Increasing the Productivity and Profitability of Lentil Through Front Line Demonstrations under Irrigated Agro Ecosystem in Malwa Region of Madhya Pradesh

S.R. Jakhar[1], S. Tripathy[1], B. Sharma[1], C.R. Kantwa[1], R. Ghaswa[1], S.R.K. Singh[2]

10.18805/LR-5482

ABSTRACT

Background: Lentil (*Lens culinaris* Medik.) is a legume crop of *Fabaceae* family. It is one important winter crops which plays a major role in supplementing the income of Ratlam district of Madhya Pardesh. One of the major constraints of pulses in India and also in lentil is low productivity due to non-adoption of recommended package of practices and improved varieties.

Methods: This study was implemented by the Krishi Vigyan Kendra, Jaora, Ratlam District (M.P) during *rabi* season in six blocks of Ratlam district. A total of 200 demonstration in farmer's fields of Ratlam district during 2021-22, 2022-23 and 2023-24. The demonstration included improved Lentil variety (IPL-316), seed rate (40 kg/ha), seed treatment, integrated nutrient management (INM) as per STV, water management at critical growth stages, weed management and application of IDM module for disease management.

Result: The results of improved technological interventions brought out that the yield of lentil could be increased by between 21.2% to 56.1%. The extension gap and technology gap index were ranged between 2.3 to 4.6 q/ha and 1.6 to 2.8 q/ha, respectively. The technology index varied was ranging between 10.7 to 18.9% indicating that adoption of improved production technologies, productivity of lentil can be increased which will consequently uplift the socio-economic levels of the farming communities.

Key words: Constraints, Demonstrations, Economics, Extension gap, Lentil, Problems, Technology, Yield.

INTRODUCTION

Lentil (*Lens culinaris* Medik.) is one of the most important winter legume crops which is grown in irrigated cropping systems, tolerant to drought and is commonly grown in the world (Sarker *et al*., 2003).

India ranked first in the lentil area and second in the production with 43 and 37 per cent of world area and production, respectively (Yadav *et al*., 2020). There is a need to increase both area and productivity of lentil in the country, with improved varieties and matching production technologies. This requires both large scale demonstrations and strong extension programmes to disseminate proven location specific technologies. Pulses with their unique ability of leaf litter fall, biological N_2 fixation (BNF) and deep root system may be a suitable option to improve the soil fertility.

The major constraints responsible for lower yield potential in lentil are unfair crop production technologies, *viz*, used improper method of sowing (broadcast method), use of poor quality seed, unawareness about seed treatment, imbalance use of external inputs (fertilizer, weedicide and pesticide), adopt least resistant varieties to disease and pest (Prasad *et al*., 2012b). Crop genotypes may behave differently due to their structure, particularly poor plant growth. In such situations, plant populations can play an important role in improving crop productivity (Prasad *et al*., 2012a). The main reason for this may be that most of the technology is yet to reach the farmers' fields; therefore, there is an urgent need for a latest production technology transfer system in this area. Advanced and latest technology transfer system can prove to be effective. Many researcher reported that improved crop production cultivation practices (Pooniya *et al*., 2015 and Ali, 1998) such as seed treatment, high yield varieties, line sowing, integrated weed and pest management have improve productivity of legumes. These good management practices have the potential to enhance the lentil production in the Ratlam district.

The CFLD is an approach to speed the extension of proven technologies at farmers' fields in a participatory mode with the objective to find out the maximum available resources for crop production and also to bridge the productivity gaps by increasing production (Kumar and Jakhar, 2020). Most of the farmers of Ratlam district grow only a confined variety of lentil, which gives low yields and

[1]Krishi Vigyan Kendra, Jaora, Ratlam-457 340, Madhya Pradesh, India.
[2]Agricultural Technology Application Research Institute, Zone IX, Jabalpur-482 004, Madhya Pradesh, India.

Corresponding Authors: S. Tripathy and C.R. Kantwa; Krishi Vigyan Kendra, Jaora, Ratlam-457 340, Madhya Pradesh, India.
Email: sarveshtripathy@gmail.com, crkantwa@gmail.com

How to cite this article: Jakhar, S.R., Tripathy, S., Sharma, B., Kantwa, C.R., Ghaswa, R. and Singh, S.R.K. (2026). Increasing the Productivity and Profitability of Lentil Through Front Line Demonstrations under Irrigated Agro Ecosystem in Malwa Region of Madhya Pradesh. *Legume Research*. **49(8):** 1438-1442. doi: 10.18805/LR-5482.

