Sesame (*Sesamum indicum*)Yield Gap and Economic analysis through Front Line Demonstrations under Rainfed Conditions in Tikamgarh district of Bundelkhan Zone of MP

Abstract

Til, also called sesame (*Sesamum indicum* L.), is one of the oldest and most important oilseed crops of India. It is cultivated on 15.23 lakh hectares of land in semi-arid tropical, sub-tropical, and temperate regions. In 2023, it yielded 8.02 lakh tons with an average yield of 527 kg/ha (Anonymous, 2023). The frontline demonstrations are one of the most common and efficient ways to introduce farmers to the latest improved crop husbandry production technologies. During the kharif seasons of 2022 and 2023, the AICRP on Sesame, Tikamgarh organized 70 protests in the Tikamgarh block in the villages of Kari, Madumar, Bilgany, and Khiriya.

The mean Extension Gap over years of poor adaptation by farmers towards novel technology was shown as 314 kg/ha, which happens to be more than double the yield collected under FP. As such, it is only at this stage that coordinating initiatives should bring in and shift the focus of the farmer regarding better technology is necessary. At an average technical index of 13.70%, it went beyond the levels wanted. The average net return under Improved Technology was 32069, while for Farmers Practice it was about ~12229. Also the average B:C ratio under Improved Technology was 3.06, while for Farmers Practice it was 2.80.

Key word: Sesame ,Front line demonstration, farmers' practises (FP), Improved technology (IT), Benefit cost ratio

Introduction:

India is endowed with a rich diversity of oilseed crops that are grown in most of its agroclimatic zones. At the same time, India has emerged as the world's largest importer of edible oils, with annual per capita consumption standing at over 19.0 kg, or nearly 36% more than is required for normal health. In this case, there is a considerable gap between the demand and supply of edible oil, and hence, India had to import 13.42 MT in the year 2021 at the cost of currency load of Rs. 80000 crores. (Anonymous, 2021). Farmers have lesser choices in selecting relatively better input-responding crops with the present unstable climate of low rainfall tracts and poor to medium fertility soils. The options available with the farmers are fewer regarding *Kharif* crops. Given the present climate's unpredictability, sesame is a preferable choice. With a total production of 8.02 lakh tons and an average productivity of 527 kg/ha in 2023, it is one of India's oldest significant oilseed crops and is produced throughout 15.23 lakh hectares in semi-arid tropical, sub-tropical, and temperate areas (Anonymous, 2023). Because of their greater linoleic content, which makes them more resistant to oxidation and rancidity, sesame seeds have a long shelf life and high-quality oil up to 62.7%. Because the seed is high in vitamins E, A, B1, B2, niacin, minerals, and the amino acid methionine, as well as lignans such sesamin and sisamolin, it is employed in both the pharmaceutical and home sectors (Dwarka *et al.*, 2024). India utilizes all three seasons *Kharif, Rabi,* and *Summer* or more than one season in some regions to grow sesame. Most cultivation is done in Madhya Pradesh, Uttar Pradesh, Rajasthan, West Bengal, Andhra Pradesh, Maharashtra, Gujarat, Tamil Nadu, Odisha, and Karnataka. The objective of this project was to assess the impact, diffusion, and promotion of improved production technology, as well as train farmers on how modern methods of production might help raise income in Bundelkhand region of Madhya Pradesh's erratic climate. The opinions of farmers regarding high-tech agricultural technology will change due to these programs.

Materials and Methods

The institute arranged 70 demonstrations during kharif 2022 and 2023 on farmers' fields of the district in rainfed conditions to create awareness among farmers of Bundelkhand about the modern production system for their benefit. Both FP and the whole IT were used in establishing a demonstration in a 0.4-hectare farmer's field for every demonstration. In addition, the HY variety, fertilizer dosage, weedicide, and insecticides formed the complete package/innovated technology (Table 1). Further, data were collected from the farmers' practice plots and from advanced technologies. The following formulae were used to calculate the extension gap, technology gap, technology index, and cost-benefit ratio:

Extension gap (qha-1) = (Yield of Improved technology plot (qha-1) – Yield of Farmers practice (qha-1)

Technological gap ((qha-1)) = Potential yield (qha-1) –demonstration yield (qha-1)

Technology index (%) = Technology gap x 100 / Potential yield

Additional returns (Rs.) =Demonstration returns (Rs.) –Farmers practice returns (Rs.)

Effective gain (Rs.) = Additional returns (Rs.) – Additional cost (Rs.)

Incremental B:C ratio = Additional returns (Rs.) / Additional cost (Rs.)

