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An Appraisal of Technological Interventions on Mustard Crop under Cluster Front Line Demonstrations

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To boost production and profitability, the current study's evaluation of technical interventions focused on a cluster front line demonstration on mustard crop, which was carried out in the KVK's operational territory in district Bhadohi of Uttar Pradesh.
Study Design: Yield gap analysis under cluster front line demonstration.
Place and Duration of Study: The present study was conducted by ICAR-IIVR - Krishi Vigyan Kendra, Bhadohi on mustard at farmer's field in different blocks of Bhadohi district under cluster front line demonstration during the period 2016-17 to 2020-21.

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Methodology: From 2016-17 through 2020-21, 374 demonstrations were carried out on farmer fields totaling 153 hectares under cluster front line demonstration, with farmer practice acting as the comparison control. KVK scientists collected yield, production expenses, and return data from farmers' practice plots (control plots) and front-line demonstration plots. Finally, the extension gap, technology gap, and technology index were calculated using the methods describe in Samui *et al*. [1].

Results: The five-year study's findings show that the demonstration plots' average annual yield was 24.20 q/ha in compared to the traditional agricultural plots' average annual yield of 17.26 q/ha. This higher yield of 4.85 q/ha and the 40.12% rise in mustard productivity over the previous five years may be enough to meet the state's current needs for oilseeds. The five-year averages for the technology gap, extension gap, and technology index were found to be 5.8 q/ha, 6.8 q/ha, and 19.35%, respectively. The finding unequivocally shows that CFLDs have advantages over conventional practices. The technology gap, extension gap, and technology index five-year averages were determined to be 5.8 q/ha, 6.8 q/ha, and 19.35%, respectively. Under the demonstration plot, the Benefit Cost Ratio was shown to be greatest (3.0) during the study year 2017-18 and lowest (2.24) during the study year 2019-20, but it averaged 2.65 during the five-year study period. As a result, positive benefit-cost ratios established the economic sustainability of the interventions and persuaded farmers in the Uttar Pradesh area of Bhadohi of their worth.

Conclusion: According to the findings of the five-year study, the demonstration plots' pooled five-year average production was 24.20 q/ha as opposed to the traditional farmer practices plots' 17.26 q/ha. This enhanced yield of 4.85 q/ha and the 40.12% rise in mustard productivity over the previous five years, may be helpful meet to the state's current needs for oilseeds. The finding unequivocally shows that CFLDs have advantages over conventional practices. During the years of investigation, it was shown that the benefit-cost ratio was higher when agricultural practices were demonstrated. According to the result it is concluded that the yield and net profit may be increase using HYV RH-749 with the recommended packages of practices in mustard crop.

Keywords: Mustard crop; CFLD; yield; extension gaps; technology index.

1. INTRODUCTION

Oil seeds are a great source of fat, and both people and animals can use edible oils for a variety of purposes. Two oil seed crops, rapeseed-mustard and groundnut, account for around 90% of all edible oil produced in the nation. The oil cakes are utilized as manures and livestock feed. Rape seed mustard and ground nuts are the two main sources of edible oil in India, respectively [2]. India, which has the greatest acreage and is the second-largest producer of rape seed mustard in the world after China, is a significant rape seed mustard cultivating nation. A vital role for oil seed crops is played in India's agricultural system. Rapeseed mustard is a seasonal oil seed crop grown during the Rabi season. Due to a number of a-biotic factors working in tandem with India's domestic price support plan, rapeseed-mustard production, area, and productivity have been varying each year. In India, it was grown on an area of 8.06 million ha under a variety of agro-ecological circumstances, producing 11.75 million tones of seed mustard with a productivity of 1458 kg/ha in 2021–2022 [3]. According to the Directorate of Economics and Statistics from the year 2022, the total cultivated area in Uttar Pradesh for the rapeseed and mustard crops was 0.76 million ha, produced 1.036 million tones, and productivity 1370 kg/ha, respectively. In order to boost agricultural output and farming communities' income, a number of agricultural improvement schemes have been implemented in India. However, in terms of increasing agricultural production, these schemes' results are not satisfactory. The main objective of Cluster Front-Line Demonstrations is to demonstrate newly released crop production potential and protection technologies and its management practices in the farmer's field under different agro-climatic regions and farming situations whereas the Front-Line Demonstration is a practical strategy to hasten the adoption of tested technologies at farmers' fields in a participatory manner with the goal of exploring the maximum amount of resources available for crop production and also closing productivity gaps by increasing output in the national basket. The fact that farmers and farm women receive training to improve their technical knowledge of the practices is now widely acknowledged. KVKs are essential to the rural economy in a number of sectors including horticulture, food processing, plant protection, and animal husbandry. In the growing crop season 2020–21, mustard was cultivated on just 189 ha in the Bhadohi district, producing 130 million tones overall and 9.77 q/ha in productivity. Because farmers in Bhadohi are reluctant to utilise good scientific management of the crop, the area and productivity of mustard are still significantly lower than in various districts of other states. Though there is a sizable yield difference between their potential output and their actual yield in actual farming circumstances, the government has given the rapeseed-mustard crop group priority. KVK Bhadohi put a lot of work into scientific cultivation training, showcasing new varieties, and other interventions. The objective of the current study was to evaluate technical interventions made to mustard crops as part of a cluster front line demonstration in the KVK's operational area.

