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Impact evaluation on productivity and profitability of rapeseed-mustard under cluster front line demonstration in Chandel district, Manipur

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Abstract

Krishi Vigyan Kendra, Chandel, ICAR-Manipur Centre, carried out the study, which aimed to maximize the productivity of mustard var. NRCHB-101 under rice fallows on 80 hectares of land with 200 demonstrations in the farmers field of Chandel district of Manipur state under Cluster Front Line Demonstration during Kharif 2019 to 2023. Following the Kharif rice harvest in the northeastern states, rapeseed-mustard has a lot of potential when left in residual moisture. In Manipur's rainfed regions, it is a significant source of revenue, particularly for marginal and small farmers. According to the findings, farmers' practices yielded 7.25 q/ha, whereas enhanced technology achieved a mean yield of 9.54 q/ha, 23.96% higher. The range of the yield increase percentages using demonstration practices compared to farmer practices was 21.79% to 27.09 percent during 2019 and 2023, the technological or yield gap ranged from 3.85 to 5.05 q/ha, while the extension gap ranged from 1.95 to 2.75 q/ha. during the study period of 2019 to 2023. Similarly, over the study period, the technological index decreased from 36.07% to 27.50%, the benefit-cost ratio under demonstrations ranged from 1.92:1 to 2.41:1, whereas under farmer practices, it ranged from 1.56:1 to 1.86:1 during the study period respectively. In order to use the rice fallow areas for boosting cropping intensity as well as crop output and productivity, it is necessary to spread the improved technology among farmers through efficient extension techniques including training and demonstrations. Farmers should be urged to implement the suggested set of procedures in order to increase their profits.

Keywords: Cluster front line demonstration, impact evaluation, production and productivity, rapeseed-mustard

Introduction

Rapeseed-mustard is world's third most important source of edible oil after soybean and oil palm. After China and Canada, India is the third-largest producer of rapeseed mustard, accounting for about 11% of global production. One of the most significant oilseed crops and the second-largest in India is rapeseed-mustard. In India, rapeseed-mustard crops are grown in a variety of agroclimatic situations, including saline soils, timely/late sowing, rainfed, irrigated, and mixed cropping, from the northeastern to northwestern hills and down south. Approximately 80% of all the hectares planted to these crops in India are used for Indian mustard. In India, the average yield of rapeseed and mustard is approximately 1499 kg/ha, whereas the average output of all oilseed crops is 1265 kg/ha (2018-19). In addition to boosting the quality of the food, the introduction of high-yielding rapeseed-mustard types, hybrids, and the development of better production and protection technologies have greatly increased the production and productivity of rapeseed-mustard in India. The primary source of income, particularly for marginal and small farmers in rainfed areas, is rapeseed and mustard. These crops are mostly grown in the country's rain-fed and resource-poor regions, therefore they play a significant role in the livelihood security of small and marginal farmers therein. It is possible to achieve significant import substitution by enhancing home production. The rainfed cropping strategy is a good fit for rapeseed-mustard crops because of their low water requirements (80-240 mm). Rainfed farming accounts for around 30.7% of the rapeseed mustard area.

Under the National Mission for Oilseeds and Oil Palm Production (NMOOP), the Ministry of Agriculture and Farmers Welfare, Government of India, launched a nationwide cluster frontline

demonstration (CFLD) initiative on oilseeds to address the issue of significance. The CFLD program based on Rapeseed-mustard has been undertaken by the ICAR-Krishi Vigyan Kendra Chandel, Manipur to increase oilseed productivity and production using improved variety and location-specific technology. Despite nonetheless, there is a lot of room and potential for oilseed cultivation in the Chandel district in rice-fallow areas to boost output, productivity, and cropping intensity. Numerous complex and interconnected factors, ranging from soil and climate-related limitations to technological and extension-oriented challenges, contribute to the poor growth rate. In addition, the main obstacles are declining land holdings, rising population pressure, rising food demand, and poor soil condition. The CFLD was carried out at farmers' fields from 2019 to 2023 in order to investigate the effects of rapeseed-mustard on output and profitability. ICAR-KVK Chandel has worked hard to demonstrate new varieties, provide training on scientific cultivation, and implement other interventions. The study's objectives were to evaluate the effects of CFLDs on grain yield, economic gains, extension, and technological gaps in the rapeseed-mustard crop in various Chandel district villages. It also aimed at informing farmers of the scientific and technical fact that, with the right package and practices, the crop's yield can easily double from its current level. The Cluster Front Line Demonstration (CFLD) is a crucial tool for providing farmers with the most recent set of practices in their entirety. Additionally, these demonstrations are thoughtfully planned, with plans in place to quickly disseminate the technology being shown to the agricultural community through the planning of other extension activities that support it, such farmers conventions and field days. Meena and Dudi, (2018)^[8].

