Journal of Natural Resource Conservation and Management
Vol. 6, No. 2, pp 165-171, 2025
doi: 10.51396/ANRCM.6.2.2025.165-171

Appraisal of recommended practices in enhancing oil seed and pulse's performance in India-A review

Rajan Bhatt[1,*] and Bikranjit Singh[1]

[1]*Krishi Vigyan Kendra, Amritsar-143601, Punjab Agricultural University, Punjab, India*
**Corresponding author email: rajansoils@pau.edu*

Received : September 02, 2025
Revised : November 08, 2025
Accepted : November 10, 2025
Published : December 31, 2025

ABSTRACT

The most recent, recommended and best ways to cultivate oil seeds and pulses have an effect on their yield and cost from the old indigenous practices. The current collated overview from across India shows that demonstration plots have led to yield improvements in many states. For example, pulses and oilseeds have had an average rise of 42.7%, showing how they may change agricultural yields. Different states' demonstrations showed different technological gaps and indices. The districts of Punjab showed lower indices (4.30–29.1%) despite considerable gaps, whereas Nagaland (33.43–47.41%) and Assam's Golaghat (49.65%) showed the largest yield disparities. Higher indices often indicate larger production gaps and greater possibilities for better extension efforts, according to regional variances associated with agroclimatic and soil conditions. Demonstration plots in different states demonstrated different economic gains. For example, peanuts in Tamil Nadu made ₹ 35,077/ha with a B:C ratio of 2.95, whereas chickpea and greengram in Madhya Pradesh made ₹ 6,757/ha and ₹ 22,571.4/ha, with B:C ratios of 2.91 and 4.78, respectively. Rajasthan and Haryana said they got ₹ 10,180/ha for clusterbean (B:C 4.99) and not much more for demonstration plots (B:C 1.22).

Keywords: Oilseeds, pulses, demonstration, yields, technological gaps, effective gains, B:C ratio

INTRODUCTION

Cluster Front Line Demonstrations (cFLDs) is a new approach that attempts to bridge the gap between scientific research and indigenous agricultural practice for growing oilseed and pulses, which further helps a lot in achieving the targets of diversification. They offer a helpful platform for connecting farmers, agricultural researchers, and extension agents to showcase innovative, scientifically recommended farming methods to boost land productivity and profitability (Bhatt *et al*., 2024; Prasad *et al*., 2022). Apart from facilitating the dissemination of innovative agricultural technologies, this initiative ensures that farmers have practical experience with modern cultivation methods, ultimately increasing adoption rates and enhancing farming outcomes. Front-Line Demonstrations (FLDs) were first proposed by the Indian Council of Agricultural Research (ICAR) in the mid-1980s as part of the Oilseed Crop Technology initiative. This movement gradually spread to include pulses and other crops, culminating in Cluster Front Line Demonstrations. The purpose of cFLDs is to show how well improved cultivars, state-of-the-art agronomic practices, and modern technological innovations function in farmers' fields under real-world conditions. Using cFLDs in cluster mode allows agricultural scientists and extension professionals to engage with more farmers, increasing the effect and visibility of the demonstrations. Though different states of the countries contributing differently as shown in Figure 1.

Krishi Vigyan Kendras (KVKs), the grassroots extension arms of ICAR, play a pivotal role in implementing cFLDs by selecting suitable demonstration sites based on agroclimatic conditions, soil types, and prevailing farming

