75.84°E longitude having an average altitude of 332 m from the sea level). A total of one hundred thirty cluster frontline demonstrations were conducted indifferent villages of district Sangrur over an area of 40 hectare from 2015-16 to 2017-18. The new variety of gobhi sarson namely GSC7 (released in 2014 by Punjab Agricultural University, Ludhiana) was provided to the beneficiary farmers in the selected villages. The farmers were selected randomly from various blocks of the district through survey, group meetings and conducting discussions with them and necessary steps like farmer's selection, site selection, layout of demonstrations etc. were followed as suggested by Choudhary, (1999). The package of practices as recommended by PAU were followed which included selection of improved variety (GSC 7), optimum time of sowing (10-30 October), proper seed rate (1.5 kg/acre), sowing method (line sowing), proper spacing, nutrient management, irrigation, weed management and plant protection measures (timely management of aphid with insecticide). The CFLDs were monitored time to time by KVK experts at farmer field to suggest necessary and need based advisories. The crop was harvested at perfect maturity stage. The data on yield and economic performance were collected from both fields of demonstration and farmer's practice to study the technology gap between the potential yield and demonstrated yield; extension gap between demonstrated yield and yield under existing practice and finally to work out the technology index. The data were analyzed by using simple statistical tools. To quantify the technology gap, extension gap and technology index, the calculations were made as given by Samui *et al.*, (2000):

Percent Increase in yield =

$$\frac{\text{Demonstrated yield} - \text{Farmer's practice yield}}{\text{Farmer's practice yield}} \times 100$$

Technology Gap (qha^{-1}) = Potential Yield – Demonstration Yield

Extension Gap ($q\ ha^{-1}$) = Demonstration Yield– Farmer's Practice Yield (Check Yield)

Technology Index (%) = Technology Gap/Potential Yield × 100

B : C Ratio = Additional return/Additional cost

RESULTSAND DISCUSSION

The detailed information about package of practices followed in demonstrated plots of gobhi sarson as well as farmer's practice have been presented in Table 1. The improved variety of gobhi sarson namely GSC 7 was sown by demonstrating farmers by following recommended cultivation practices which included; optimum time of sowing (last week of October to first week of November), proper seed rate (3.75 kg/ha), proper sowing method (line sowing), optimum spacing (45 × 10-15 cm), efficient nutrient and irrigation management, timely weed management and recommended plant protection measures for obtaining potential yield whereas under farmer's practice all the cultivation practices were carried out in an unspecified and unscheduled manner depending upon local knowledge and farmers' own Wisdom.

Table 1: Package of practices followed for demonstrations and Local check (Farmer's practice Plot) in gobhi sarson.

Parameters	PoP in CFLDs	Farmer's practice
Crop variety	GSC 7	Local
Time of sowing	Last week of October to First week of November	Whole November
Seed rate	3.75 kg/ha	4-5 kg/ha
Method of sowing	Line sowing	Broadcasting /Traditional
Spacing (cm)	45 × 10-15	No specific spacing between rows and plants
Nutrient Management (NPK in Kg)	40:12:0/ ha	No scheduled
Irrigation	First irrigation during first fortnight of January and second one during second fortnight of February	No specific schedule
Weed management	Two manual weedings after 3-4 weeks and 45 days and thinning after 21-25 days after sowing	No specific schedule
Plant protection	Against aphid (*Lipaphis erysimi*) foliar spray of 100 gm Actara 25 WG in 180-250 litre water /ha	Nil

