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Impact of Cluster Front Line Demonstrations on Yield and Economics of Toria in Tirap District of Arunachal Pradesh, India

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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

The Cluster Front Line Demonstration (CFLD) program, launched by Ministry of Agriculture and Farmer's Welfare, Government of India, New Delhi nder the National Mission on Oilseed and Oil Palm (NMOOP). The KVK Tirap carried out CFLD on Toria on 80 ha between 2017 and 2018, benefiting 200 individuals spread over 18 villages in the district that was specifically chosen. Primary data served as the study's primary source. The purpose of the study is to examine how the Cluster Front Line Demonstration by Krishi Vigyan Kendra, Tirap, has affected the district's socioeconomic situation, adoption and technology gap, and adoption patterns of both beneficiaries

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and non-beneficiaries. According to the study, cluster front-line demonstrations of tested technologies can significantly improve the yield potential and net income from oilseed farming while also raising the income levels of the participating farmers. In comparison to farmers' practices, the CFLDs reported higher average gross returns (Rs. 38560 and Rs 44812) and net returns (Rs. 18686 and Rs 19991) with a cost: benefit ratio (2.12 and 2.34); indicating the technology's economic viability.

Keywords: CFLD; yield and economics; enormous disparity.

1. INTRODUCTION

The enormous disparity between supply and demand that has led to a 9% increase in vegetable oil imports to 24.59 lakh tons in November and December of 2020 from 2019 makes oilseed production in India extremely important (The Economic Times, 2021). The total oilseeds consist of sesamum, castor, soyabean, ground nut, sunflower (Kharif oilseeds) and mustard, linseed, sesamum, nizers, sunflower and soyabean (Rabi oilseeds). The rape seed and mustard grows in 60 lakh ha area with production of 80 lakh tons; consists around maximum share (30 %) in oil seed crops [1]. The total area of rapeseed and mustard in Arunachal Pradesh is 35000 ha with a production of 32000 MT [11]. According to the analysis, rape and mustard productivity and area had not increased to the desired level. As compared to the agriculturally advanced states like Punjab, Gujarat, and Haryana, it is noticeably lower. The main causes of this decreased production include the use of conventional seed varieties, the refusal to embrace new farming techniques and the sparing application of chemical fertilizers and other soil nutrients. However, the crop's yield has not grown because the farming method is still conventional and no technical advances have been made. The crop Toria (*Brassica campestris*) yields a lot of mustard and rapeseed. It contains some significant cultivar, such as TS-46, with a yield potentiality of 1200 kg/ha and suitability for the agro-climatic conditions of Arunachal Pradesh. After oil palm and soybean, it is the third-most significant edible oilseed crop worldwide. In Arunachal Pradesh, toriasown between mid-October and mid-November. However, in the rice-toria cropping system, the crop is sown late, sometimes as late as December. The toria contains 37 to 49% oil content. The oil and seed are used as condiments in the making of oils for hair, medications, pickles, curries, and vegetables. Feed and manure are made from the oil cake. Young plants' leaves are utilized as green vegetables, and cattle can benefit from eating their green stems and leaves. Mustard oil is used in the tanning industry to soften leather. Under the National Mission on Oilseeds and Oil Palm (NMOOP), the Ministry of Agriculture and Farmer's Welfare, Government of India, New Delhi, launched the Cluster Front Line Demonstration (CFLD) initiative. The Division of Agricultural Extension, Indian Council Agricultural Research (ICAR), New Delhi was tasked with laying out the CFLD on significant oilseed crops, including sesame, mustard, rapeseed, and linseed; with arranging demonstrations across the nation via Krishi Vigyan Kendras. The national oilseed CFLD was started by the Indian Council of Agricultural Research, New Delhi, with the primary goal of showcasing the production potential of new varieties and the associated scientific production technologies. Increasing oilseed productivity nationwide was another goal of the program. CFLDs may be very important in reducing the adoption gap and raising productivity. Cluster Frontline Demonstration aims to showcase the improved field conditions of farmers, as well as the advantages and possibilities of the newest and most advanced technology when used in cluster form. Thus, in order to boost oilseed output in the Tirap district of Arunachal Pradesh, attempts have been undertaken to implement an innovative package of techniques through Cluster Front Line Demonstrations (CFLDs).

2. MATERIALS AND METHODS

The study was carried out during rabi seaons of 2017-18 and 2018-19 in the Tirap district of Arunachal Pradeshat the fields of several villages' farmers on oil seed crops -toria, during2017–2018 and 2018–2019. Primary data served as the study's primary source. Prior to implementing the CFLD program, KVK Scientists gathered baseline data about the villages. During the study period,KVK had done CFLD on Toria on 80 hectares encompassing 200 nos. of beneficiaries in the district. The TS-46 variety was used for demonstration.

