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Impact of frontline demonstration on performance of sesamum in Bongaigaon district

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Abstract
A total of 74 numbers of cluster frontline demonstrations (CFLD) on a high-yielding variety of sesamum (ST 1683) in 224 hectares of land spread over different villages were conducted by Krishi Vigyan Kendra, Bongaigaon, Assam, in three consecutive years, i.e., 2016 to 2018, to assess the impact of cluster frontline demonstrations (CFLD) on bridging the gap between the potential yield and the yield obtained from farmers' practices. It was observed that the adoption of improved agro-technology substantially increased the yield and returns from the sesamum crop. On an average, 18.88% increase in sesamum production was observed under CFLDs compared to farmers' practice. A technology gap of 2.30 q/ha and an extension gap of 1.27 q/ha were observed, which reflects the need for specialized extension methodologies. The technology index, which decreased from 27.80% to 24.4%, clearly indicated the importance of the technologies demonstrated. The positive effect of various technologies was clearly visible by the higher B:C ratio under CFLD plots.

Keywords: Seed yield, yield gap, sesamum, net returns, cluster frontline demonstration

Introduction
Sesamum is one of the oldest crops cultivated by the human race. Locally, it is known as 'Til' in the state of Assam. It is an important edible oilseed crop, next only to groundnut and rapeseed cultivated in India. The crop is grown in an area of 1.53 million hectares, with an annual production of 7.50 lakh tons. The present level of productivity is low compared to other countries in the world, most probably due to the cultivation of local varieties with inappropriate crop management practices. India contributed about 27 percent of the world's sesamum area, 23 percent of the world's production, and with a productivity of 322 kg/ha annually, making India rank first in the field of production in the world (Anonymous, 2021) [2]. In addition to its high oil content (44-57%), it is also a rich source of nutrients such as proteins (18–25%) and carbohydrates (13.5%). It also possesses medicinal and nutritional value (Myint *et al*., 2020). It is popular among the common people as a source of oil as well as for its uses in different delicacies and religious ceremonies. It has gained further importance on account of its use for edible purposes, hydrogenation, manufacture of paints, pharmaceuticals and insecticides.

In the state of Assam, sesamum is an important *kharif* oilseed crop occupying an area of 12,128 ha with an average yield of 674 kg/ha (Anonymous, 2022) [3]. The crop is largely exclusively grown in rain-fed situations throughout the state. Crops are mostly grown by farmers on less productive soils with little to no fertilizer application and inadequate management techniques. There is enough scope to improve the productivity of sesamum in the state of Assam with proper intervention, such as the use of high-yielding varieties with recommended packages and practices. Therefore, the present study was conducted as a cluster frontline demonstration for assessing the impact of high-yielding varieties in conjunction with scientific crop management practices on sesamum yield and economic returns.

Materials and Methods
Cluster frontline demonstrations (CFLD) on sesamum were conducted every kharif season

during the years 2016 to 2018 by the Krishi Vigyan Kendra in 74 farmers' field at Bongaigaon district, Assam comprising a study area of 224 ha. An improved variety ST 1683 of sesamum along with the recommended fertilizer dose (30:20:20 kg/ha of N: P_2O_5:K_2O) was used and other packages and practices as prescribed by Assam Agricultural University were followed in demonstration plots, and comparisons were made with the local variety of sesamum, considering it as farmers' practice (check). The training programme was organized for farmers' selection and development of skills about technological intervention for successful sesamum cultivation. Field days were also conducted in each cluster to show case the results of FLDs to the farmers of the same village and neighboring villages. In order to evaluate the effect of FLDs intervention on sesamum yield, crop yield data was gathered from various FLDs as soon as harvesting was completed. Additionally, scientists conducted regular field visits in the area from 2016–17 to 2018–19 to verify the yield of local checks. Ultimately, the seed yield, cultivation costs, net returns, and benefit–cost ratio were calculated. To find out yield gaps, different parameters were calculated using the following formula (Singh and Singh, 2020) [9].

$$\text{Percent increase in yield (\%)} = \frac{\text{Yield from demonstration plot (q/ha)} - \text{Yield of check (q/ha)}}{\text{Yield of check (q/ha)}} \times 100$$

Technological gap (q/ha) = Potential yield of the crop (q/ha) – Demonstration yield of the crop (q/ha)

Extension gap (q/ha) = Yield from demonstration plot (q/ha) – Farmers' plot yield (q/ha)

$$\text{Technological index (\%)} = \frac{\text{Potential yield of the crop (q/ha)} - \text{Yield from demonstration plot (q/ha)}}{\text{Potential yield of the crop (q/ha)}} \times 100$$

Results and Discussion

Seed Yield

The results revealed that the seed yield of Sesamum under demonstration plot varied from 6.50q/ha to 6.80q/ha whereas in farmers' practice, seed yield of local variety varied from 5.40q/ha to 5.50q/ha (Table 2). The mean seed yields recorded under CFLD and farmers' practice were 6.70q/ha and 5.43q/ha, respectively. In demonstration plots, the per cent increase in seed yield ranged from 16.92% to 20.59% during the study period. Over the years 18.88% increase in mean seed yield was recorded. Similar results were reported by Bezbaruah *et al.* (2020) [4] and Gogoi *et al.* (2020) [5]. Singh *et al.*, (2019) [8] observed an average sesamum yield of 5.65 q/ha in CFLDs which was 1.75 q/ha higher than the check (3.90q/ha). The higher seed yield in demonstration plot is ascribed to the adoption of improved variety, seed treatment with biofertilizers, recommended dose of fertilizers and improved measures for insect pest and disease infestation according to the recommended package of practices.