The results presented in Table 2 shows that a total of 130 cluster frontline demonstrations were conducted during the three study years i.e. 2015-16 to 2017-18 over an area of 40 ha at farmers' fields in different selected villages of district Sangrur. The maximum yield of 21.50 q/ha was recorded during *rabi* 2017-18 against the potential yield of 22.25 q/ha whereas the yield of demonstrated plots was averaged to be 18.72 and 18.48 q/ha in 2015-16 and 2016-17 respectively. Similarly, the average yield of gobhi sarson under farmer's practice was recorded to be the maximum during *rabi* 2017-18 whereas as it was 16.07 and 15.50 q/ha during 2015-16 and 2016-17 respectively. It was noted that the demonstrated plots yielded 16.49, 19.22 and 15.60 per cent higher yield over the farmer's practice during the study years 2015-16, 2016-17 and 2017-18 respectively. Similar results were confirmed by Ghintala *et al.*, (2018) in frontline demonstrations, the improved Mustard variety RH-749 recorded the higher seed as compared to local check. The mean increase in yield of demonstrated plots was found to be 17.10 percent over the farmer's practice. The reasons for lesser yield under farmer's practice may be attributed to use of local/un-recommended variety, delayed sowing, excess use of seed, lack of thinning, untimely application of fertilizers & irrigation and lack of plant protection measures. These results are in conformity with the findings of Mitra and Samajdar (2010) in FLDs on rapeseed and mustard and of Rathod *et al.,* (2013) in soybean produced on an average 38.83% more yield of rapeseed as compared to local practices. The findings are also in similarity with the study of Singh, (2002); Dhaka *et al.,* (2015); Lal *et al.,* (2016); Poonia and Pithia (2011). The results are also in the line with the findings of Gupta *et al.,* (2020) recorded on an average 36.95 per cent higher yield in the frontline demonstrated plot as compare to farmers practices.

Table 2: Performance of gobhi sarson in crop technology demonstrations (*Rabi* 2015-16 to 2017-18).

Year	No. of demonstrations	Potential yield (q /ha)	Improved package of practices (IP) (q /ha)	Farmer's practice (FP) (q/ha)	% increase over farmer's practice
Rabi 2015-16	20	22.25	18.72	16.07	16.49
Rabi 2016-17	85	22.25	18.48	15.50	19.22
Rabi 2017-18	25	22.25	21.50	18.60	15.60
Mean		**22.25**	**19.57**	**16.72**	**17.10**

The perusal of Table 3 shows that the technology gap in the demonstrated yield over potential yield was recorded to be 3.53, 3.77 and 0.75 q/ha during 2015-16, 2016-17 and 2017-18 respectively. The average technology gap was calculated to be 2.68 q/ha during the three years of study. The variation in technology gap may be attributed to environmental differences, selection of variety, seed rate, sowing time, soil fertility, method of fertilizer application and timely plant protection measures. Mitra and Samajdar, (2010); Katare *et al.,* (2011) recorded similar findings regarding technology gap in their study during 2010 and 2011 respectively. The extension gap varied from 2.65 to 2.98 q/ha during 2015-16 to 2017-18 with an overall mean of 2.84 q/ha. The causes for extension gap were observed to be lack of awareness amongst farmers regarding latest high yielding varieties and recommended package of practices. The technology index varied from 3.37 to 19.94 percent during the period under study with mean value of 11.05 per cent. It shows the feasibility and effectiveness of the new technology at farmers' fields. The similar findings were reported by Kirar *et al.,* (2006); Meena *et al.,* (2016).

Table 3: Analysis of Technology gap, Extension gap and Technology index under CFLDs of gobhi sarson during 2015-16 to 2017-18.

Year	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
Rabi 2015-16	3.53	2.65	15.86
Rabi 2016-17	3.77	2.98	16.94
Rabi 2017-18	0.75	2.90	3.37
Mean	**2.68**	**2.84**	**11.05**

