Original Research Article

The EnhancingProductivityandProfitabilityofSesame by CFLD ProgrameinTirapDistrictofArunachalPradesh, India

ABSTRACT

Sesame (*Sesamumindicum*L.) is an important oilseed crops.The sesame's productivityintheTirapdistrictislow,andattemptsweremadeto increase the planted area and improve the productivity by adopting high yielding variety along with integratedcrop management (ICM) practices. The ICM practices including sowing of improved variety (Kaliabar),seedtreatmentwithmancozeb@3 g/kgseed+neemoilapplicationat25-30days after sowing~~DAS~~+sprayingofcarbendazimforcontrolofleafspot~~wasdemonstratedin farmer's field.~~ The results revealed that increase in seed yield over farmers' practice was 30.96 and 31.26 percentduring2017-18and2018-19,respectively.Intermsofeconomics,itwasobservedthatdemopracticesrecorded higher net returns/ha compared to farmer's practice during the both years. Thebenefit cost ratio of demo plots; during both years was 2.20 and 2.36, respectively.The technology indexvaried between from 42.25 per cent to 36.50 per cent; which depicting that farmers has to educate for adoption of economically viabletechnologiesofoilseedcropsinTirapdistrict.

Key words: CFLD, yield, yield gap, extension gap, B: C ratio.

Introduction

The sesame (*Sesamum indicum* L.) is not widely grown due to its low yield (Pathak *et al.* 2017). India's sesame production (405 kg/ha) is quite low in comparison to other countries worldwide. In India, ~~Sesame~~ sesame is grown on 1.37 L~~l~~akh hectares with production of 3.99 MT while average production of ArunachalPradesh is very low (367 kg/ha) (Anonymous, 2019). Itslow 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 (Ranganatha, 2013).

Sesame productivity in the Tirap is low dueto 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

Comment [A11]: I recommend to change the title of this work, since it's very similar to: Enhancing Productivity and Profitability of Sesame under Cluster Frontline Demonstration in Morigaon District of Assam, India By RanjitaBezbaruah ,Rijusmita Sharma Deka , Juli Sharma and PallaviSaikia

Comment [A12]: Add what CFLD means or References

Comment [A13]: Add causal agent of Leaf spot

Comment [A14]: Add the fact that a comparison was made with farmer's practices

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Comment [A15]: Anonymous isn't a valid reference for a scientific publication 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.

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MATERIALSANDMETHODS

The total 75 numbers of front-line demonstrations underCluster front line programmewere carried out in the rainfed conditions throughout the 2017-18 and 2018 –19 years. A 0.4 hectare 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 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 (Table 1).

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Comment [A18]: Add References and/or description about the CFLP

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The soil is 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*. (2004) 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 (Samui *et al*. 2000).

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$$\text{Yield incensement (\%)} = \frac{\text{Demo yield} - \text{farmers yield}}{\text{Farmers yield}}$$

Technology gap = Potential yield – Demonstration yield

Extensiongap= Demonstrationyield–farmers yield

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

NetReturn =Gross Return –Costof cultivation

$$\text{B: C ratio} = \frac{\text{Gross return}}{\text{Cost of cultivation}} \times 100$$

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Economic analysis

The cost of cultivation of sesame includes costof inputs like seeds, labour charges, pesticides, fertilizers, *etc*.; which purchased by the farmer's or provided by the KVK. The gross returns were obtainedbyconvertingtheharvestintomonetarytermsattheprevailingmarketrateduringthecourse ofdemonstration. While the netreturnswereobtainedbydeducting cost of cultivation from gross returns.The Benefit: Cost ratio was calculated by dividinggross returns by cost of cultivation (Deka*et al.*2019).

Table1.Productiontechnologies details (~~Demostration~~Demonstration plots vs. farmer's practice)insesamecropunderCFLDin Tirap districtofArunachalPradesh.

Parameter	**DemoPractice**	**Farmers Practice**	**Gap**
Variety	Kaliabar	local	Full
LandPreparation	TwoPloughings	Oneploughing	partial
SeedRate	6 kg/ha	8-10 kg/ha	Higherseedrate
SeedTreatment	Mancozeb@3.0g/kgseed	NoseedTreatment	Full
Methodofsowing	Linesowing	Linesowing	
Timeofsowing	1st week of November	1st week of November	
Fertilizerdose	:20(Basedonsoiltestvalues)(Topdressing of half of Ndose)	low dose of fertilizers (No top dressing)	Partial
Methodoffertilizerapplication	Line	broadcasting	partial
Weedmanagement	Preemergenceapplicationofpendimethalin alongwithoneneed-basedhandweeding	No use of weedicide	Full
Plantprotection	Neem oil application at 25-30 DAS and atfloweringtopodformationstagefor insect management and carbendazim's application for control of leaf spot	No Spray	Full

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

Year	Area (Ha)	No of CFLDs	~~Variey~~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

RESULTSANDDISCUSSION

ProductionPractices

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. Additionally, farmers did not treat their seeds, 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 (Sharma *et al.* 2015). Despite several attempts by Agriculture Scientists and Department Officials from the line departments, a large number of farmers in the nation are neither aware of the practice nor adhere to it.During the study; a partial planting time different was noted, but it had little impact on crop yield.

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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.* (2020). 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*.(2014) and Singh *et al.* (2016) reported similar results.

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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 for vector control of phyllodyunder 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 agrotechnologies 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*.(2000), Dour *et al.* (2015) and Kokate*et al*. (2016).

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Technologygap

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*. (2018) and Mishra *et al*. (2016) found similar results. The technologygap shows the cooperation of farmers in conductingtheCFLDs, the results wereencouraging.

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.* (2020).

Technologyindex

The term ‘technology index’ denotes the feasibilityof 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 e*t al*. (2004) and Sharma*et al*. (2015) observed similar results in lowering the technology index by implementing the FLDs.

EconomicReturns

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*. (2018) and Sagar*et al*. (2004).

CONCLUSION

By adopting the improved variety andimproved technology, the yield of sesame canbe increased positively in Tirap districtof Arunachal Pradesh. The increase in yield of sesamemay be attributed due to use of improved variety; use of appropriate seed rate, soil test based nutrientmanagementandplantprotectionmeasures taken in accordance with recommendedpackageofpractices. Thedemonstration proved better economic return; which hadencouragedthefarmersfor adoption of improved interventions. So, in these consequences it can beconcluded that technology gaps and extension gapcan be minimized by adopting scientific interventionatthefarmer’sfield,whichleadtoenhancementin the production and productivity of sesame inTirapdistrictofArunachalPradesh.

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