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Impact evaluation of cluster front line demonstrations on mustard productivity and profitability in Sirohi District of Rajasthan

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Abstract
Krishi Vigyan Kendra organizes Cluster Front Line Demonstrations (CFLDs) yearly for wider adoption of new varieties of crops by farmers as per ICAR-assigned targets. The study assessed the impact of four hundred demonstrations on mustard in 137 ha area in Sirohi since 2020-21 to 2022-23 across several villages of the district. Farmers' meetings and group conversations with the farmers helped identify the technological limitations. The results showed a notable increase in the average yield of the mustard crop (26.47%) in the exhibited plot as compared to the farmer's practice plot. The average yield of the demonstration plots increased in 2020–21, 2021–22, and 2022–23 by 28.97%, 31.07%, and 19.39%, respectively. In the following years, the technological gap was 2.75 q/ha, 3.9 q/ha, and 3.1 q/ha, while the extension gap was 4.92 q/ha, 5.24 q/ha, and 3.05 q/ha. The yield increase in the demonstration plots over the course of these three years was expressed as increased income over the check plots, amounting to Rs. 20656 ha^{-1}, Rs. 26361 ha^{-1}, and Rs. 16655 ha^{-1} in different years.

Keywords: Edible oilseeds, mustard productivity and profitability, demonstrations

Introduction

Edible oilseeds are an important part of the human diet on a daily basis. According to farmers, the price of oilseed is one of the most important and powerful factors in determining how much land should be planted to oilseed crops, as this decision is based on pricing from the previous growing season. Mustard (*Brassica juncea*) is second most important crop after soybean accounts for about 25% of the nation's oilseed production. Rapeseed and mustard is grown on 6.23 million ha producing 9.34 tonnes of output per hectare at an average productivity of 1499 kg (GOI, 2019-20). India is now the world's top producer of rapeseed and mustard, accounting for 21.6% of worldwide production, according to USDA (2016) [36]. As per financial express of 25th Feb. 2021, the government of Rajasthan anticipates that there would be approximately 3 million hectares of mustard according to fully compiled district-wise data,

The primary oilseed crop known as Indian mustard accounts for more than 80% of all rapeseed-mustard output in India (Meena *et al.*, 2014; Meena *et al.*, 2015) [20, 19]. With lower production costs and water requirements, this group of oil seed crops offers the potential to increase the amount of edible oil produced domestically. To meet the country's future demand for edible oil-which is still growing due to population expansion, rising per capita consumption, and a steady increase in the output of local oilseed crops-high yielding innovative cultivars are required (Shengwu *et al.*, 2003) [31]. High yielding innovative varieties combined with methodical adoption of enhanced techniques could boost crop productivity per unit area (Ranawat *et al.*, 2011; and Rai *et al.*, 2016) [29, 28]. Rajasthan under CFLD areas, a notable increase in mustard output was observed in last years. In 2016-17, Average yield was recorded 17.77 q/ha., which was 4.07q/ha more than farmer's practice. An enhancement of 4.23 q/ha was observed in 2017-18 (Meena *et al.*, 2018) [21].

Front line demonstrations (FLDs) are one of the most successful extension strategies because farmers are generally driven by the ideas that "learning by doing" and "Seeing is believing."

Featuring recently released varieties with crop productivity and protection technologies along with their management strategies in the farmer's field across a range of agro-climatic locations and farming scenarios is the main objective of front-line demonstrations. While conducting demonstrations in the farmer's field, KVK scientists are expected to examine the elements that lead to increased crop yield, produce data on production and feedback information, and analyze production constraints in the field. Considering the significance of the Cluster Front Line Demonstrations (CFLDs) on mustard, KVK, Sirohi undertook the NFSM project entitled "Cluster Frontline Demonstrations on Oilseed under NFSM" during the year 2020-21, 2021-22 and 2022-23.