Technology gap

From the results it was observed that Sesamum variety produced an average yield of 6.70 q/ha under CFLDs as against potential yield of 9.00 q/ha. An average technology gap of 2.30q/ha was observed between the demonstration and potential yield which might be due to varied agro-ecosystems, soil fertility status and climatic conditions of the area. Similar findings were also reported by Singh *et al.*, (2021) [7]. Further, decrease in technology gap from 2.50q/ha to 2.20q/ha was observed in subsequent years of demonstration which reflects more numbers of farmer participation in conducting FLDs and adoption of Sesamum production technologies.

Extension gap

An increasing trend of extension gap was observed in the present study. The annual extension gap of 1.10q/ha,1.30q/ha and 1.40q/ha was observed during 2016-17, 2017-18 and 2018-19, respectively. An average of extension gap of 1.27q/ha clearly indicates the need of farmer's education on recent and improved agricultural technologies. Greater use of the latest production technologies along with more emphasis on the adoption of high yielding varieties will lead to a narrow extension gap. The latest technologies will motivate the farmers to discard the old technology and to accept new ones.

Technology index

The technology index shows the feasibility of the evolved technology at the farmers' fields as lower the value of technology index more is the feasibility of the technology. During the study period, a decline in the value of the technology index from 27.8 per cent in 2016-17 to 24.4 per cent in 2018-19 was observed. This reduction exhibited the feasibility of different technology demonstrated in the study areas (Table 2). The variation in the technology index during the study period reaffirms the scope for further improvement in productivity of Sesamum in the district. The results confirmed that the CFLD programme was highly effective in disseminating knowledge related to various aspects of sesamum production and adopting appropriate agricultural techniques among farmers. Rohit and Singh (2019) [6] also reported similar findings.

Table 1: Details of Frontline Demonstrations laid out on Sesamum crop

Crop season	Technology demonstrated	Nos. of FLD	Area covered (ha)	Nos. of farmers
Kharif 2016-17	HYV of Sesamum (ST 1683) with scientific management practices	30	78	30
Kharif 2017-18	HYV of Sesamum (ST 1683) with scientific management practices	20	81	20
Kharif 2018-19	HYV of Sesamum (ST 1683) with scientific management practices	20	65	20
Total				

Table 2: Overall yield gap analysis in Sesamum variety ST 1683

Crop season	Variety Demonstrated	Farmers' variety	Nos. of FLD	Area covered (ha)	Seed yield (q/ha)			Increase in yield (%)	Technology gap (q/ha)	Extension gap (q/ha)	Technological index (%)
					Potential Yield	Yield under CFLD	Yield of local check				
Kharif 2016-17	ST 1683	Local	30	78	9.00	6.50	5.40	16.92	2.50	1.10	27.8
Kharif 2017-18	ST 1683	Local	20	81	9.00	6.80	5.50	19.12	2.20	1.30	24.4
Kharif 2018-19	ST 1683	Local	20	65	9.00	6.80	5.40	20.59	2.20	1.40	24.4
Total			70	224	-	-	-	-	-	-	-
Mean					9.00	6.70	5.43	18.88	2.30	1.27	25.53

Economics

The inputs and outputs prices of commodities prevailed during the study of demonstration were taken for calculating net return and Benefit: Cost (B:C) ratio (Table 3). The net returns obtained for the cultivation of local check varied from Rs. 37800 to 44800/ha as compared to demonstration (Rs 54605 to 54720/ha). An average net return of Rs 25550/ha and B:C ratio of 2.52 under farmers' practice as compared the average net return of Rs. 36558/ha and B:C ratio of 3.03 under demonstration was observed. The economic feasibility of the technological intervention was clearly evident from the higher B:C ratio in the CFLD plots. The same can act as a stimulus in convincing the farmers for adoption of the same. The annual variation in input and output cost might have resulted in variation in B: C ratio during different years. The B:C ratio under improved cultivation practices was higher than farmers' practices in all the years of study and this may be due to higher yield obtained under improved technologies compared to farmers' practice. This result is consistent with the findings of Gogoi *et al*. (2020) [5] and Ambulkar and Dixit (2014) [1].

Table 3: Economic analysis of FLD's vs Farmers' practice on Sesamum crop

Crop season	Gross cost (Rs/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		B:C ratio	
	FLD	Farmers' practice	FLD	Farmers' practice	FLD	Farmers' practice	FLD	Farmers' practice
Kharif 2016-17	17050	15150	54605	37800	37555	22650	3.20	2.50
Kharif 2017-18	18500	17300	54400	44000	35900	26700	2.94	2.50
Kharif 2018-19	18500	17500	54720	44800	36220	27300	2.96	2.56
Mean					36558	25550	3.03	2.52

Conclusion

From the above study it can be concluded that adoption of improved agro-techniques in CFLD plots increased the seed yield substantially. An average increase of 18.88% in mean grain yield of sesamum was observed in CFLD plots compared to farmers' practice. While comparing the potential yield of sesamum variety under study with that of demonstration yield, an average technology gap of 2.30q/ha and extension gap of 1.27q/ha were observed. The declining technology indices clearly indicated the importance of the technologies demonstrated. The positive effect of various technologies was visible by higher B: C ratio under FLD plots.

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