2. MATERIALS AND METHODS

Krishi Vigyan Kendra (KVK) conducted 374 demonstrations on oilseed crop of mustard on selected farmer's field in different blocks of Bhadohi district with an area of 153 hectares under cluster front line demonstration during the period 2016-17 to 2020-21. The Indian mustard (*Brassica juncea*) variety RH-749 with recommended packages and practices used in the CFLD programme during the study details are given I chart 1. It matures in 140–146 days, has an oil content of 38.5–39.5 per cent, and has a potential yield of 32.000 q/ha. It was released in 2013 by the CCSHAU, Hisar Haryana. Based on the survey Choudhary (1999) suggested, farmers were identified and selected for the CFLDs. The required inputs were delivered, and KVK experts visited the demonstration fields frequently to ensure that the farmers were being guided in the right direction to provide other farmers the opportunity to learn how efficient technology operates. In order to provide other farmers the chance to see how proven technology benefits them, field days and group meetings were also organized. Mid-October seeding took place in certain irrigated conditions, and the crop was harvested in the first two weeks of March. By using a drill set at a depth of 2-3 cm, seeds were sown in rows 45 cm apart. However, the typical techniques employed by farmers involve the use of a local cultivar (Varuna), a seed rate of 5 kg/ha, no seed treatment, broadcast sowing from the final week of October to the final week of November, no use of fertilizer patterns to under dose applications, i.e., to use urea and DAP, and no weed, water, or plant protection measures (Chart 1). To provide other farmers the chance to see how well-performing technologies work, field days and gatherings of farmers were also planned. Both CFLD plots and control plots were used to get the required data and the cost of cultivation, net return, benefit-cost ratio, technology index, technology gap, and Extension gap were calculated by formula given in Ahmad *et al*., [4] and Meena *et al*., [5] as shown below.

Technology gap = Variety's Potential yield - Demonstrated yield

Extension gap = Demonstrated yield - Yield under existing practice

$$\text{Technology index } = \frac{\text{Variety's Potential yield } - \text{ Demonstrated yield}}{\text{Potential yield}} \text{ x } 100$$

3. RESULTS AND DISCUSSION

3.1 Yield Interpretations

According to Table 1, mustard variety RH-49 achieved an average yield of 24.30, 25.40, 27.80, 22.0, and 21.5 q/ha under proven technique in the years 2016-17, 2017-18, 2018-19, 2019-2020, and 2020-21, respectively. However, according to farmer practices, the yields in the comparable years were 17.90, 18.60, 15.60, and 16.30 q/ha. The mustard yield (RH-749) was highest with shown technology in 2018-19 (27.19 q/ha). Nevertheless, following farmer practices, the average yield was 17.26 for the five-year demonstration period. However, the percentage gains above the local yield for the years 2016-17, 2017-18, 2018-19, 2019-2020, and 2020-21, respectively, were 35.75, 36.56, 55.31, 41.02, and 31.90. In comparison to farmer practices, average production increased by 40.12% over the five-year experiment. During the five-year study, mustard with the variety RH-749 yields a greater yield than farmer practices. Thus, the mustard variety RH-749 can provide more plant growth and yield than farmer techniques. The findings are congruent with those of Mishra *et al*. [6], Kushwaha *et al*., [7], Meena *et al*., [8], Meena *et al*., [5] in different crops. The findings clearly demonstrate the advantages of CFLDs over traditional approaches for improving mustard yield in the studied region. These criteria included high-yielding cultivars, timely planting, Thinning, balanced fertilizer treatments, including sulphur, optimum watering, need-based plant protection, and others.