Table.1 Components of whole package or Improved Technology of FLDs

S.No.	Technological Interventions for Whole package/ Improved Technology	
1	HY Varieties	TKG-306 & 308
2	Seed rate	2.0 kg
3	Seed treatment	Carbendazim @3g/kg seed
4	Fertilizers	60N: 40P:20K
5	Weedicide	Quizolofop-N- ethyl (Turga Super)
6	Pesticide (Need based)	Imidacloprid and/or Profenophos

Table.2 Seed yield and other parameters for gap analysis of FLD on sesame

S. No	Year	Number of demonstrations	Area (ha)	Mean Yield (Kg/ha)		Extension gap (kg/ha)	Technology gap (kg/ha)	Technology index (%)
				IT	FP	IT	FP	IT
1	2022	30	12.ha	698	402	296	102	12.75
2	2023	40	16.ha	683	352	331	117	14.625
mean		**70**	**28 ha**	**691**	**377**	**314**	**110**	**13.7**

Where EG stands for extension gap, TG for technological gap, TI for technology index, and IT for improved technology.

Table.3 Economic analysis of various economic parameters under IT as well as FP

Year	Cost of cultivation (Rs/ha)		Mean gross returns(Rs/ha)		Net returns (Rs/ha)		B:C ratio		Additional Cost under IT (Rs. /ha	Additional gross return (Rs./ ha)	Additional net return (Rs
	IT	FP	IT	FP	IT	FP	IT	FP			
2022	23644	14416	73238	42175	49594	27759	3.23	3.16	9228	31063	21835
2023	23644	14416	68275	35200	44631	20784	2.89	2.44	9228	33075	23847
Total	**23644**	**14416**	**70756.5**	**38688**	**47113**	**24272**	**3.06**	**2.8**	**9228**	**32069**	**22841**

Where IT=Improved technology; FP=Farmers practice; AC:Additional Cost under IT, AG:Additional gross return, AN: Additional net return

Results and Discussion Farmers Practice proved to be inadequate based on the study's result; this is because significantly high mean seed production value, 698 kg/ha, was recorded by much higher under Improved Technology, which is more than two-fold that obtained under Farmer Practice. Therefore, improvement technology needs focused efforts by improving farmers' perspectives in changing their perceptions toward technology for an improved outcome. (Table -2) But the highest productivity was recorded in 2022 under both IT and its corresponding FP, which could be because of edaphic conditions and rainfall pattern. The result of the present study is in consonance with that of Meena and Dudi (2018) and Kushwaha *et al.* (2018).

Extension Gap: The mean yield under farmers' practices (FP) is nearly equal to the mean Extension Gap (EG) over years, which was found to be 296 kg/ha. Farmers' inadequate adoption of improved technology (IT) necessitated the use of comprehensive strategies to quickly close this gap. The results above are consistent with those of Shiv Ratan *et al.* (2021). One of the best strategies to alter farmers' attitudes toward improved technology (IT) is through these demonstrations. Furthermore, frequent field trips and trainings may also alter farmers' perspectives. (Dayananad *et al.*, 2012; Katare *et al.*, 2011; Mitra and Samajdar, 2010; Thakur *et al.*, 2022).

Technology Gap (TG): During the investigation period, an average TG of 102 kg/ha was found. The probable reason for this disparity may be attributed to the rain-fed conditions, pattern of precipitation, and marginal and sub-marginal soils (Meena and Singh 2017 and Singh SB, 2017).

Technological Index (TI): The Technology Index indicates the viability of improved technology in the field. A low value indicates more desirability. Average TI stands at 13.70%, and it goes without saying that farmers will have to make a considerable effort to easily and quickly adapt improved technology into their fields. Arvind Kumar (2017), Balai *et al.* (2012), Iqbal *et al.* (2017), Rao *et al.* (2011), Shiv Ratan *et al.* (2020), and Shiv Ratan *et al.* (2021) Thakur *et al.* (2022) are all in accordance with the results of the present study.

The cost of cultivation for IT and FP was determined for economic analysis based on current input and output prices (Table 3). The cultivation cost was Rs. 14416 under FP and Rs. 23644 under IT. The average incremental cost under IT in the Tikamgarh district and Bundelkhand, which was at such low levels of adoption, remained at Rs. 9228. It is time to intensify efforts and alter the perception of farmers with regard to better technology and scientific interventions through FLDs, trainings, and in-person visits. The mean net return for the studied years was Rs. 47113 under IT and Rs. 24272 under

FP, where there lies a huge inconsistency of Rs. 22841 in added net return. It was found that IT would have increased the net income of farmers by 48.48%, which motivated them to adopt it. Furthermore, due to the significant quantity of output that was utilized under IT, the B: C ratios were found to be 3.06 under IT and 2.8 under FP (Thakur *et al.*, 2022, Sharma *et al.*, 2017, Meena and Singh, 2017, Athya and Panday, 2020a&b, Shiv Ratan *et al.*, 2020 and Shiv Ratan *et al.*, 2021).