Submitted: 01-02-2025 **Accepted:** 16-09-2025 **Online:** 17-11-2025

high susceptible to wilt, in this regard, to increase the productivity, the Department of Agricultural, Cooperative and Farmers Welfare had sanctioned the project "Cluster Frontline Demonstration on Pulses" to ATARI, Jabalpur, Zone IX, through national food security mission (NFSM). KVK Ratlam was selected by ATARI, Jabalpur to implement this project with an objective to promote the production and productivity of lentil through CFLDs with latest and specific technologies *viz*- large seeded high yielding varieties and resistance to *fusarium* wilt (IPL-316) lentil variety under best package of practices.

MATERIALS AND METHODS

The following objective of the CFLDs *viz*: latest crop production technologies popularize the newly released and improved varieties for varietal diversification and efficient management of inputs (Table 1). The present study of CFLDs was conducted during 2020-21, 2021-22 and 2022-2023 Rabi season by the KVK Ratlam, M.P. For conducting CFLDs, farmers were selected following the survey suggested by Choudhary (1999).

Total 200 farmers were selected in 80 ha area with 200 demonstration @ 1.0 acre (Table 2). The selected farmers followed the full package of practices like soil testing, improved variety of IPL-316, optimum seed rate (40 kg/ha), line sowing + seed treatment was done with Carbendazim 12% + Mancozeb 63% WP @ 2 g/kg seed + (Trichoderma viridi 5 g/kg + Rhizobium 10 g/kg+ PSB culture @10 ml/ kg seed), applied balance dose of fertilizers on the basis of soil test value, timely weed management, irrigation scheduling and plant protection measure. Timely field visits made by the scientists ensured proper guidance in timely application of inputs and crop management. The relevant extension activities like field days and training at the demonstration sites were organized regularly to keep farmers motivated and aware of demonstrated technology and its performance at the farmer's fields. The yield data of each demonstration was recorded in a systematic manner and the yield of farmers' practices was also recorded at the same time. Data pertaining to crop growth, yield attributes and yield were collected at harvest and analyzed statistically. The B: C ratio was calculated based on the net return and cost of cultivation in each treatment. The extension gap (q/ha), technology gap (q/ha) and technology index (%) were calculated using the following formula as suggested by Samui *et al.* (2000); Kadian *et al.* (2004); Sagar and Chandra (2004); Dayanand and Mehta (2012).

$$\text{Extension gap (q/ha)} = \text{Demonstration yield (q/ha)} - \text{Farmers yield (q/ha)}$$

$$\text{Technology gap (q/ha)} = \text{Potential yield (q/ha)} - \text{Demonstration yield (q/ha)}$$

$$\text{Technology index (\%)} = \frac{\text{Technology gap (q/ha)}}{\text{Potential yield (q/ha)}} \times 100$$

RESULTS AND DISCUSSION

CFLD on lentil were conducted by using lentil variety (IPL-316) in an area of 80 ha at 200 farmers field in different blocks of Ratlam district during the experiment period it was observed that the demonstration field have enhanced the seed yield compared to the farmer's field.

Yield

The result expressed that the higher average yield of lentil in demonstration field over farmers field were due to knowledge and adoption of best package of practices it increase up to (56.1, 24.5 and 21.2%) during 2021-22, 2022-23 and 2023-24, respectively as compared to

Table 1: Improved production technology of demonstration and farmers practices of Lentil.

Technology intervention	Demonstration practices	Farmer's practices	GAP
Soil testing	Have been done all demonstration	Not in practice	Full gap
Seed rate	40 kg/ha	60 kg/ha	High seed rate
Herbicide	Pendimethalin as pre emergence or Imizathypre as post emergence	No herbicide	Full gap
Farming situation	Irrigated/rainfed	Irrigated/rainfed	No gap
Variety	IPL-316	Local	Full gap
Seed treatment	(Carbendazim 12% + Mancozeb 63% WP) @ 2 g/kg seed + Trichoderma viridi 5 g/kg + *Rhizobium* and PSB culture @10 ml/kg seed	Not seed treatment	Full gap
Method of sowing	Line sowing at recommended spacing with seed drill	Broadcasting	Full gap
Fertilizer doses	Recommended dose of fertilizers as per STV	Use of imbalance fertilizers	Full gap
Weed control	Two mechanical weeding	No weeding	Full gap
Plant protection	IPM	Indiscriminate application	Full gap
Grading the produce	Grading followed	Not followed	Full gap