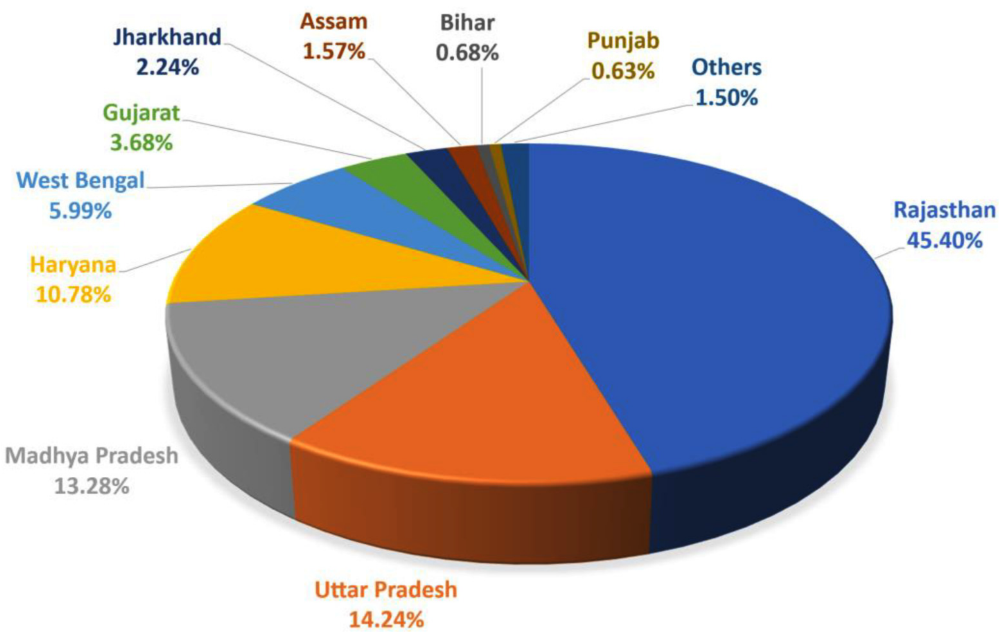

Fig. 1. Percent share of Indian states in production of oilseeds in 2023-24

practices to ensure regional relevance. They provide participating farmers with training on improved seed varieties, nutrient and water management, pest and disease control, post-harvest practices, and soil health management, thereby enhancing technical skills and confidence in adopting innovations. The effectiveness of FLDs is assessed through indicators such as grain yield, technology index, extension yield gap, and economic parameters including additional costs, returns, and benefit–cost ratios, which together reflect feasibility, productivity gaps, and economic viability. By clearly demonstrating the advantages of scientific practices over traditional methods, cFLDs act as an effective technology transfer tool, encouraging wider adoption and improving farm productivity and profitability.

Beyond boosting output, cFLDs promote ecologically responsible and resource-efficient agricultural methods, which contribute to sustainability. Many of these demonstrations emphasise the use of biofertilizers, integrated pest management (IPM), water-saving techniques, and precision agriculture tools. By minimising an excessive dependence on chemical inputs, cFLDs guarantee sustainable agricultural practices, reduce input costs, and enhance long-term soil health (Bhatt *et al*., 2022). Moreover, the financial benefits of cFLDs extend beyond individual farmers. With more oilseeds and pulses produced locally, the country's food security and agricultural commodity self-sufficiency are improved. India is a major consumer of edible oils and pulses, therefore boosting domestic production through improved farming methods reduces dependency on imports and boosts the economic stability of the agriculture sector. In different countries, the area as well as production of rapeseed-mustard from 2019-20 to 2023-24 of India is shown below for a clear understanding (Fig. 2)

Till the early 1970s, India's edible oil imports remained below 1 lakh tonnes per year; however, during the second half of the 1970s, stagnating domestic oilseed production led to a sharp rise in imports, which reached about 15 lakh tonnes annually and further increased to nearly 20 lakh tonnes by 1987–88. In response, the Technology Mission on Oilseeds (TMO) was launched in 1986, resulting in a significant turnaround, with oilseed production increasing from 11.3 million tonnes to 20.1 million tonnes and imports declining to about 1 lakh tonnes by 1992–93. Subsequently, the post-1991 economic liberalization era marked a renewed opening of the edible oil sector to imports, particularly palm oil from Malaysia and Indonesia. In the post-COVID-19 period, India began reassessing excessive globalization under the Atmanirbhar Bharat strategy, and in this context, the Ministry of Agriculture and Farmers' Welfare launched the National Mission on Edible Oils–Oil Palm (NMEO-OP) in 2021 with a budget outlay of ₹ 11,040 crore to expand oil palm cultivation to 10 lakh hectares.