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.NA

2.NA

3.NA

References:

Anonymous, 2021. Department of food and public distribution, Ministry of consumer affairs, food and public distribution, GOI.

Anonymous. 2023. Annual Report, 2023 of ICAR- AICRP on Sesame & Niger JNKVV campus Jabalpur (M.P.), 1.

Athya DP and Panday AK. 2020a. Biology of leaf webber and capsule borer, *Antigastra catalaunalis* (Dup.) in sesame. Journal of Entomology and Zoology Studies, 8(2): 55-61.

Athya DP and Panday AK. 2020b. Economic injury level of sesame leaf webber and capsule borer *Antigastra catalaunalis* (Duponchel). Indian Journal of Entomology, 82(4): 735-738.

Balai C M, Meena R P, Meena B L and Bairwa R K 2012. Impact of front line demonstration on rapeseed-mustard yield improvement. *Indian Res. J. Ext. Edu*., 12:113-116. Commodity Profile of Edible Oils for Sept. 2019

Dayanand, Verma R K and Mehta, SM. 2012. Boosting mustard production Technology through front line demonstrations. *Indian Res. J. Ext. Edu.*,12:121-123.

Dwarka, Thakur S, Katara VK , Chadar N and Parmar S. 2024. Introduction to Insect Pests of Sesame (*Sesamum indicum* L.) and their Management: A Review. Journal of Advances in Biology & Biotechnology, 27(12):378-384.

Iqbal A M, Shikari A B, Naseer S, Nagoor S, Aziz M, Dar Z, Ali J, Ganai M A and Parry G A 2017. Participatory varietal selection in rapeseed-mustard. *J Oilseed Brassica 8: 201-206*

Katare S, Pandey S K and Mustafa M. 2011. Yield gap analysis of rapeseed -mustard through frontline demonstrations. *Agriculture updates* 6(2):5-7.

Kumar A, Yadav D K and Rana D S 2012. Rapeseed-mustard in India: Present scenario, future projection and R & D issues. *Indian Farming* 62(8):14-21.

Kushwaha R S, Kumar R, Kaur A , Bhadouria VS and Gupta N. 2018. Impact of front line demonstration (FLD) on the yield of rapeseed-mustard in Gwalior district of MP. *Technofame* 7(1) 61-64.

Meena ML and Dudi A. 2018. Boosting the mustard production technology through front line demonstration in Pali district of Rajasthan. *Journal of oilseed brassica* 9(2):176-181

Meena ML and Singh D. 2017. Technological and extension yield gaps in green gram in Pali district of Rajasthan. *Legume Res* 40: 187-191.

Mitra B and Samjadar T. 2010. Yield gap analysis of rapeseed and mustard through frontline demonstration. *Agril. Ext Rev* 22: 16-17

Rao D M, Chandrashekhar P and Neeraiah R. 2011. Productivity enhancement in ground nut. *Indian Farming* 60:39-40.

Ratan S, Thakur SR, Nayak MK and Singh VK. 2021.Dissemination and popularization of improved technology through front line demonstrations among sesame farmers of Bundelkhand region. *Int. J. Curr. Microbiol. App.Sci (2021) 10(01): 2097-2101.*

Ratan S, Tiwari U K, Nayak M K and Thakur S R .2020. Assessment of relative impact of improved technology and scientific interventions on the income of sesame farmers in tribal area of Bundelkhand region. *Int. J. Curr. Microbiol.App. Sci.*, 9(7):809-813.

Sharma R, Bhati DS and Sharma SK. 2017. Impact of front line demonstration on rapeseed-mustard growers. *Journal of progressive Agriculture* 8(1): 115-118.

Singh, SB. 2017. Yield gap analysis of rapeseed mustard through front line demonstration under rainfed conditions in Uttarakhand. *Technofame* 6*(1):* 89-92.

Thakur S, Ratan S and Nayak MK. 2022. Dissemination and impact assessment of improved technology and scientific interventions through front line demonstrations among sesame farmers of Tikamgarh, Bundelkhand Region in Madhya Pradesh. J. *Oilseeds Res.*, 39(3 & 4) : 253-255.

Web links

https//www.nmoop.gov.in