Chart 1. Package of practices followed by farmers under CFLD and in general

Particulars	Technology Interventions	Farmer's practices
Variety	RH-749	Local cultivar (Varuna)
Seed rate	3.0 kg/ha	4-5 kg/ha
Seed treatment	Carbandazim @ 2.5g/kg seed	No use
Time of sowing	Second fortnight of October	Last week of October to last week of November
Method of sowing	Row-to-row spacing of 45 cm aprat with a sowing direction of east to west	Broadcasting, no direction for sowing techniques
Fertilizer management	120: 60: 30 (N:P:S) kg/ha	Use of urea 80 kg / ha. and DAP (100 kg / ha), No use of Sulphur
Thinning	Thinning was done within 7 to 15 days after sowing to maintain the plant population at 25 cm apart.	Not in practice
Weed management	Pendimethalin 30 EC 3.3 litres/ha pre-emergence treatment, followed 30 days later by hand weeding	No use
Water management	If no rain falls, light irrigation should be applied before flowering and after podding.	No proper use
Plant protection	Application of imidacloprid based on need at a rate of 0.5 ml/l lt. of water for the management of aphid control	Injudicious use of insecticide

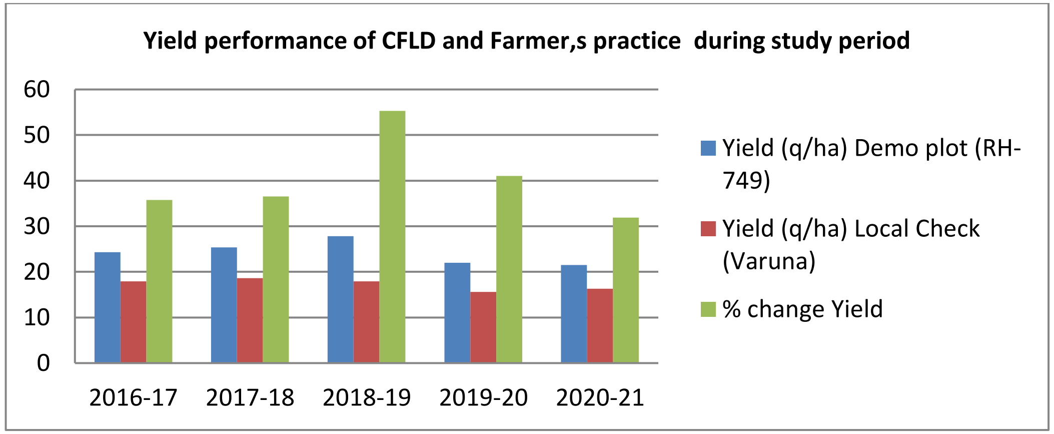

Fig. 1. Yield performance of CFLD and Farmer,s practice during five years

Table 1. Technical analysis of mustard crop variety RH-749 under CFLD

Year	No. of Farmers	Area	Yield of the crop (q/ha)		Per cent change in yield
			Demo	Local Check (Bahar)	
2016-17	67	26.5	24.30	17.90	35.75
2017-18	66	26.5	25.4	18.6	36.56
2018-19	77	30.0	27.80	17.90	55.31
2019-20	45	20.0	22.0	15.6	41.02
2020-21	123	50.0	21.5	16.3	31.90
Total/ Mean	**378**	**153**	**24.2**	**17.26**	**40.12**