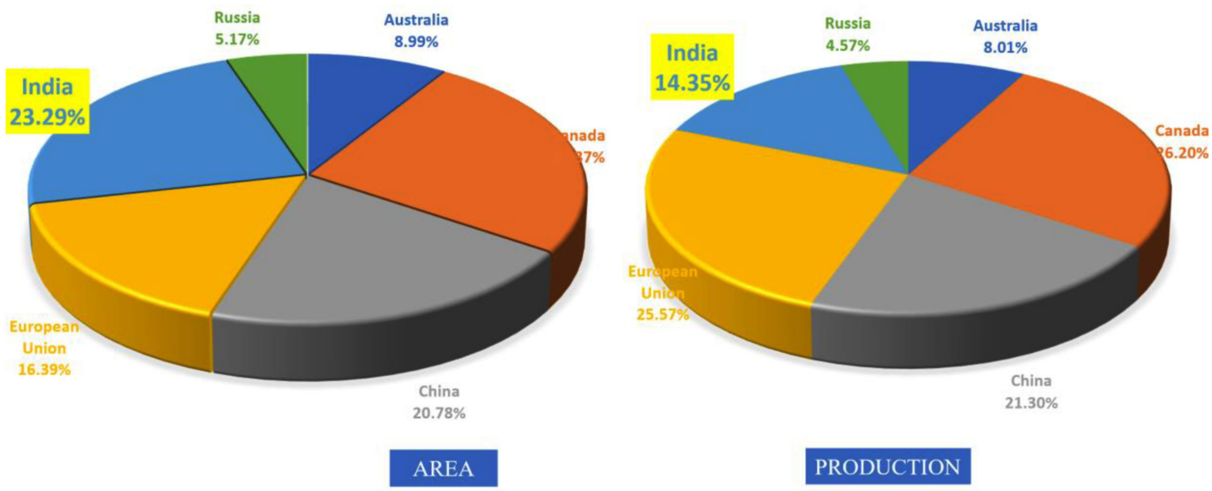

Fig. 2. Percent share of countries in Rapeseed-Mustard area and production (2019-20 to 2023-24)

The cFLD model promotes collaboration among government agencies, private agribusiness firms, research institutes, and agricultural colleges to facilitate the development and dissemination of improved agricultural technologies and provide farmers with updated technical support. However, its implementation faces challenges such as limited funding for large-scale demonstrations, logistical constraints in remote areas, farmers' resistance to adoption, and climate variability affecting outcomes. Addressing these issues requires enhanced financial support, effective farmer engagement strategies, and targeted policy interventions, making cFLDs an important approach for accelerating the adoption of improved farming practices. Present review collected different studies to showcase the effects of recommended technologies on yields, technology yield gap, extension yield gap, technology index and finally onto the incremental benefit cost ration as observed in the demonstration plots over the farmer's plots.

MATERIALS AND METHODS

In order to assess how the recommended set of practices affected the economics and yield of oil seed and pulses in India, fourteen research papers were examined. The yield enhancements (equation 1), technology yield gap, extension yield gap, and technology index (equations 2, 3, and 4) were calculated using economic principles (Bhatt *et al.*, 2024; Prasad *et al.*, 2022) and their calculations are displayed in equations no. 5 and 6.