farmers' field (Table 3). The maximum yield recorded with demonstration yield was (12.8, 12.2 and 13.4 q/ha) and farmers plot was (8.2, 9.8 and 11.1 q/ha) during 2021-22, 2022-23 and 2023-24, respectively. Similar findings were also reported by Tomar (2010); Singh *et al*. (2014) and Jakhar *et al.* (2025). The increase yield of demonstration under improved technology was due to use of wilt resistant high yielding varieties, integrated pest management, integrated nutrient management, adopt line sowing method, applied soil test best fertilizer, seed treatment. Similarly, yield increments in CFLD of different crops were document by Dhaka *et al*. (2015); Jakhar *et al.* (2018); Chalie-U.R. *et al*. (2025) and Tiwari *et al*. (2024).

Extension and technology GAP

Yield of CFLD lentil and potential yield of the lentil was compared to determine the yield gaps which were further classified into extension and technology gap (Table 4). The extension gap is the difference between the demonstration yield and farmers yield. The average extension gap was observed (4.6,2.4 and 2.3 q/ha) during 2021-22, 2022-23 and 2023-24, respectively and average extension gap observed was 3.1 q/ha. This emphasized the need to aware the farmers through different intervention method which was used during the demonstration. The technology gap is the ratio of potential yield of the variety to the demonstration yield of lentil. The technology gap in the demonstration yield was (2.2, 2.8 and 1.6 q/ha) during 2021-22, 2022-23 and 2023-24, respectively. The technology gap recorded may be attributed to the dissimilarity in the status of soil fertility, timely sowing and weather conditions. Similar findings were reported by Mitra and Samajdar (2010).

Technology index

The technology index shows the feasibility of the evolved technology in the farmer's field. The lower value of technology index means higher the feasibility of the latest technology (Table 4). The technology index is (14.7, 18.9 and 10.7%) during 2021-22, 2022-23 and 2023-24, respectively which is clearly showed the efficacy of the best performances of technical intervention. This will speed the adoption of demonstrated latest interventions to enhance the yield of lentil. Similar findings were reported by Kantwa *et al*. (2024).

Analysis of economic returns

The analysis of economic data in Table 5 expressed that the cost of indulging in the adoption of latest technology in lentil varied and was more profitable. As per the presented data in Table 5 showed high B:C ratio of demonstration plot was (2.73, 2.42 and 3.53) over the farmers plot (1.98, 2.00 and 3.03) during the 2021-22, 2022-23 and 2023-24, respectively. The average cost and net income (Rs 20076, 21046 and Rs 20348/ha), respectively over to farmer's practice (Rs 18605, 19667 and Rs 18900/ha), respectively. Similar finding were reported by Singh *et al*. (2014) and Tomar, (2010). Hence, compatible B:C ratios vouched the economic viability of the technology and convinced the farmers of the utility of the latest technology. The above results were in agreement with the Raghav *et al*. (2020). The B:C ratio of demonstration plots under the latest

Table 2: Year wise details of cluster front line demonstration on lentil.

Year	Crop	Variety	Number of demonstrations	Nos. of clusters	Area (ha)	Provide need based input
2021-22	Lentil	IPL-316	50	2	20	Improved seed of lentil, Variety: IPL-316, soil test and applied fertilizer based on soil test value and seed treatment input.
2022-23	Lentil	IPL-316	75	3	30	
2023-24	Lentil	IPL-316	75	3	30	
Total	-	-	200	8	80	

Table 3: Yield analysis of cluster front line demonstrations of lentil on farmers' field.

Year	Technology demonstrated	Demonstration yield (Q/ha)	Farmers practice (Q/ha)	Percent increase yield
2021-22	Wilt resistance high yielding variety IPL-316	12.8	8.2	56.1
2022-23	Wilt resistance high yielding variety IPL-316	12.2	9.8	24.5
2023-24	Wilt resistance high yielding variety IPL-316	13.4	11.1	21.2

Table 4: Gap analysis of cluster front line demonstrations of lentil on farmers' field.