Materials and Methods

From Rabi 2019 to 2023, the study was conducted in the Chandel district, Manipur. 200 demonstrations were held in 80 hectares of farmers' fields. The demonstrations used a combination of improved technologies, including seed

treatment, nutrient management, plant population maintenance, and the entire package. Farmers used the local variety Yella and the Rapeseed-mustard variety NRCHB-101 was used as demonstrations. Clay loam soils with medium to low fertility status were prevalent in the study area. Rapeseed-mustard seeds were planted on rice fallows, and weeding and thinning were always done 30 to 35 days after the seeds were sown. This was done to ensure that the plants were distributed evenly within a row, as an excessive number of them can adversely affect crop growth and yield. With a seed rate of 10 kg/ha, the seeds were sown during the first week of November. Data on plant characteristics, economic yield, and economic returns from CFLD plots and fields from local practices adopted by the farmers were collected and evaluated. Utilising techniques created by Samui *et al.* (2000)^[11] and Meena and Dudi (2018)^[8], the yield data from the farmers' practice and the demonstration were documented, and their yield gap (technological gap, extension gap) and technology index were calculated as follows:

Tech. gap = Potential yield - Demo. Plot yield

Ext. gap = Demo. Plot yield - Farmer's plot yield

Technology index = $\frac{P_i - D_i}{P_i} \times 100$

P_i

Where,

P_i = Potential yield; D_i = Demonstration yield

Results and Discussion

Demonstration technology and farmers' practice

The comparison between farmers' practices and the Cluster Front Line Demonstration (CFLD) is shown in Table 1. Plant protection measures, integrated crop management techniques, and seed treatment were not used in the farmers' practice, but they were implemented in the CFLD demonstration plot.

Table 1: Details of improved package and farmers' practice

Particulars	Improved package	Farmers practices (Local check)
Variety	NRCHB-101	Yella
Seed rate	10 kg/ha	20 kg/ha
Seed treatment	Seed treatment with carbendazim @ 3g/kg seeds	No seed treatment
Time of sowing	Last week of October to 1 st week of November	Last week of November to 1 st week of December
Thinning and weeding	Thinning and weeding was done at 25-30 DAS	No thinning and weeding were done
Irrigation	Rainfed	Rainfed
Fertilizer dose	Application of 60 kg N, 40 kg P, 20 kg K / ha	No proper dose of fertilizers
Plant protection measures	Need based insecticides & fungicides spray	No insecticides & fungicides spray

Table 2: Yield and Gap analysis of Rapeseed-mustard under CFLD and Farmers field

Year	Area (ha)	Demonstration (No.)	Yield (q/ha)		Increase in yield (%)	Yield/Technology gap (q/ha)	Extension gap (q/ha)	Technology Index (%)
			Demonstration	Farmers practise				
2019	20	50	8.95	7.00	21.79	5.05	1.95	36.07
2020	30	75	9.20	7.18	21.96	4.80	2.02	34.29
2021	20	50	9.45	7.30	22.75	4.55	2.15	32.50
2022	20	50	9.96	7.35	26.20	4.04	2.61	28.86
2023	10	25	10.15	7.40	27.09	3.85	2.75	27.50
Total	80	200						
Average			9.54	7.25	23.96	4.46	2.30	31.84

Table 3: Economic impact of improved mustard production technology under real farm situation

Year	Cost of cultivation (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		Benefit Cost Ratio (BCR)	
	Demonstration	Local Check	Demonstration	Local Check	Demonstration	Local Check	Demonstration	Local Check
2019	18650	17900	35800	28000	17150	10100	1.92	1.56
2020	19150	18800	36000	28720	17650	9920	1.92	1.53
2021	19650	19150	42525	32850	22875	13700	2.16	1.72
2022	20400	19580	44820	33075	24420	13495	2.19	1.69
2023	21100	19930	50750	37000	29650	17070	2.41	1.86
Average	19790	19072	41979	31929	22349	12857	2.12	1.67

Yield

Based on the data in Table 2, the CFLDs demonstrated plots recorded a maximum yield of 10.15 q/ha in 2023 and a minimum yield of 8.95 q/ha in 2019. The mean seed yield for the five consecutive years under the demonstrated plots was 9.54 q/ha, which was higher than the farmers' tradition yields of 7.25 q/ha. Under CFLDs, yield increased by an average of 23.96% in comparison to farmer practice. The findings are consistent with those of previous researchers Mandira *et al.* (2022) and Chongloi and Singh (2021) [2].