% Increase in the yield= (Yield in demonstration plots – Yield in farmers' practice plots)/ Yield in farmers' practice plots) × 100 …(1)

Technology yield gap (kg ha^{-1}) = Potential yield (kg ha^{-1})- Demonstration yield (kg ha^{-1}) …(2)

Extension yield gap (kg ha^{-1}) = Demonstration yield (kg ha^{-1})- Farmers' practice yield (kg ha^{-1}) …(3)

Technology index (%) = [(Potential yield (kg ha^{-1})- Demonstration yield (kg ha^{-1})]÷Potential yield (kg ha^{-1})×100 …(4)

Effective gain (₹ ha^{-1}) = Additional returns (₹ ha^{-1})- Additional cost (₹ ha^{-1}) …(5)

Incremental B:C ratio = Additional returns (₹ ha^{-1}) ÷ Additional cost (₹ ha^{-1}) …(6)

RESULTS AND DISCUSSION

Yield enhancements

Under the KVK initiatives, the productivity of black gram in Kathua grew by 52.41% (Jamwal *et al.*, 2020). In Poonch, the productivity of chickpea increased by 40.60 percent, moong by 35.50 percent, mash by 49.71 percent, and rajmash by 28.73 percent, according to Kumar *et al.*, 2017 (Fig. 3). According to Singh *et al.*'s research from 2021, the yield of FLDs grown on summer moong in Sonepat in Haryana increased by 21.3%, going from 8.9 q/ha to 10.8 q/ha. According to Prasad *et al.*'s research from 2022, FLD plots in Uttar Pradesh were found to have boosted pigeonpea and greengram yields by 29.7% and 30.4%, respectively. FLDs on Gobhi sarson led to a 9.6% increase in FLD plots in the state of Punjab (Bhatt *et al.*, 2024), whereas yardlong bean showing a 36.75% improvement in Shivamogga in the state of Karnataka (Adivappar *et al.*, 2018) reported a similar improvement. Other noteworthy findings include an increase of 35.4% for greengram

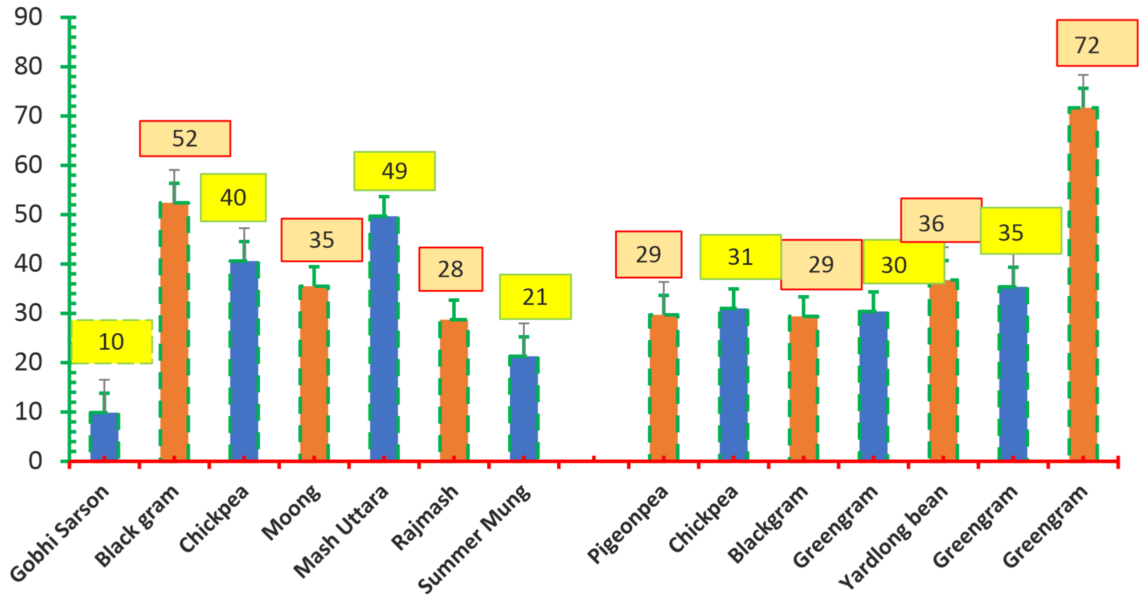

Fig. 3. Observed yield enhancement (%) in demo plots as compared to conventional farmer's plots

populations in the state of Rajasthan (Meena and Singh, 2017) and an extraordinary growth of 71.67% for greengram populations in the state of Assam (Bezbaruah and Deka, 2020) (Fig. 3). It is clear from these findings that FLDs have the potential to significantly improve agricultural productivity, particularly in the areas of oilseed and pulse production.