Research Methodology

The study was carried out in the Sirohi district situated in south west of Rajasthan between parallels of 24°21′ and 25°17′ North latitudes and 72°16′ and 73°10′ East longitudes. This district occupies prominent place in the agro- climatic zone II A *i.e.* ‘Transitional Plain of Luni Basin ‘comprising three blocks of the district *viz*. Sheoganj, Reodar and Sirohi and Zone IV A *i.e.* “Sub Humid southern Plain and Aravali Hills comprising two blocks *viz.* Pindwara and Aburoad. Cluster frontline demonstrations (CFLD’s) were conducted during 2020-21, 2021-22 and 2022-23 with evaluation of the performance of integrated crop management in Mustard in Sheoganj, Reodar, Sirohi, and Pindwara blocks of the district. In this study, total 400 farmers were selected from aforesaid blocks during consecutive years under cluster frontline demonstration of Mustard. All the technological interventions were taken as per prescribed package and practices for integrated crop management of Mustard crop (Table 1). The seed yield, gap analysis, input cost, net return and additional gain parameters were recorded (Table 2, 3 and 4). Assessment of gap and adaptation level study was done before conducting the CFLD. The CFLDs were carried out in villages using the participatory approach where farmers engaged at all levels. KVKs provided critical inputs such as seed, soil ameliorates, herbicides, micro-nutrients, bio-fertilizers etc at a maximum cost of Rs. 6000/ha. For achieving the potential yields of India Mustard, farmers applied fertilizers and micronutrients as per recommendations (Chauhan JS, 2013) [3]. The training programmes were organized for farmer’s selection and development of skill about technological intervention for successful mustard cultivation. Farmer’s fields were visited regularly under cluster frontline demonstrations under NFSM project by subject matter specialists. The farmer’s feedback information was also recorded. The extension activities *i.e*. training programme, kisan goshthi and field days were organized at the cluster frontline demonstrations villages. The information were computed from the farmer’s farm and analyzed to comparative performance of frontline demonstrations and farmer’s practice. To find out gaps, different parameters were calculated by following formula.

a) Extension gap = Demonstrated yield-Farmers’ practice yield

b) Technology gap = Potential yield- Demonstration yield

c) Additional return = Demonstration return - Farmers practice return

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

$$\text{B: C Ratio} = \frac{\text{Gross Return}}{\text{Gross Cost}}$$

Results and Discussion

Grain Yield: In 2020-21, 2020-22, and 2022-23, the demonstration results showed that grain yield was 21.90, 22.1, and 19.75 qha-1 over a three-year period, while in farmer’s practice, the yield was recorded at 16.98, 16.86, and 16.70 qha-1. The average yield increase was 28.97, 31.07, and 19.39 percent, with additional returns of Rs. 20656, 26361, and 16655 ha-1, respectively. According to the observation, the average grain output in the fields that were on observation was more than what farmers in every block of the Sirohi area typically produced. The higher yield in CFLDs field might be due to bench mark surveys before conducting FLDs, regular capacity building programmes, trainings, field days and follow up of package and practices including good variety seed, seed treatment, balanced dose of fertilizers, plant protection measures accordingly (Table 2). The findings were similar with results of other researcher as Amule (2016) [4], Meena *et al.* (2018) [21], Meena *et al.* (2019) [22], Choudhary *et al.* (2018) [7].

Technology Gap: The discrepancy between demonstration yields and potential yield is known as the technological gap. According to Table 3, the technology gap varied between 275 kg/ha in 2020-21, 390 kg/ha in 2021-22, and 310 kg/ha in 2022-23. Differences in crop management techniques, local weather patterns, and soil fertility status can all be factors contributing to the technological gap. Laxmi *et al.* (2017) [17], Kumar and Jakhar (2022) [16], Phukon *et al.* (2021) [27], Kumar *et al.* (2022) [16] all came to similar conclusions. Understanding the most recent scientific advancements in agricultural production techniques can significantly reduce the technology divide. To minimize these gaps, extension wings must work together to increase farmers' use of location- and crop-specific technologies.

Extension Gap: The findings indicated that the demonstrated villages in the Sirohi area had extension gaps ranging from 3.05 to 5.24 qha-1. This indicates that a capacity building program is necessary in order for Mustard to embrace enhanced production technology (Table 3). Farmer’s practices are not as effective as frontline demonstrations, according to Vittal *et al.* (2005). According to studies by Devi *et al.* (2018) [9], Kumar and Kispotta (2017) [17], and Meshram *et al.* (2022) [25], mustard productivity and production were increased by minimizing the extension gap by scientific intervention. It also highlights the growing necessity to reverse the trend of this large extension gap by educating farmers through a variety of extension methods, including CFLDs, trainings, field visits, etc. Extension agencies, workers in the specific areas can popularize all the improved technologies of cultivation among farmers for minimizing extension gap.

Technology Index: The technology index shows how easily accessible technology is in a farmer's field. The lower the value of technology index more is the feasibility. Consequently, Table 3 shows that the technology index fluctuated between 12.4 in 2020-21, 15 in 2021-22, and 12.22 in 2022-23. These results were consistent with those of Dhillon *et al.* (2016) [10], Parashar *et al.* (2021) [26], and Biyan *et al.* (2012) [6].