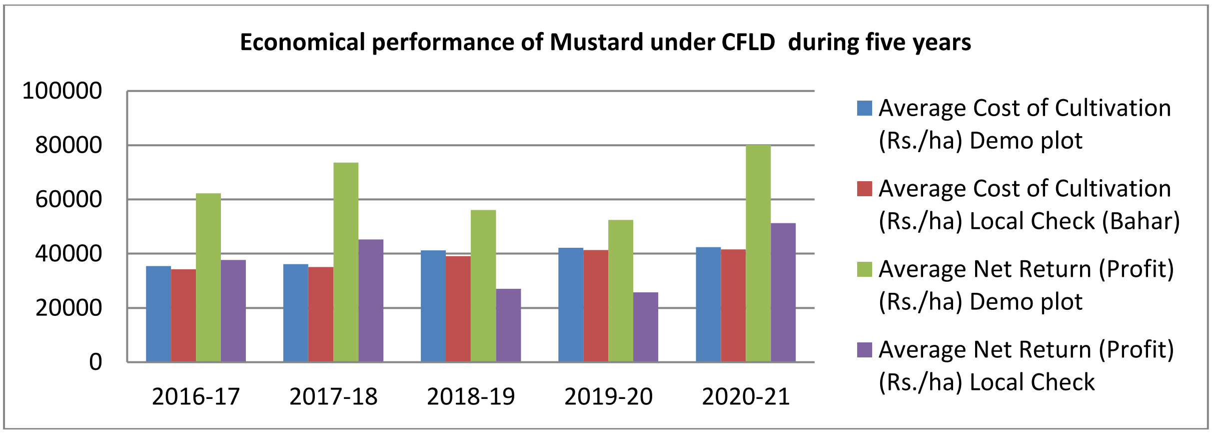

Fig. 2a. Economical performance of Mustard under CFLD during five years

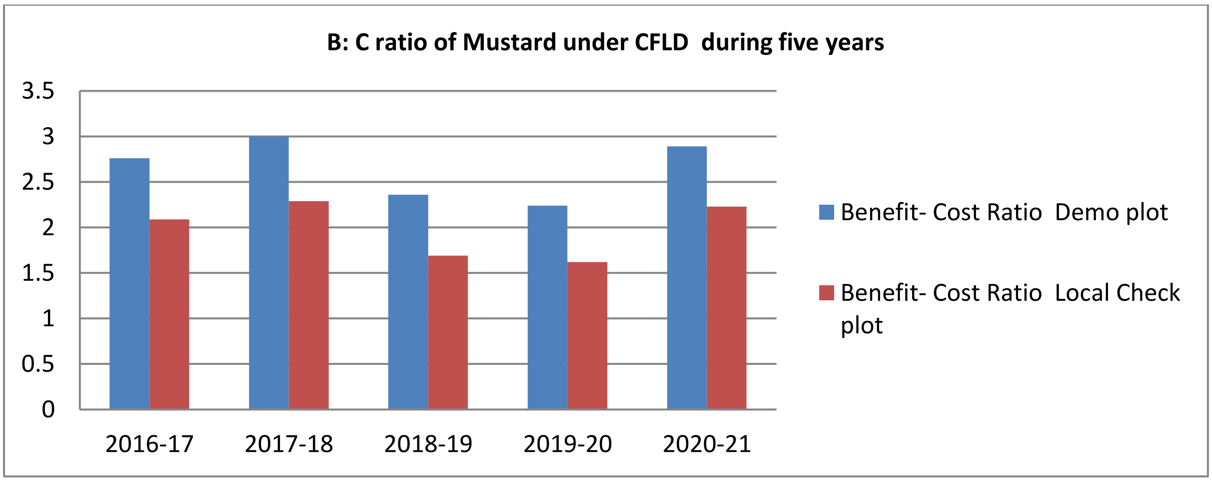

Fig. 2b. B: C ratio of Mustard under CFLD during study period.

Table 2. Economic analysis of mustard crop under CFLD during 2016-17 to 2020-21

Year	Economic of Demonstration (₹.)				Economic of FP (₹.)			
	Gross Cost	Gross Return	Net Return	B:C	Gross Cost	Gross Return	Net Return	B:C
2016-17	35430	97686	62256	2.76	34310	71958	37648	2.09
2017-18	36154	109728	73574	3	35102	80352	45250	2.29
2018-19	41202	97300	56098	2.36	39150	66230	27080	1.69
2019-20	42200	94600	52400	2.24	41300	67080	25780	1.62
2020-21	42400	122550	80150	2.89	41600	92919	51310	2.23
Average	**39477.2**	**104372.8**	**64895.6**	**2.65**	**38292.4**	**75707.8**	**37413.6**	**1.984**

3.2 Economic Interpretations

Table 2 summarizes the economic impact of mustard. The gross costs of cultivating mustard in the demonstration years of 2016-17, 2017-18, 2018-19, 2019-20, and 2020-21, respectively, were.35430,.36154,.41202,.42200, and.42400 per hectare. The gross costs that were maintained under control throughout successive years, on the other hand, were.34310, 35102, 39150, 41300, and.41600 per hectare. The data also shows that the net return under demonstration plots was.37648, 45250, 27080, 25780, and.51310 per ha during respective years, as opposed to farmer's practices.62256, 73574, 56098, 52400, and.80150 per hectare during 2016-17, 2017-18, 2018-19, 2019-20, and 2020-21, respectively. During the five years of the cluster front-line demonstration, the average cost of cultivation was Rs. 39477.4 per ha, the gross return was 1044372.8, and the net return was Rs.64895.6 per ha, compared to Rs. 38292.4 per ha, Rs.75707.8 per ha, and 37413.6 for farmers' practices, respectively. Under the demonstration plot, the Benefit Cost Ratio was estimated to be at its top (3.0) during the study year 2017-18 and at its lowest (2.24) during the study year 2019-20, while it averaged 2.65 across the five-year study period. This finding is consistent with Mishra *et al*. [6]; Meena *et al*., [8] and Meena *et al*., [5] in several crops.