Technology index, technology gap, and extension yield gap

Soybean, mustard and linseed demonstrations in Madhya Pradesh revealed moderate technology gaps (1.20–4.56 q/ha) and technology indices ranging from 7.1 to 22.5% (Chauhan *et al.*, 2020; Shaktawat and Chundawat, 2021; (Table 1). Tests conducted on toria, groundnut, and sesame in Nagaland revealed technology indices that were higher than average (33.43%–47.41%), indicating larger differences in yield realization (Imtisenla *et al.*, 2020). Rajasthan received only 12.74% of the technology index (Ali *et al.*, 2022), compared to 21.9% for Telangana's groundnut demonstrations (Marlabeedu *et al.*, 2022). Although there were notable technological differences in Punjab's districts of Pathankot, Sangrur, and Ferozepur (4.7–6.4 q/ha), the technology indices remained low (4.30–29.1%), indicating that people were more inclined to employ superior methods (Sharma and Singh, 2023; Kaur *et al.*, 2023; Kaur and Aulakh, 2020) (Table 1). There are significant technological differences in Assam's mustard and sesame demonstrations; Golaghat has the highest technology grade of 49.65% (Saikia *et al.*, 2024). As per table technology adoption differs by region, might be due to different agroclimatic conditions and texturally divergent soils. Greater yield gaps and greater potential for improved extension strategies are indicated by higher indexes.

In Madhya Pradesh, mustard showed a technology gap of 4.10 q/ha with a 14.84% technology index (Shukla *et al.*, 2022), while soybean and mustard recorded lower gaps (2.04 and 1.42 q/ha) with indices of 12.0% and 7.15%, respectively (Kumar *et al.*, 2021). Assam reported a lower technology gap (1.68 q/ha) but higher extension yields gap (3.24 q/ha), suggesting scope for improved transfer of practices (Kumar *et al.*, 2023) (Table 1). Haryana exhibited a higher technology index (22.54%), reflecting relatively larger yield gaps and highlighting the need for enhanced adoption of improved technologies (Hooda *et al.*, 2024).

Enhancement in economics

According to Sasikumar and Rathika (2023), groundnut demonstrations in Tamil Nadu showed effective benefits of ₹ 35,077/ha with a B:C ratio of 2.95, which was higher than the FP ratio of 1.90. With a demonstration B:C ratio of 2.91, the chickpea production at Sidhi, Madhya Pradesh, was ₹ 6,757/ha (Singh *et al.*, 2022) (Fig. 4). In Harda, greengram

Table 1. Effect of FLD plot on technology index, extension yield gap and technology index

Sr. No.	State	FLD conducted	Crop	Technology gap (q/ha)	Extension yield gap (q/ha)	Technology index (%)	Reference
1.	Madhya Pradesh	KVK, Mandsaur	Soybean Mustard Linseed	4.56 3.55 1.20	2.51 4.63 5.00	22.5 16.2 7.1	Shaktawat and Chundawat (2021)
2.	Madhya Pradesh	KVK, Datia	Mustard	4.02	2.87	12.75	Singh *et al.* (2020)
3.	Nagaland	KVK, Kohima under NFSM	Toria Groundnut Sesame	1.15 1.56 1.72	4.75 8.06 2.67	39.55 47.41 33.43	Imtisenla *et al.* (2020)
4.	Telagana	KVK, Kampasagar Under NMOOP	Groundnut	4.98	6.58	21.9	Marlabeedu *et al.* (2022)
5.	Madhya Pradesh	KVK, Seoni	Mustard	4.10	2.37	14.84	Shukla *et al.* (2022)
6.	Assam	KVK, Assam	Mustard	1.68	3.24	14.19	Kumar *et al.* (2023)
7.	Haryana	KVK, Fatehabad Under NMOOP	Mustard	3.03	2.92	22.54	Hooda *et al.* (2024)
8.	Rajasthan	KVK, Padampur	Groundnut	3.5	3.57	12.74	Ali *et al.* (2022)
9.	Madhya Pradesh	KVK, Gawalior	Soybean Mustard	2.04 1.42	2.88 3.20	12.0 7.15	Kumar *et al.* (2021)
10.	Assam	KVK, Golaghat	Sesamum	1.08	4.96	49.65	Saikia *et al.* (2024)
11.	Punjab	KVK, Pathankot	Mustard	6.4	5.6	29.1	Sharma and Singh (2023)
12.	Punjab	KVK, Sangrur	Mustard	5.04	1.54	6.92	Kaur *et al.* (2023)
13.	Punjab	KVK, Ferozepur	Mustard	4.7	1.0	4.30	Kaur and Aulakh (2020)

