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The Impact Assessment of Front Line Demonstrations on Sesame: A Case Study 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

Sesame (*Sesamum indicum* L.) is an important oilseed crops. The sesam's productivity in the Tirap district is low and attempts were made to increase the area and improve the productivity by adopting high yielding variety along with integrated crop management (ICM) practices. The ICM practices including sowing of improved variety (Kaliabar), seed treatment with mancozeb @ 3 g/kg seed + neem oil application at 25-30 days after sowing + spraying of carbendazim for control of leaf spot (caused by *Cersospora sesame*) was demonstrated in farmer's field. Similarly farmers were also sown at same time but they could not follow the scientific method of its cultivation. The results

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revealed that increase in seed yield over farmers' practice was 30.96 and 31.26 per cent during 2017-18 and 2018-19, respectively. In terms of economics, it was observed that demo practices recorded higher net returns/ha compared to farmer's practice during the both years. The benefit cost ratio of demo plots; during both years was 2.20 and 2.36, respectively. The technology index varied between from 42.25 per cent to 36.50 per cent; which depicting that farmers has to educate for adoption of economically viable technologies of oilseed crops in Tirap district.

Keywords: CFLD; yield; yield gap; extension gap; B: C ratio.

1. INTRODUCTION

The sesame (*Sesamum indicum* L.) is not widely grown due to its low yield [1]. India's sesame production (405 kg/ha) is quite low in comparison to other countries worldwide. In India, Sesame is grown on 1.37 lakh hectares with production of 3.99 MT while average production of Arunachal Pradesh is very low (367 kg/ha) Handbok agri data, 2022. Its low productivity is mostly caused by its rainfed cultivation on marginal and sub-marginal areas, which is often done in situations of poor management and input scarcity. But better cultivars and agricultural production techniques that can raise sesame productivity levels are now being developed for various agro-ecological conditions around the nation. Under irrigation, a well-managed sesame crop can yield 1200 –1500 kg/ha and 800 - 1000 kg/ha under rainfed [2].

Sesame productivity in the Tirap is low due to use of poor quality of seeds, inadequate nutrient management, and inadequate understanding of pest and disease control. To overcome the same situation, good quality seeds, time sowing, applying the recommended fertilizer dosage at the right time and implementing need-based plant protection measures against insect pests and diseases are ways to minimize the knowledge gap among farmers and increase the productivity and profitability of sesame. The primary objective of demonstration was to showcase and disseminate better agro technology in farmers' fields by which farmers can learn technological knowhow at their own field Sagar et al. [3].

2. MATERIALS AND METHODS

Under the study, total 75 numbers of front-line demonstrations under Cluster front line demonstration (CFLD) was carried out throughout the 2017-18 and 2018 –19 years. A 0.4hectare area was used for each demonstration. The improved variety – Kaliabar; was used in demonstration. The seeds were treated with mancozeb at a rate of 3 g/kg, neem oil was applied at a rate of 25–30 days after sowing (DAS), monocrotophos was sprayed at a rate of 1.5 ml/L of water during flowering to pod formation stage for insect management and carbendazim was sprayed to control leaf spot; caused by *Cercospora sesame* (Table 1).

The soil of demonstration plots was sandy loam; where demonstrations had conducted; having a low to medium fertility condition. The soil's pH ranged from 4.6 to 5.2. At the time of threshing, yield statistics for both the farmers' practice and the enhanced method were noted. Table 1 displayed the specifics of planting and harvesting according to season. The Yadav et al. [4] approach was used to calculate the yield gain in the demonstrations above farmers' practices. The following formula was used to estimate the technology gap, extension gap and technology index [5].

Yield incensement (%) = [(Demo yield – farmers yield)/ Farmers yield]

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – farmers yield

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

Net Return = Gross Return – Cost of cultivation

Benefit cost (B: C) ratio = (Gross return/ Cost of cultivation) x 100

2.1 Economic Analysis

The cost of cultivation of sesame includes cost of inputs like seeds, labour charges, pesticides, fertilizers *etc*.; which purchased by the farmer's or provided by the Krishi Vigyan Kendra (KVK).

The gross returns were obtained by converting the harvest into monetary terms at the prevailing market rate during the course of demonstration. While the net returns were obtained by deducting cost of cultivation from gross returns. The Benefit: Cost ratio was calculated by dividing gross returns by cost of cultivation [6,7].

3. RESULTS AND DISCUSSION

3.1 Production Practices

There was a clear gap in sesame production because most farmers did not use the latest and best technologies (Table 1). Farmers used a higher seed rate than the recommended seed rate, which increased the cost of seed input (Table 1). Additionally, farmers did not treat their seeds (Table 1), despite the fact that seed treatment play important role against soil borne diseases as well as sucking insect pests that ruin crop emergence and early growth [8]. During the study; a partial planting time different was noted, but it had little impact on crop yield. Meanwhile this partial time has resulted a minor improvement in yield and a decrease in the frequency of pests and diseases; which was reported by Alam et al. [9]. According to the data (Table 1), farmers applied lower dose of fertilizer without top dressing when they did apply fertilizer, which resulted in reduced yields. The farmers of Tirap's district could not apply any suggested fertilizers; based on soil tests. Singh et al. [10] and Singh et al. [11] reported similar results in oil seed crops.