3.3. Technology gap

During the five-year period from 2016-17 to 2020-21, the technology gap trend varied from 2.2 to 8.5 q/ha (Table 2). Participation in demonstrations by farmers and subsequent favorable results resulted in an average technology gap of 5.8 q/ha. In their investigations on mustard crops Kushwaha *et al*., [7] and Raghav *et al*., [9] on other crops found comparable results. Differences in soil fertility levels, rainfall patterns, insect infestation levels, weed severity, changes in cluster frontline demonstration site placement, local meteorological circumstances, and so on during the duration of the project.

3.4 Extension gap

It emphasizes the disparity between yield from farming methods and yield from demonstrations. Between 2016-17 and 1920-21, there was a 6.8 q/ha average extension gap between farmers' practices and proven techniques, with a range of 5.2-9.9 q/ha (Table 2). It demonstrates the impact of farmers adopting technology as well as the need to educate farmers through a variety of extension methods, such as cluster front line demonstrations for the adoption of improved production and protection technology, in order to reverse the trend of a wide extension gap. Kushwaha *et al*., [7], Meena *et al*., [8], Meena *et al*., [5] also reported similar finding in mustard and other crops.

3.5 Technology Index

This index indicates the feasibility of technology that has been verified in the farmer's field. The lower the technology index value, the more economically feasible an improved technology is. During the five years of research, a technology index of 19.33 percent was observed on average, proving the utility of technology. Throughout the five-year trial, the technology index ranged from 7.33 to 18.33 percent (Table 2), illustrating the significant fluctuation that may be explained by weather, soil fertility, and crop stress. These findings are consistent with those of Singh *et al*. [10] and Mishra *et al*. [6].

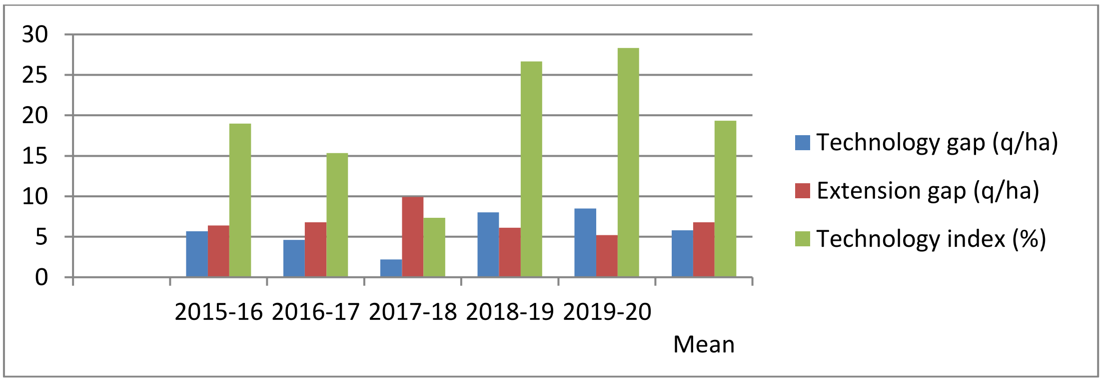

Fig. 3. Different gaps of Technological, Extension and Technology Index of HYV Mustard (RH 749) under CFLD during study period

Table 3. Various gaps of demonstrated technology of mustard crop variety RH-749 during investigation year

Year	Potential Yield (q/ha)	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
2015-16	30	5.7	6.4	19.0
2016-17	30	4.6	6.8	15.33
2017-18	30	2.2	9.9	7.33
2018-19	30	8.0	6.1	26.67
2019-20	30	8.5	5.2	28.33
Mean	**30**	**5.8**	**6.8**	**19.33**

4. CONCLUSION

According to the findings of the current study, mustard production employing the improved variety RH-749 yielded more than farmer practices throughout the evaluation period. The data imply that cluster frontline demonstrations that encourage farmers to adopt superior agro-technologies, as observed in the CFLD plots, can boost oilseed crop yield and productivity. It can be deduced that employing enhanced mustard cultivation technology can greatly narrow the technical gap, resulting in increased mustard productivity in the area. To close these gaps, cooperative extension programs that boost farmer use of location- and crop-specific technologies are required. As a result, extension organizations can play an important role in the dissemination of technical information through numerous educational avenues. According to the result it is concluded that the yield and net profit may be increase using HYV RH-749 with the recommended packages of practices in mustard crop.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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