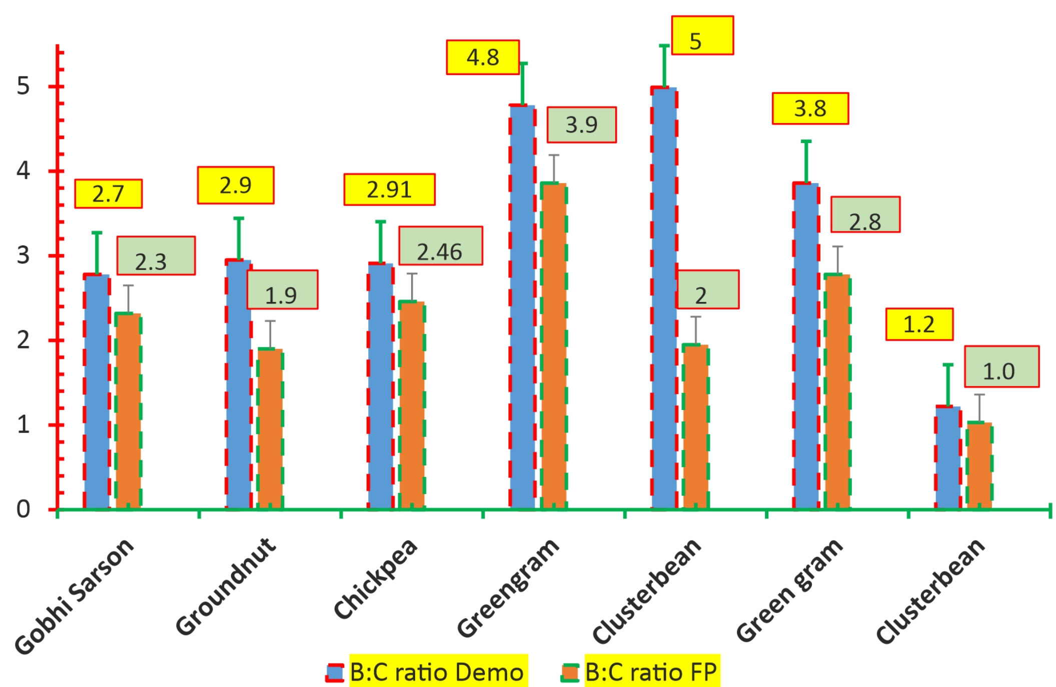

Fig. 4. Effect of the recommended practices on benefit cost ratio in demo plots compared with farmers plots receiving indigenous practices

demonstrations reported high effective gains of ₹ 22,571.4/ha, with an exceptional demo B:C ratio of 4.78 (Bharti *et al*., 2024). In Rajasthan, clusterbean recorded effective gains of ₹ 10,180/ha and a B:C ratio of 4.99 (Jain *et al*., 2017). Demonstrations at Bharatpur and Jodhpur also showed strong economic performance in chickpea and greengram, respectively, with demo B:C ratios above 3.0 (Puniya *et al*., 2020). In Haryana, demonstration plots reported with low economic returns, with a demo B:C ratio of 1.22, reflecting minimal improvement over FP (Satyajeet *et al*., 2021) (Fig. 4).