The economic analysis of CFLDs of gobhi sarson has been presented in Table 4. It can be seen that the mean cost of cultivation for three years of study was calculated to be Rs. 26176/ha as compared to Rs. 23981/ha in farmer's practice. In this way, at overall level the additional cost in improved package of practices was calculated to be Rs. 2194/ha. It was further observed that during all the three years of study the gross returns were found to be higher in demonstrated plots where improved package of practices were followed. The average gross returns at overall level were calculated to be Rs. 77104/ha in improved production practices which were higher by Rs. 21356/ha than farmer's practice (Rs 55748/ha). Similarly, the net returns were also found to be higher in improved production practices over farmer's practice in all the study years. At overall level the average net returns were estimated to be Rs 51261/ha as compared to Rs. 31677 under farmer's

practice which were higher by Rs. 19584/- over farmer's practice. The higher net returns in improved production practices were due to higher grain yield in demonstrated plots as compared to farmer's practice. The similar findings were reported by Mokidue *et al.,* (2011); Verma *et al*., (2016); Raj *et al.,* (2013); Suryavanshi *et al.,* (2020). The highest and lowest benefit: cost ratio (BCR) were 14.62 and 6.46 in 2015-16 and 2017-18 respectively. The value of BCR is sufficiently good to prove the economic viability of interventions made under FLD programme and to motivate farmers for adopting the cultivation of gobhi sarson under irrigated conditions. The results are corroboration with the findings of Balai *et al*., (2012) in rapeseed and mustard, Jain *et al.,* (2019) in the cluster bean and Singh *et al.,* (2019) in pulses.

Table 4: Economic analysis of cluster frontline demonstrations of gobhi sarson at farmers' fields (*Rabi* 2015-16 to 2017-18)

Year	Cost of cultivation (Rs./ha)		Additional cost in demonstration (Rs./ha)	Gross returns (Rs./ha)		Net returns (Rs./ha)		Additional return in demonstration (Rs./ha)	B:C ratio (BCR)
	IP	FP		IP	FP	IP	FP		
Rabi 2015-16	26665	25890	775	76580	65741	50915	39581	11334	14.62
Rabi 2016-17	27480	26200	1280	75250	55830	47770	29630	18140	14.17
Rabi 2017-18	24383	19855	4528	79482	45675	55099	25820	29278	6.46
Mean	**26176**	**23981**	**2194**	**77104**	**55748**	**51261**	**31677**	**19584**	**11.75**

The extension activities were carried out to transfer the recommended technologies, receiving feedback through interaction programmes and to provide on the spot guidance to beneficiary farmers and to further expose the success of demonstration plot to the farmers of nearby area. The information on various types of extension activities such as farmer training programmes, kisan goshties, field days, field visits, etc. conducted during 2015-16 to 2017-18 has been given in Table 5 on cumulative basis.

Table 5: Cumulative extension activities, 2015-16 to 2017-18.

Sr. No.	HRD components	Number	Beneficiaries
1.	Trainings on oilseed production	06	168
2.	Kisan gosthi	03	145
3.	Field day	04	645
4.	Literature distribution	1000	1000
5.	Agro-advisory through M-Kisan Portal	05	5319
6.	Field visit	20	141

CONCLUSION

To conclude, it can be said that cluster frontline demonstrations (CFLDs) played an important role in disseminating the recommended cultivation practices for realizing higher productivity and returns over the farmer's practice in all the study years. Further, it helped the scientists to minimize the extension and technology gap to make the gobhi sarson cultivation more remunerative. This also led to create a cordial relationship between farmers and scientists and built mutual confidence between them. The CFLD beneficiary farmers may act as an agriculture ambassador for faster dissemination of improved production practices amongst fellow farmers and horizontal expansion in area under oilseeds. The frequent visits of scientists to farmer fields at all important and critical stages of the crop cultivation along with performing different extension activities in participatory mode made the beneficiary farmers more confident and inculcated convincing power amongst them.

FUTURE SCOPE

The country is still depending on larger imports of vegetable oils to meet the domestic consumption requirements of its population and the rapeseed-mustard crops occupies an important position in contributing towards total edible oil production in the country. Therefore, there is a great scope for bringing more and more area under *rabi* oilseeds by convincing the farmers and forming favourable policies for remunerative prices and good procurement system to make the country self-reliant in edible oil production. It has been documented that the country is spending about Rs. 75000 crores for the import of vegetable oils and with the present rate it will be around 80000 crores in next five years, if domestic production is not enhanced.

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Conflict of Interest. None.

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