Year	Potential yield (Q/ha)	Demonstration yield (Q/ha)	Farmers' practice yield (Q/ha)	Extension gap (Q/ha)	Technology gap (Q/ha)	Technology index
2021-22	15	12.8	8.2	4.6	2.2	14.7
2022-23	15	12.2	9.8	2.4	2.8	18.9
2023-24	15	13.4	11.1	2.3	1.6	10.7
Average	15	12.8	9.7	3.1	2.2	14.8

Table 5: Economic analysis of cluster front line demonstrations of lentil on farmers' field.

	Year economics of demonstration (Rs./ha)				Economics of farmer's practices (Rs./ha)			
	Gross cost	Gross return	Net return	B:C ratio	Gross cost	Gross return	Net return	B:C ratio
2021-22	20076	74925	54848	2.73	18605	55550	36945	1.98
2022-23	21046	71985	50939	2.42	19667	58900	39233	2.00
2023-24	20348	92160	71811	3.53	18900	76103	57203	3.03
Average	20491	79690	59199	2.89	19057	63518	44460	2.34

interventions was higher than farmer's practices may be due to the higher yield obtained from yielding variety RVG 202 under improved technologies compared to farmers practice. The similar trend was reported by Mokidue *et al*. (2011) and Anuratha *et al*. (2019).

CONCLUSION

The demonstration expressed the need to aware the farmers in adoption of latest technology to reduce the extension gaps through different technology transfer centers. Therefore, it is suggested that these factors may be taken into consideration to improve the scientific knowledge of the farmers. Potential yield of improved variety was achieved by communicating scientific knowledge to the farmers, providing need based quality inputs in due time and proper and timely application of inputs. This is the best way to sustain the credibility and reliability of the technology among the farmers. It can be concluded that newly introduced variety of lentil along with latest package of practices performed well in the Ratlam district of Madhya Pradesh and adoption is also appreciable among the farmers.

ACKNOWLEDGEMENT

We are grateful to National Food Security Mission- Pulses (NFSM-P), Department of Agriculture Cooperation, Government of India for grant-in-aid to implement the lentil enhancement project. We are also thankful to Agricultural Technology Application Research Institute Zone-IX, Jabalpur (M.P.) for providing fund and facilities during CFLD and farmers, who adopted the technologies and provided needed information.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

REFERENCES

Ali, M. (1998). Consolidated Report on *kharif* and *rabi* Pulses, Agronomy 1997-1998, All India Pulse Improvement Project, DPR, Kanpur.

Anuratha, A., Ravi, R. and Selvi, J. (2019). Impact of cluster frontline demonstration on black gram in Nagapattinam district of Tamil Nadu. *Journal of Pharmacognosy and Phytochemistry*. **2:** 722-725.

Chalie-U.R., Jakhar, S.R., Mitra, N.G., Baghel, S.S., Sahu, R.K. and Dwivedi, B.S. (2025). Impact of *Trichoderma viride* as bio-stimulator on nodule enumeration, nutrient quality and yield of chickpea (*Cicer arietinum* L.) in central India. *Legume Research*. **48(3):** 456-461. doi: 10.18805/LR-4914.

Choudhary, B.N. (1999). Krishi Vigyan Kendra- A Guide for KVK Managers. Publication, Division of Agril. Extn., ICAR, Division of Agricultural Extension, Indian Council of Agricultural Research. Krishi Anusandhan Bhawan, Pusa. New Delhi. pp 73-78.

Dayanand, V.R.K. and Mehta, S.M. (2012). Boosting mustard production through frontline demonstrations. *Indian Research Journal of Extension Education*. **12(3):** 121-123.

Dhaka, B.L., Poonia, M.K., Meena, B.S. and Bairwa, R.K. (2015). Yield and economic viability of coriander under front line demonstrations in Bundi district of Rajasthan. *Journal of Horticulture Science*. **10(2):** 226-228.

Jakhar, S.R., Kumar, V. and Mitra, N.G. (2018). Effect of seed inoculation with liquid and carrier based *Rhizobium* cultures and phosphorus levels on rhizobia population and yield of soybean (*Glycine max*). *Annals of Plant and Soil Research*. **20(2):** 197-202.