Consequently, the villages of Deomali, Namsang, Sipini, LekhiPathar, Mopaya,Bera, Khela, Soha, Turret, Doidam, NatunKheti, Subang, Paniduriya, Noitong, Donrong, Thalot and Noksawere specifically chosen to participate in the current study. A roster of farmers was generated via group discussions, and those who were chosen were instructed to adhere to the Toria package of techniques that Assam Agricultural University had advised. The need based inputs were delivered to the selected farmers and proper monitoring of the demonstrationplotsby the KVKS cientistsensureproperguidancetothe farmers. The sowing was done from mid October to mid November under rainfed environment every year. Table 1 includes the details about the farmer's practices and technological interventions. At the time of harvest, crop yields from the demonstration and check plots were recorded in order to determine the yield differences (Table 4). Based on current market input prices and minimum support prices for outputs, the economic parameters (gross return, net return, and B:C ratio) were calculated [2]. The following formula was used to determine the percentage change to view the impact, benefit-cost ratio, technology gap, extension gap, and technology index.

Extension Gap = Demonstration Yield – Farmer's practice Yield

Technology Gap = Potential Yield – Demonstrated Yield

Impact change (%) = Change in No. of adapters/ No. of adapters before demonstrations X 100

Technology index = ((Potential yield – Demonstration yield) / Potential yield] x 100

3. RESULTS AND DISCUSSION

3.1 Technology Adoption Gap

Table 1 provided specifics about farmers' practices and technology assistance. The Table showed that the entire gap was found in the following areas: seed rate, sowing technique, seed treatment, variety utilization, and fertilizer use. Conversely, there was a partial adoption gap for plant protection methods, which may have resulted from farmers' practices that produced low yields. Similar findings were reported by Deka et al. [3] and Kadian et al. [4] for oilseeds. Due to lack of availability and ignorance about high producing varieties, farmers typically employ local kinds. Farmers typically utilize a larger seed rate than is advised when using the broadcasting method of sowing. Due to ignorance and lack of interest, farmers were not employing seed treatment techniques for serious diseases like downy mildew and dumping off. On the other hand, in the demonstration plots, using superior cultivars, applying fertilizer in moderation, and planting at the right time all contributed to higher yields.

3.2 Impact of CFLD on Adoption Technology of Toria Production

Table 2 displays the technologies adopted by CFLD on Toria. It was observed that adopter selection of improved variety such as TS-46 increased significantly from 56 (13.20 %) to 368 (557.13 %) following demonstrations. Similarly, sowing time segment had also improved from 82 to 518; which increased 631.70 % after demonstration. The recommended dose of manures and fertilizers had also proven positive adoption at village level. The Nutrient management and disease management had also proved significant improvement from 29, 16 to 155 and 55 (534.48 and 343.75 %) respectively. Which has proved that seed treatment had positively impacted; which is a best example about successful intervention of CFLD at farmer's field.The appropriate dose of seed rate, time sowing and cultural practices such as weed management had also proved significantly better toria yield at farmers yield. The method of sowing, seed treatment, seed rate and weed management segments had changed positively after demonstration from 38,22,44, 26 to 54, 69,74 and 159 (142.10 %, 313.64%, 168.18 and 611.53 % respectively). The overall impact has calculated 412.81 %.

Additionally, there was a notable increase in the adoption of enhanced techniques, such as better soil preparation, irrigation management, and sowing technique. It was noted, meanwhile, that non-participating farmers adopted the above-mentioned Toria enhanced practicesat a low rate. The CFLD program run by KVK Tirap raised the adoption level of Toria production technology overall by 184.96%. The outcomes of this study closely align with the research conducted on oil seed crops by Kiresur et al. [5] and Kumar et al. [6].

Table 1. Technology details; demonstrated at farmers field

S.N.	Particulars	Intervention	Farmer's practice	Gap
1	Farming situation	Rainfed	Rainfed	No gap
2	Sowing time	Mid november	Mid November	No gap
3	Sowing method	Line sowing	Broadcasting	Full gap
4	Seed rate	6 kg/ha	12 kg/ha	Full gap
5	Seed treatment	With Metalaxyl @ gm/kg seed	No seed treatment	Full gap
6	Variety	TS 46	Local	Full gap
7	Nutrient management	N: 30 kg, Phosphorus: 35 kg, Potash: 20 kg+ Sulphur	Imbalance dose of nutrient management	Full gap
8	Plant protection	Dimethoate/ Rogor against aphid control	No use of any pesticide	Full gap
		Mancozeb against blight control	No use of any pesticide	Full gap

Table 2. Extent of technology adoption

S.N.	Technology	Before CFLD	After CFLD	Changes in no of adopters	Change in per cent of adopters
1	Selection of varieties	56 (13.20)	368 (86.79)	312	557.13
2	Sowing time	82 (13.66)	518 (86.33)	436	631.70
3	Nutrient management	29 (13.61)	184 (86.38)	155	534.48
4	Disease management	16 (18.39)	71 (81.60)	55	343.75
5	Method of sowing	38 (29.23)	92 (70.76)	54	142.10
6	Seed treatment	22 (19.46)	91 (80.53)	69	313.64
7	Seed rate	44 (27.16)	118 (72.83)	74	168.18
8	Weed management	26 (12.32)	185 (87.68)	159	611.53
Overall impact					412.81