3.2 Yield

In Comparison between demonstration's plots vs. farmer's plots, the sesame yields in the farmer had higher yields. The percentage difference between the yields of farmers' plots and demonstration plots varied from 28 % to 38%. The scientific package of practices which was applied in demonstration plots; which was implemented in direction of scientists from KVK Tirap, was primarily responsible for the rise in seed production of the demonstration plots. The use of improved variety: Kaliabar, reduced the occurrence of phyllody disease and increased sesame output. In comparison to farmers' methods, the introduction of seed treatment, time of sowing, fertilizer application based on soil test values and adoption of plant protection measures; spray of neem oil prevented the vectors (name of insect- Jassid) for vector control of phyllody under CFLDs significantly increased sesame yield. It was clear that, in similar environmental conditions, the demonstration's production outperformed the farmer's practice. The outcomes of the demonstrations and the agro-technologies used in the CFLDs inspired farmers who had not yet adopted these technologies and they expressed a willingness to do so in the future (Table 2). These results were consistent with those of Bora et al. [12], Dour et al. [13] and Kokate et al. [14].

Table 1. Production technologies details (Demonstration plots vs. farmer's practice) in sesame crop under CFLD in Tirap district of Arunachal Pradesh

Parameter	Demo Practice	Farmers Practice	Technological Gap
Variety	Kaliabar	local	Full
Land Preparation	Two Ploughings	One ploughing	partial
Seed Rate	6 kg/ha	8-10 kg/ha	Higher seed rate
Seed Treatment	Mancozeb @3.0 g/kg seed	No seed Treatment	Full
Method of sowing	Line sowing	Line sowing	
Time of sowing	1st week of November	1st week of November	
Fertilizer dose	40:2: 40:20:20 (Based on soil test values) (Topdressing of half of N dose)	low dose of fertilizers (No top dressing)	Partial
Method of fertilizer application	Line	broadcasting	partial
Weed management	Pre emergence application of pendimethalinalong with one need-based hand weeding	No use of weedicide	Full
Plant protection	Neem oil application at 25-30 DAS and at flowering to pod formation stagefor insect management and carbendazim's application for control of leaf spot	No Spray	Full

Table 2. Technology gap, extension gap and technology index of sesame crop in Tirap district of Arunachal Pradesh

Year	Area (Ha)	No of FLDs	Variety	Yield (Kg/ha)			% increase over farmers practice	Technology gap (kg/ha)	Extension gap (Kg/ha)	Technology index (%)
				Potential yield	Demonstrated yield	Farmer's practice				
2017-18	30	75	Koliabar	800	462	352	30.96	338	110	42.25
2018-19	30	75	Koliabar	800	508	387	31.26	292	121	36.50

Table 3. Economic analysis of Sesame cultivation in Tirap district of Arunachal Pradesh

Year	Cost of cultivation (Rs/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		B: C ratio	
	Demo practice	Farmer practice	Demo practice	Farmer practice	Demo practice	Farmer practice	Demo practice	Farmer practice
2017-18	16754	14853	39960	30976	20206	18123	2.20:1	1.98:1
2018-19	18286	16128	43180	33219	24894	17154	2.36	2.05

3.3 Technology Gap

The discrepancy between the variety's potential yield and the yield seen in the demonstration plot is known as the "technology gap." According to Table 2, the technology gap for 2017-18 and 2018-19 was 338 and 292 kg/ha, respectively. The observed technological gap may be explained by a number of limitations, including variations in the nutrient level of the soil, the availability of moisture, the control of diseases and insect pests and the unpredictable weather that occurred during crop season at various places. Meena et al. [15] and Mishra et al. [16] found similar results. The technology gap shows the cooperation of farmers in conducting the CFLDs; the results were encouraging.

3.4 Extension Gap

The yield differential between a farmer's plot and a demonstration plot is known as the extension gap. In 2017–18 and 2018 –19, respectively, an extension gap of 110 and 121 kg/ha was noted (Table 2). The production in demonstration plots was subsequently increased by putting the recommended package of techniques into practice and using high-yielding cultivars. By teaching farmers using a variety of extension methods, it is important to highlight the gaps in extension that have been formed. The current investigation also supported by the findings of Zimik et al. [17].

3.5 Technology Index

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. During the year of 2017-18 it was 42.25 % as compared 36.50 % during the year of 2018-19 (Table 2). This change in the technology index was caused by the application of improved variety, improved package of practices, farmers training etc. during the research years. Furthermore, a decrease in the technology index over the course of the study's years indicated unequivocally that the technologies showcased in frontline demonstrations are feasible. Sagar et al. [3] and Sharma et al. [18] observed similar results in lowering the technology index by implementing the FLDs [19].

3.6 Economic Returns

According to the economic study, the displayed plots during both demonstration years had greater gross returns, net returns, and benefit to cost ratios than the farmer's practice, showing increased profitability. For the year of 2017–18 and 2018–19, the benefit–cost ratio of the demonstration plots was 2.20 and 2.36 respectively (Table 3). Therefore, the farming community in Tirap district can increase its yield potential and financial returns by implementing enhanced sesame production procedures. These outcomes were consistent with the previous research conducted by Patil et al. [18] and Sagar et al. [3].

4. CONCLUSION

In the Tirap district of Arunachal Pradesh, the yield of sesame can be positively raised by implementing improved technology and improved varieties. The utilization of better varieties, proper seeding rates, fertilizer management based on soil tests, and plant protection measures implemented in compliance with suggested package of practices may all be responsible for the improvement in sesame output. The farmers felt inspired to use better interventions after the demonstration demonstrated a higher economic return. It is therefore possible to draw the following conclusions from these results: scientific farmer intervention can reduce technological and extension gaps, improving sesame productivity and production in the Tirap area of Arunachal Pradesh.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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