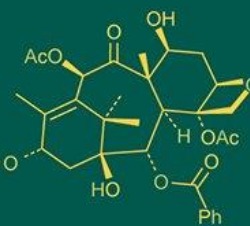
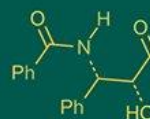


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Assessment of yield gaps and technology adoption in mustard through CFLDs in Chitrakoot, Uttar Pradesh

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Abstract

Cluster Front Line Demonstrations (CFLDs) on mustard (*Brassica juncea* L.) were conducted by DRI-Krishi Vigyan Kendra, Chitrakoot during 2022-23 and 2024-25 to assess yield gaps, economic viability, and technology adoption under Bundelkhand region. The average seed yield under demonstration plots ranged from 16.59 to 17.49 q/ha, which was significantly higher than farmers' practice (13.50-13.42 q/ha), resulting in a yield increase of 22.89% to 30.33%. The extension gap ranged from 3.09 to 4.07 q/ha, while the technology gap ranged from 7.51 to 8.41 q/ha. Economic analysis revealed higher net returns (₹63,621-₹64,346/ha) and benefit-cost ratio (3.14-3.17) under demonstrations compared to farmers' practices. The results indicated that CFLDs played a crucial role in enhancing productivity, profitability, and adoption of improved mustard production technologies in the Bundelkhand region.

Keywords: Mustard, CFLD, yield gap, technology index, economics, Bundelkhand

Introduction

Mustard (*Brassica juncea* L.) is an important part of edible oilseed crops. Indian farming system, its role is significant for oilseed security. In 2024-25 total production is 126.04 lakh metric tonnes, and net sown area is around 92.15 lakh hectares in India (PIB, 2025). Uttar Pradesh ranks 3rd in mustard production at a national level, but the particular Bundelkhand region faces several problems, such as poor adoption of improved technologies, erratic rainfall, and low soil fertility. and yield per ha compares low to other states' production. Mustard is a good income-generating crop because in 2025-26 the government decided the MSP is 5,950 Rs./Quintal, and if a cluster-based approach is used, farmers can change the mustard through processing and change the oil recovery to 36-46%, and the profit increase can compare to direct seed selling. The Cluster Front Line Demonstration (CFLD) programme, implemented through Krishi Vigyan Kendras (KVKs), aims to demonstrate improved crop production technologies at farmers' fields under real conditions. CFLDs are effective in bridging the gap between recommended practices and farmers' practices, thereby enhancing productivity and income. The present study was undertaken to evaluate the impact of CFLDs on mustard in the Chitrakoot district with the objectives: To assess yield gaps between demonstration and farmers' practices, evaluate economic benefits of improved technologies and study the extent of technology adoption among farmers.

Materials and Methods

Study Area & number of demos

The study was conducted in three blocks (Karwai, Pahadi & Manikpur) of the Chitrakoot district of Uttar Pradesh, located in the Bundelkhand region characterised by a semi-arid climate, low rainfall, and poor soil fertility. And implementation of demonstration in 2022-23 selected 43 farmers and covered 20 ha. Area with given improved mustard variety PM-30 & 2024-25: selected 150 farmers cover 60 ha area with given improved variety DRMR-1165 technology Improved production technologies demonstrated included:

- High yielding varieties
- Line sowing and optimum seed rate
- Balanced fertilization (DAP, urea)
- Integrated Pest and Disease Management (IPM/IDM)

- Scientific irrigation practices

Farmers' practice (local check) was used for comparison.

Data Collection and Analysis

Data on yield and economics were collected from demonstration and farmers' fields. The following indicators were calculated:

Extension Gap (q/ha) = Demonstration Yield - Farmers' Yield

Technology Gap (q/ha) = Potential Yield - Demonstration Yield

Technology Index (%) = (Technology Gap) / (Potential Yield) × 100

(Potential yield assumed = 25 q/ha)

Economic parameters

Gross cost: Total Fixed Cost + Total Variable Cost

Gross return: (Total Output) / (Market Price per Unit)

Net return: Gross return - Gross cost

Benefit-Cost (B:C) ratio: (Gross return) / (Gross Cost)

Results and Discussion

In our experiment, we distributed the 2022-23 PM-30 variety and its potential yield of 18-24 q/ha, and in 2024-25, we distributed DRMR-1165, whose potential yield is reported as 23-26 q/ha. As per the variety's nature, our research yield is also under the given potential yields' average yield.

a. Yield Performance

The results revealed that demonstration plots recorded significantly higher yield compared to farmers' practice. Show the Table 1.