3.3 Economic Performance

The findings of the estimation of Toria's economics (crop average yield, cultivation costs, gross and net return) under Cluster front-line demonstrations are shown in Table 3. When compared to the typical farmer's practice, the study's analysis revealed that the average yield of toria in the plots that were displayed was 945kg/ha and890 kg/ha as compared 636 kg/ha and 587 kg/ha respectively during 2017–18 to 2018–19, respectively. Therefore, it is clear that toria's performance was significantly better than local practice under the plots that were displayed. The outcome is consistent with Mitra's outcome [7], Mahale [8], Ojha [9], Patil [10]in oilseeds. The Cluster front line demonstrations showed greater average gross returns (Rs. 38560 and Rs 44812 over vs. Rs 25440 and Rs 29555) and net return (Rs. 19686 and Rs 19991 vs. Rs.11978 and Rs. 13827) with cost: benefit ratio (2.12 and 2.34 vs. 1.88 and 1.87). Here all the values of economic indicators are showing the economic feasibility of the technology over farmers practice (Table 3). The current results are consistent with research by Sagaret al. [11], Tiwari [12], and Mahale [8]. Significant variations in yield could be caused by weather fluctuations and varietal traits during the cropping season. Therefore, there is potential to use enhanced technology to a greater level in order to raise the crop's sustainable productivity.

The Table 4 consisting the parameters viz. potential yield, extension gap, technological gap and technology index. The differences between demonstrated yield and farmers yield extension gap. The term 'technology index' denotes the feasibility of the evolved technology at the farmers' fields. If the value of technology index is lower; means there are more chances of technology dissemination at farmer's field. In Toria, the average technology gap was 2.34 q/ha. It suggests that there is still a gap in technology demonstrations, which prevents participating farmers from benefiting from the displayed variety's potential output. Variations in the district's climate, the fertility of the soil and improper crop management are some of the variables that could be contributing to the technological gap.

Table 3. Economic Performance details

Year	No of farmers	Area (ha)	Yield (kg/ha)		Yield increase (%)	Cost of cultivation (Rs/ha)		Gross return (Rs)		Net return (Rs)		B:C ratio	
			Demo.	Check		Demo.	Check	Demo.	Check	Demo.	Check	Demo.	Check
2017-18	125	50	964	636	34.37	18874	13462	38560	25440	19686	11978	2.12	1.88
2018-19	75	30	890	587	32.22	19146	15728	44812	29555	19991	13827	2.34	1.87

Table 4. Seed production and gap analysis

Year	Potential yield (kg/ha)	Actual Yield (kg/ha)		Extension gap	Technology gap	Technology index
		Demo.	Check			
2017-18	1200	964	636	328	236	19.66
2018-19	1200	890	587	303	310	25.83

There was an extension gap between the yield of the demonstration plot and the farmer's practices. The extension gap in Toria was found to be 328 kg/ha and 323 kg/ha and technology gap was 236 kg/ha and 310 kg/ha respectively during the demonstration period and this gap should be reduced by utilizing a variety of extension strategies, such as timely information distribution through print or electronic media, training and awareness campaigns led by extension staff, etc. The farmers would be encouraged to adopt better practices by the extension workers' raised awareness, which would close the extension gap [5]. The viability of evolving technology in the farmer's field is demonstrated by the technology index. A lower technological index denotes a technology's efficient operation.

In Toria, the technological index was 19.66 and 25.83 percent respectively. The differences could result from varying soil fertility levels, regional weather patterns, disease outbreaks, pest infestations, or poor management of appropriate farming techniques. Balai [2], Dekal [3], Kumar [6] revealed similar findings in the cases of mustard and toria.

4. CONCLUSION

Because the farmers in the Tirap district were inspired by the innovative agricultural technologies used in the demos, the results showed that the Cluster front line demonstration had a good and significant impact on them. When compared to current methods, the technologies on display were better in every way. Revenue has increased as a result of Toria's productivity rising to 34.37 % and 32.22 % during both years. Thanks to the CFLD program; by providing farmers with scientific information, extension staff can reduce the gap between current technology and extension. The local toria variety was not as productive as the CFLD variety, however this variety's performance and potential could be further enhanced by using suggested management techniques. In order to spread technology to their adjacent farmers, the participating farmers are essential. Improved varieties are used more frequently when the CFLD is present. Because of KVK's CFLD programs in the district, the majority of the low-yielding native varieties were replaced with high-yielding variety likeTS-46, which may assist boost oil seed crop production at the micro, meso, and macro levels.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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