Jakhar, S.R., Tripathy, S., Sharma, B., Kantwa, C.R., Ghaswa, R., Bhadauria, R.S., Kumar, S. and Tiwari, G.P. (2025). Cluster frontline demonstration: An effective technology dissemination approach for maximization of productivity and profitability of chickpea (*Cicer arietinum* L.). *Legume Research*. **48(3):** 480-484. doi: 10.18805/LR-5304.

Kadian, K.S., Sharma, R. and Sharma, A.K. (2004). Evaluation of front line demonstration trials on oilseeds in Kangra Vally of Himanchal Pradesh. *Annals of Agricultural Research*. **18:** 40.

Kantwa, C.R., Tripathy, S., Bhadauria, R.S., Sharma, B., Jakhar, S.R., Kumar, S. and Singh, S.R.K. (2024). Front line demonstration on performance of chickpea in Malwa region of Madhya Pradesh. *Legume Research*. **47(1):** 74-77. doi: 10.18805/LR-4890.

Kumar, V. and Jakhar, D.S. (2020). Impact assessment of frontline demonstrations on mustard (*Brassica juncea* L.) in Bhiwani district of Haryana. *International Journal of Current Microbiology and Applied Sciences*. **9(4):** 395-402.

Mitra, B. and Samajdar, T. (2010). Yield gap analysis of rapeseed and mustard through frontline demonstrations. *Agriculture Extension Review*. **22(2):** 16-17.

Mokidue, I., Mohanty, A.K. and Sanjay, K. (2011). Correlating growth, yield and adoption of Urdbean technologies. *Indian Journal of Extension Education*. **11(2):** 20-24.

Pooniya, V., Choudhary, A.K., Dass, A., Bana, R.S., Rana, K.S., Rana, D.S., Tyagi, V.K. and Puniya, M.M. (2015). Improved crop management practices for sustainable pulse production: An Indian perspective. *Indian Journal of Agricultural Sciences*. **85(6):** 747-758.

Prasad, D., Bangarwa, A.S., Kumar, S. and Ram, A. (2012a). Effect of sowing dates and plant population on chickpea (*Cicer arietinum*) genotypes. *Indian Journal of Agronomy*. **57(2):** 206-208.

Prasad, D., Bhan, C., Sharma, V. and Prasad, H. (2012b). Effect of various plant geometry on chickpea (*Cicer arietinum*) under different dates of sowing: A review. *Journal of Progressive Agriculture*. **3(2):** 113-117.

Raghav, D.K., Kumar, U., Kumar, A. and Singh, A.K. (2020). Impact of cluster frontline demonstration on pigeon pea for increasing production in rain fed area of district Ramgarh (Jharkhand) towards self-sufficiency of pulses. *Indian Research Journal of Extension Education*. **20(4):** 34-39.

Sagar, R.L. and Chandra, G. (2004). Front line demonstration on sesamum in west Bengal. *Agricultural Extension Review*. **16(2):** 7-10.

Samui, S.K., Maitra, S., Roy, D.K., Mondal, A.K. and Saha, D. (2000). Evaluation of frontline demonstration on groundnut (*Arachis hypogaea* L.) in Sundarbans. *Indian Society of Coastal Agricultural Research*. **18(2):** 180-183.

Sarker, A., Erskine, W. and Sing, M. (2003). Regression models for lentil seed and straw yields in near east. *Agricultural and Forest Meteorology*. **116:** 61-72.

Singh, D., Patel, A.K., Bangel, S.K., Singh, M.S., Singh, A. and Singh, A.K. (2014). Impact of front line demonstration on the field and economic of chickpea in Sidhi district of Madhya Pradesh. *Journal of AgriSearch*. **1(1):** 22-25.

Tiwari, G.P., Tripathy, S., Bhandari, J., Kumar, S., Bhadauria, R.S., Ghaswa, R., Jakhar, S.R. and Mishra, S. (2024). Role of cluster demonstration in enhancement of soybean production in Ratlam District of Madhya Pradesh. *Legume Research*. **46(8):** 1059-1063. doi: 10.18805/LR-5139.

Tomar, R.K.S. (2010). Maximization of productivity for chickpea through improved technologies in farmers yield. *Indian Journal of Natural Products and Resources*. **1(4):** 515-517.

Yadav, A.K., Singh, K.M., Singh, R.K., Singh, R.P. and Nayak, R. (2020). Production and productivity enhancement in lentil through cluster front line semonstrations in Azamgarh District. *The Journal of Rural and Agricultural Research*. **20(1):** 65-68.