Economics: Data shown in Table No. 4 represents the economic analysis of mustard cluster frontline demonstration conducted by

Krishi Vigya Kendra, Sirohi. The data can be summarized as follows in 2020-21, 2020-22, and 2022-23, the gross return from suggested practice was Rs. 94607, 111504, and 107681 ha-1, while in farmer's practice, it was Rs. 73951, 85143, and 91026 ha-1. In the Sirohi district of Rajasthan, the average additional return ranged from Rs. 16655-26656 ha-1 in suggested practice, which showed helpful in terms of mustard production and economics in consecutive years. The results are consistent with those of Verma *et al.* (2012) [37], Bairwa *et al.* (2013) [5], and Dayanand *et al.* (2014) [8], who all reported that the enhanced package and practices resulted in increased benefit costs, gross and net returns. Increased grain output and improved produce pricing in the market could be the cause of increased net return and B:C ratios. In their respective studies, Lal *et al.* (2015) [18] and Kalita *et al.* (2019) [13] reported similar results. The findings plainly showed that farmers have benefited from front-line demonstration, as they were motivated by the technology employed in demonstration plots that produced crops of improved quality and yield.

Table 1: Details of package of practices of mustard cultivation

S. No.	Technological practices	Existing Farmer's Practice	Recommended Practice
1.	Variety	Existing/ Old local varieties	Giriraj, RH-725, RH-0406, RH-0749
2.	Seed rate	5-6 kg/ha	3-4 kg /ha
3.	Seed treatment	No proper seed treatment	Seed treatment with Carbendazim 50 WP 2 g/kg seed
4.	Soil treatment	No soil treatment	Soil treatment by *Trichoderma viride* @ 2.5 kg/ha cultured with 100 kg FYM
5.	Sowing method	Sowing crops in 22.5 cm rows. No practice of thinning	Sowing crops in 30 cm rows & thinning as per need at 15-20 DAS
6.	Wee Weed management	Hand weeding	Pendimethalin @ 0.75 kg/ha as PE or hand weeding at 30 DAS
7.	Plant protection	Improper use of insecticides	i) Spray of Imidacloprid 17.8 SL 100 ml/ha ii) Management of sucking pest -Foliar spray of Acetamprid@ 250 g/ha & White rust & Blight: Metalaxyl 8%+ Mancozeb 64% @ 2 g / liter of water

Table 2: Seed yield analysis of Cluster Front Line Demonstrations on Mustard

Year	Crop	Variety	Area (ha)	No. of demo	Average yield (ha)		% increase over FP
					RP	FP	
2020-21	Mustard	DRMRIJ-31	167	250	21.90	16.98	28.97
2021-22	Mustard	RH-0749	50	100	22.1	16.86	31.07
2022-23	Mustard	RH-0406	20	50	19.75	16.7	19.39

RP-Recommended Practice, FP-Farmer Practice

Table 3: Gap analysis of cluster front line demonstrations on mustard

Year	Recommended Practice Yield	Farmer Practice Yield	Extension Gap (q/ha)	Technological Gap (q/ha)	Technological Index (%)
2020-21	21.90	16.98	4.92	2.75	12.40
2021-22	22.1	16.86	5.24	3.9	15.00
2022-23	19.75	16.7	3.05	3.1	12.22

Table 4: Economic analysis of Cluster Front Line Demonstrations on Mustard

Year	Gross Return (Rs./ha)		Cost of Cultivation (Rs. /ha)		Net Return (Rs./ha.)		B:C ratio		Additional Gain (Rs./ha)
	Demo	Local	Demo	Local	Demo	Local	Demo	Local	
2020-21	94,607	73,951	23,710	21,805	70,897	52,146	3.99	3.39	20,656
2021-22	1,11,504	85,143	21,890	20,100	89,614	65,043	5.09	4.23	26,361
2022-23	1,07,681	91,026	23,900	21,666	83,781	69360	4.51	4.21	16,655

Fig 1: Year wise yield and per cent change of CFLDs on Mustard

Conclusion

The assessment of the aforementioned study showed that, compared to farmers' practices across all blocks in the Sirohi area, Integrated Crop Management of mustard produced higher yield and net returns in recommended practice. Economic analysis conducted using the specified parameters also revealed that the cluster front line demonstration recorded higher gross returns, net returns, and additional returns. This suggests that the cluster front line demonstration is a useful tool for improving oilseed production and productivity as well as for transforming farmers' knowledge and skill sets. Because of this, it is necessary to spread these enhanced technologies so that farmers in each agro-climatic system can use them more widely. To minimize the extension gap and improve oilseed production in the district, extension organizations must also give farmers the necessary technical assistance through a variety of teaching and extension strategies.

Future Scope

It would help to increase productivity and income if farmers implement the suggested techniques and package to improve the oilseed production area. To reduce the large yield and extension gaps through capacity building programs, the KVK and other extension institutes should show how new technology affects oilseed output and encourage farmers to adopt new technology.

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