CONCLUSION

Improved oilseed and pulse producing practices in demonstration plots reported with overall higher yield and benefits than the farmers indigenous methods. Regional performance differences require context-specific treatments.

REFERENCES

Adivappar, N., Manjesh, M., and Sharanabasappa. (2018). Impact of frontline demonstrations on productivity and economics of yardlong bean *Vigna unguiculata* subsp. *sesquipedalis* (L.) Verde. *International Journal of Farm Sciences, 8*(1), 86–89. https://doi.org/10.5958/2250-0499.2018.00020

Ali, S., Singh, B., and Meena, R. (2022). Technology gap assessment and productivity gain through frontline demonstration in groundnut. *International Journal of Agricultural Sciences, 18*(1), 396–401.

Bezbaruah, R., and Deka, R. S. (2020). Impact of cluster frontline demonstration on productivity and profitability of greengram in Morigaon district of Assam. *Journal of Krishi Vigyan, 9*(1), 164–169.

Bharti, O. P., Jatav, R. C., Tiwari, S. K., Baraiya, B. R., Chouhan, P., and Singh, S. R. K. (2024). Impacts of cluster frontline demonstrations on yield and economics of green gram in Madhya Pradesh, India. *Legume Research, 47*(11), 1944–1950. https://doi.org/10.18805/LR-5250

Bhatt, R., Astha, Kaur, R., and Singh, B. (2024). Impact of scientific interventions on gobhi sarson yields, yield gap indices and profitability in tropics. *Journal of Soil and Water Conservation, 23*(3), 320–327. https://doi.org/10.5958/2455-7145.2024.00038.4

Bhatt, R., Singh, P., Majumder, D., and Kaur, G. (2022). Climate-smart technologies for reducing water footprints in different cropland ecosystems: A meso analysis. *Proceedings of the Indian National Science Academy*. https://doi.org/10.1007/s43538-022-00148-4

Hooda, V., Kumar, S., and Singh, S. K. (2024). Estimation of gap and economic analysis of CFLD mustard crop. *Journal of Agricultural Research and Technology, 49*(1), 127–131.

Imtisenla, Pongen, L. Y., Temjennungsang, Sema, K., Pienyu, K. M., Zhiete, and Zhimomi, V. A. (2020). Oilseeds production gaps under cluster frontline demonstration in Kohima district of Nagaland, India. *International Journal of Current Microbiology and Applied Sciences, 9*(5), 2023–2028.

Jain, L. K., Parewa, H. P., and Nandan, B. (2017). Productivity and profitability analysis of clusterbean at farmers' field in Barmer district of Rajasthan. *Journal of Food Legumes, 31*(2), 119–122.

Jamwal, A., Mahajan, V., Ajrawat, B., Kumar, A., and Sharma, V. K. (2020). Impact of cluster frontline demonstrations on yield of black gram (*Vigna mungo*) under rainfed conditions in Kathua district of Jammu and Kashmir. *International Journal of Chemical Studies, 8*(4), 3314–3316.

Kaur, R., Singh, M., and Kumar, A. (2023). Impact of cluster frontline demonstrations on productivity and profitability of gobhi sarson in Sangrur district of Punjab. *Journal of Oilseed Brassica, 14*(1), 85–88.

Kaur, J., and Aulakh, G. S. (2020). Enhancing rapeseed (*Brassica napus* L.) productivity through frontline demonstrations in Ferozepur district of Punjab. *Journal of Oilseed Brassica, 11*(1), 91–94.

Kumar, A., Hada, N., Gurjar, L. S., and Jatav, C. B. S. (2021). Frontline demonstration as an effective means for increasing yield of oilseed crops. *Journal of Pharmacognosy and Phytochemistry, 10*(2), 566–567.