Economics

The cost of cultivation, gross return, net return, and benefit cost ratio were calculated using the input and output prices of the commodities that were most prevalent during each demonstration year (Table 3). Year-by-year net returns for CFLD practices varied from Rs 17150 to Rs 29650, with an average net return of Rs 22349. During the years of experimentation, net returns for farmers' practices ranged from Rs 10100 to Rs 17070, with an average net return of Rs 12857. According to the estimated benefit-cost ratio, farmers' practices ranged from 1.53 to 1.86 and recommended practices from 1.92 to 2.41. Therefore, it was evident that the high-yielding Indian mustard variety NRCHB-101, which was produced using scientific methods, performed better than the native cultivar Yella. It can be concluded that holding demonstrations of new technologies aids farmers in boosting their revenue. Previous studies by Dutta (2014) [4], Tiwari and Saxena (2001) [13], and Sachan *et al.* (2023) [10] have revealed similar findings.

Yield gaps

To estimate the yield difference over the years of demonstration (2019 to 2023), the yield of farmers' var. Yella and Rapeseed-mustard var. NRCHB-101 under Cluster Front Line Demonstration were compared. The yield gap/technology gap has been shown to vary between 3.85 and 5.05 q/ha over the years of investigation. 2019 saw the largest yield/technological gap (5.05 q/ha), while 2023 saw the smallest gap (3.85 kg/ha) (Table 2). By applying Cluster Front-Line Demonstrations with tested technology in farmers' fields, the potential output of rapeseed-mustard can be significantly boosted. Uneven rainfall distribution, differences in soil fertility, unfavourable weather patterns, and localized crop management problems that occur while attempting to maximize the production potential of specific crop cultivars may all be contributing factors to the greater technological gap. Chongloi and Singh (2021) [2] and Ahmad *et al.* (2017) [1] also reported similar results.

Extension gaps

With each subsequent year of observation, the extension gap exhibited growing trends (Table 2). During the 2019-2023 study period, the extension gap varied from 1.95 to 2.75 q/ha. In order to reverse the trend, it highlights the necessity of educating farmers through many kinds of means so they will embrace

improved agricultural production technologies. Thus, the concerning trend of the widening extension gap will be reversed by using the newest production technology and high-yielding cultivars. Farmers will eventually abandon the outdated technology and embrace the new ones as a result of the new developments. This result is consistent with Chongloi, *et al.* (2024) [3] findings.

Technology Index

The viability of the advanced technology in farmers' fields is shown by the technology index. The more feasible the technology, the lower the technology index value (Mishra *et al.*, 2007) [9]. According to the technology index data (Table 2), it reached its maximum of 36.07% in 2019 and its lowest of 27.50% in 2023. This implies that there is a considerable gap between the technology used by farmers and that developed at research institutions. The technology index demonstrates how the enhanced technology is feasible in the farmer's field. Insect and pest infestations, weather patterns, variations in soil fertility, and the unavailability of irrigation water during critical times can all be attributed to this variation in the technology index over the course of the study. Cluster Front Line Demonstration, however, would eventually result in increased production and productivity enhancement in rapeseed-mustard cultivation when district farmers adopted the established method. This will be accomplished by introducing high-yielding varieties and showcasing improved technologies, followed by a vigorous awareness campaign. Similar findings are also reported by Sanjay Kumar *et al.* (2020) [12].

**Fig 1:** Rapeseed-mustard var. NRCHB-101 under CFLD Oilseeds

Conclusion

Based on the Five-year data, it can be concluded that the Cluster Front Line Demonstration program was successful in changing farmers' perceptions of growing rapeseed-mustard and encouraged of how the fallow land of rice could be used to improve resource use efficiency. It also demonstrated that the use of improved variety seed and a scientific package of

practices could increase the yield of rapeseed-mustard by 21.79% to 27.09%. Under challenging rice fallow situations, scientific agriculture techniques using improved rapeseed-mustard varieties may aid in increasing oilseed production. Farmers were convinced to adopt the intervention by the demonstration's economic viability, which was supported by the favourable benefit-cost ratio. Additionally, farmers should be educated about scientific agricultural methods. Consequently, the technologies showcased under CFLDs contributed to the expansion of rapeseed-mustard growing area, as well as the enhancement of productivity and output.

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