Table 1; Yield performance under the Demo and Local field.

Year	Demo Yield (q/ha)	Local Yield (q/ha)	% Increase
2022-23	16.59	13.50	22.89
2024-25	17.49	13.42	30.33

According to the farmer's field with local practices, yield gain is 13.50 years (2022-23), and under the demonstration field with the PM-30 variety with all improved technology used, it is 16.59 quintals per hectare. And show an increasing 22.89% compared to local farmers' practices, with the same result of a 30.33% yield increase in 2024-25 as compared to the farmer's field and the demonstrated field. The increase in yield may be attributed to adoption of improved varieties, balanced nutrient management, and effective pest control measures. A similar report found maximum yield under a frontline demonstration plot (Hooda *et al.*, 2024) ^[2].

b. Yield Gap Analysis

1. Extension Gap

Indicates the need for wider dissemination of improved technologies among farmers. During 2022-23, 3.09 q/ha and 2024-25, 4.07 q/ha, the yield increased, covering the wider spread of the extension gap, similar to a similar report that found the extension gap observed in farmers' practices (Hooda *et al.*, 2024; Sarkar *et al.*, 2025) ^[2, 4].

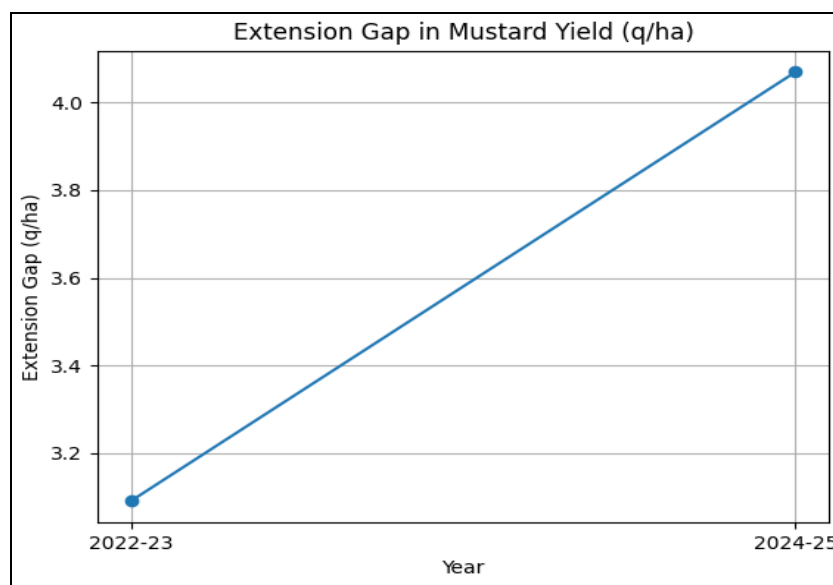


Fig 1: Extension gap in Mustard Field Year 2022-23 & 2024-25

2. Technology Gap

The reduction in yield can be reasoned in terms of the technology gap, which reflects the difference between the demo inputs plot and what is actually implemented in the field. In 2022-23, the yield was 8.41 q/ha, while in 2024-25 it decreased to 7.51 q/ha. This change indicates the adoption of technology. Reducing this technology gap extension extent like tools like awareness and training, Knowledge of improved inputs can help improve yields in the future year, similar to the better yield gain after reducing the technology gap reported (Vishal *et al.*, 2022) ^[5].

3. Technology Index

The technology index decreased from 33.64% in 2022-23 to 30.04% in 2024-25, indicating an improvement in the performance of demonstrated technologies under farmers' field conditions. A lower technology index showcases the smaller gap between potential yield and actual yield; however, improvement may be better attributed to understanding, increased ground-field experience and its acceptance of the improved technologies.

c. Economic Analysis

In 2022-23, local farmer practices' gross cost is Rs. 25,500 and front-line demonstration gross cost is Rs. 29,300, but net return is higher in demonstration (Rs. 63,621) than farmers' practices (Rs. 50,100). The B:C ratio is also higher, 3.17, compared to farmers' practices, 2.96. In 2024-25, local

farmer practices' gross cost is Rs. 27,900 and front-line demonstration gross cost is Rs. 30,100, but net return is higher in demonstration (Rs. 64,346) than farmers' practices (Rs. 44,568). All similar findings were observed in previous research (Hooda *et al.*, 2024; Sarkar *et al.*, 2025)^[2, 4]. Fig.2 show the economical trend both years.