Kumar, B., Devi, M. T., Saikia, P., Bordoloi, R. M., Tripathi, A. K., Kumar, R., and Sinha, P. K. (2023). Performance of cluster frontline demonstrations on rapeseed in Assam. *Indian Journal of Hill Farming, 36*(Special Issue), 58–62.

Kumar, S., Mahajan, V., Sharma, P. K., and Parka, S. (2017). Impact of frontline demonstrations on production and productivity of pulses under rainfed ecology in mid-hills of Jammu and Kashmir, India. *Legume Research.*

Marlabeedu, S., Bharath, T., Pallavi, S., Himabindu, T., Shankaraiah, M., and Sumalini, K. (2022). Impact analysis of cluster frontline demonstrations on groundnut in Nalgonda district, Telangana. *Indian Journal of Extension Education, 58*(4), 66–70.

Meena, M. L., and Singh, D. (2017). Impact assessment of frontline demonstrations on greengram: Experience from rainfed conditions of Rajasthan. *Journal of Applied and Natural Science, 9*(4), 2456–2460.

Prasad, A., Verma, L. C., Kumar, V., Singh, L. P. K., Singh, V. K., and Anand, R. K. (2022). Impact of frontline demonstrations on yield of pulses. *The Pharma Innovation Journal, 11*(Special Issue 7), 2100–2102.

Puniya, M., Chandawat, M. S., Nagal, G., Jeetarwal, R., Ola, B., and Kumar, A. (2020). Scaling up of green gram production under frontline demonstrations in Jodhpur district of Rajasthan, India. *International Journal of Current Microbiology and Applied Sciences, 9*(1), 1982–1989. https://doi.org/10.20546/ijcmas.2020.901.224

Chauhan, R., Rikhari, Y. C., Kumar, P., and Singh, A. K. (2020). Evaluation of frontline demonstration on mustard crop in Bundelkhand zone. *Indian Journal of Extension Education, 56*(1), 18–22.

Saikia, P., Deka, B. C., and Das, P. (2024). Impact assessment of cluster frontline demonstrations programme on oilseed crops in Golaghat district of Assam. *Indian Research Journal of Extension Education, 24*(2), 80–85.

Sasikumar, K., and Rathika, K. (2023). Impact of cluster frontline demonstrations on yield enhancement of groundnut (*Arachis hypogaea* L.) in Vellore district of Tamil Nadu, India. *International Journal of Environment and Climate Change, 13*(11), 3678–3682. https://doi.org/10.9734/ijecc/2023/v13i113547

Satyajeet, Satpal, Dhanda, S. K., and Kumar, J. (2021). Yield and gap analysis of improved crop production technology in clusterbean through participatory approach. *Forage Research, 47*(2), 245–248.

Shaktawat, R. P. S., and Chundawat, G. S. (2021). Technological and extension yield gaps in oilseed crops in Mandsaur district of Madhya Pradesh. *Journal of Krishi Vigyan, 9*(2), 206–209.

Sharma, S., and Singh, N. D. (2023). Impact assessment of cluster frontline demonstration on yield gap of gobhi sarson (*Brassica napus* L.) in sub-mountainous area of Punjab, India. *The Pharma Innovation Journal, 12*(12), 1003–1006.

Shukla, N., Singh, N. K., and Chaturvedi, P. (2022). Yield and extension gap analysis through frontline demonstration in mustard crop. *The Pharma Innovation Journal, 11*(Special Issue 3), 1523–1526.

Singh, J., Singh, K., Hemender, and Premdeep. (2021). Impact assessment of frontline demonstrations on summer mung productivity under irrigated agro-ecosystem of Haryana. *Legume Research.* https://doi.org/10.18805/LR-4517.

Singh, A. K., Chauhan, R., Rikhari, Y. C., and Kumar, P. (2020). Evaluation of frontline demonstration on mustard crop in Bundelkhand zone. *Indian Journal of Extension Education*, 56(1), 18–22.