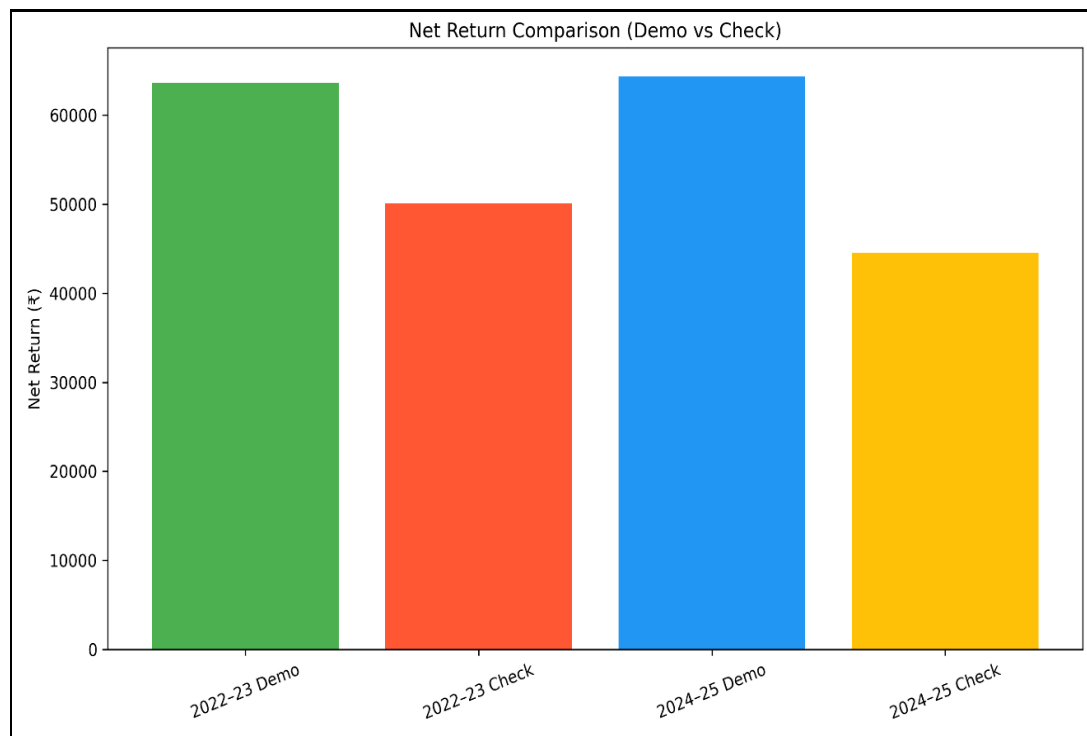


Fig 2: Net return compares both year 2022-23 & 2024-25

d. Statistical analysis

The statistical analysis shows that demo yield (17.04 q/ha) is higher than local farmers' practices' yield (13.46 q/ha). Variability is slightly higher in demon plots; both have low CV, indicating stable performance on the yield.

Parameter	Demo Yield (q/ha)	Local Yield (q/ha)
Mean (q/ha)	17.04	13.46
Standard Deviation (SD)	0.64	0.06
Standard Error (SE)	0.45	0.04
Coefficient of Variation (CV%)	3.73%	0.42%

Conclusion

The study clearly demonstrates that CFLDs are an effective approach for improving mustard productivity and profitability in Chitrakoot district. The yield increase of up to 30.33%, higher net returns, and improved B:C ratio indicate that adoption of improved technologies can substantially enhance farmers' income. The reduction in technology index over time also suggests increasing acceptance of demonstrated technologies. Therefore, scaling up CFLDs and strengthening extension services can play a vital role in achieving oilseed self-sufficiency in the Bundelkhand region.

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