LR-5304
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RESEARCH ARTICLE Legume Research- An International Journal

Cluster Frontline Demonstration: An Effective Technology Dissemination Approach for Maximization of Productivity and Profitability of Chickpea (*Cicer arietinum* L.)

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10.18805/LR-5304

ABSTRACT

Background: Chickpea (*Cicer arietinum* L.) is a premier legume crop of Fabaceae family. It is also known as gram and Kabuli chana. It is one of the major rabi season pulse crop of the Ratlam district. The main objective of this study is the enhance production and productivity of chickpea through CFLDs with latest and specific technologies *viz*- large seeded high yielding varieties and resistance to *fusarium* wilt (RVG 202) chickpea variety under best package of practices. The major problem of ratlam district is productivity of chickpea is very low because of non-adoption of latest intervention by the farmer's like use wilt resistant variety, imbalance use of plant nutrient, water stress at critical stage, infestation of weeds and incidence of pest.

Methods: The present study was carried out by the Krishi Vigyan Kendra, Jaora, Ratlam District (M.P) during rabi season. Total 110 demonstration in farmer's field of ratlam district during two years *i.e.*, from *rabi*, 2020-21, *rabi* 2021-22 on integrated crop management (ICM). Front line demonstration on chickpea were organized five cluster of ratlam district. The demonstration intervention technology is improved variety (RVG-202), Optimum seed rate 80 kg/ha, properly seed treatment, crop nutrient management RDF as per STV, water management at critical stages, weed management and application of IDM module for the management of disease.

Result: The results of study show a positive impact onfarming community due to the significant enhancement in crop yield greater than farmer. Results of the study revealed that the interventions increase demonstration field seed yield of chickpea by 30.76 and 32.71% over the farmers' field respectively, both the years. The average intervention technology gap (3.04 q/ha) extension gap 4.08 q/ha) and Technology index 15.22% suggested further improvement in the extension activities. The annual average benefit: cost ratio was higher (2.43 and 2.52) of the demonstrated plot compare to farmers plot (1.95 and 1.97), respectively. The similar trend was observed in terms of gross and net income returns which was demonstration plot is Rs 94589 Rs 67385 and under farmer's plot it was Rs 72783 and Rs. 49283 respectively.

Key words: Chickpea, Demonstration, Productivity, Profitability, Yield.

INTRODUCTION

Pulses are versatile crops that are better for nutritional security and soil health. Pulses are rich in proteins and are the second most important constituent of Indian diet after cereals. Chickpea (*Cicer arietinum* L.) is a premier legume crop of Fabaceae family. It is also known as gram and Kabuli chana. It is one of the major rabi season pulse crop of the Ratlam district. The total world acreage under pulses is about 93.18 (Mha) with production of 89.82 (Mt) at 964 kg/ha yields level. India, with >28 Mha pulses area, it is the largest pulse producing country in the world. It ranks first in area and production with 31 per cent and 28 per cent respectively. During 2020-21 our productivity at 885 kg/ha, has also increased significantly over last 05 year. As usual, Madhya Paredsh (M.P) has significant contributed 28% of the total area and 34% of total production of chickpea in the country, M.P ranked first both in area and production after that by Maharashtra, Rajasthan and Karnataka (Directorate of Pulses Development 2021-22). Pulses with their unique ability of leaf litter fall, biological N2 fixation (BNF) and deep root system may be a suitable option to retouch soil fertility. A major benefit of pulses is that they can fix atmospheric nitrogen with the help of rhizobia bacteria, thus least the requirement for additional fertilizer inclusive nitrogen supplements Chalie-U *et al*. (2022); Jakhar *et al.* (2018).

The major constraints responsible for lower yield potential are unfair crop production technologies, *viz*. used improper method of sowing (broadcast method), use of poor quality seed, unawareness about seed treatment,

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How to cite this article: Jakhar, S.R., Tripathy, S., Sharma, B., Kantwa, C.R., Ghaswa, R., Bhadauria, R.S., Kumar, S. and Tiwari, G.P. (2024). Cluster Frontline Demonstration: An Effective Technology Dissemination Approach for Maximization of Productivity and Profitability of Chickpea (*Cicer arietinum* L.). Legume Research. DOI: 10.18805/LR-5304.

Submitted: 10-02-2024 **Accepted:** 25-06-2024 **Online**: 24-07-2024

imbalance use of external inputs (fertilizer, weedicide and pesticide), adopt least resistant varieties to disease and pest. 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 Tiwari *et al*.(2023) in soybean and Kantwa *et al.* (2024) in chickpea 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 chickpea 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 chickpea, which gives low yields and 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. The main objective of this study to promote the production and productivity of chickpea through CFLDs with latest and specific technologies *viz*- large seeded high yielding varieties and resistance to *fusarium* wilt (RVG 202) chickpea variety under bestpackage of practices.

MATERIALS AND METHODS

The following objective of the CFLDs *viz*: latest crop production technologies popularize the newly released and improvedvarieties for varietal diversification andefficient management of inputs. The present study of CFLDs was conducted during 2020-21 and 2021-22 *Rabi* season by the KVK Ratlam, M.P. For conducting CFLDs, farmers were selected following the survey suggested by Choudhary (1999). The demonstrations were conducted at farmer’s field during 2020-21 and 2021-22 in different villages of Ratlam district. Table 1 expressed the gap between improved production technology of demonstration and farmers practices of chickpea.

Total 110 farmers were selected in 44 ha area with 110 demonstration @0.4 acre (Table 2). The selected farmers followed the full package of practices like soil testing, improved variety of RVG202, optimum seed rate (80 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), 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

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

Technology Intervention	Demonstration practices	Farmer’s practices	GAP
Seed rate	80 kg/ha	100 kg/ha	High seed rate
Herbicide	Pendimethalin as pre emergence or Imizathypre as post emergence	No herbicide	Full gap
Spacing	Row×Row: 45 cm, Plant×Plant 20 cm, Sowing depth: 8-10 cm	Row×Row: 30 cm, Plant×Plant: 10 cm, Sowing Depth: 6-8 cm	No gap
Farming situation	Irrigated/rainfed	Irrigated/rainfed	No gap
Variety	RVG-202	Local	100
Seed treatment	(Carbendazim 12% + Mancozeb 63% WP) @ 2 g /Kg seed + *Rhizobium* and PSB culture @10ml/ kg seed	Not Seed treatment	Full gap
Sowing	October 1-10	October 1-10	
Method of sowing	Line sowing at recommended spacing with seed drill	Line sowing or broadcasting	No 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

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 Dayanand and Mehta (2012).

Extension gap (q/ha) =

Demonstration yield (q/ha) - Farmers yield (q/ha)

Technology gap (q/ha) =

Potential yield (q/ha) - 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 chickpea were conducted by using chickpea variety (RVG 202) in an area of 44 ha at 110 farmers field in different village 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 (Table 3).

Yield

The result expressed that the higher average yield of chickpea in demonstration field over farmers field were due to knowledge and adoption of best package of practices it increase up to (30.76 and 32.71%) as compared to farmers′ field. The maximum yield recorded with demonstration yield was (16.83 and 17.08 q/ha) and farmers plot was (12.87 and 12.87 q/ha). 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. Similar yield enhancement in different crops in cluster frontline demonstrations were documented by Jha *et al*. (2020) in black gram; Jha *et al*. (2020) in pigeonpea; Kantwa *et al*. (2024) in chickpea; Tiwari *et al*. (2023) in soybean. The results were in conformity with the findings of Saikia *et al*. (2018) and Kumar *et al*. (2023).

Extension and technology GAP

Yield of CFLD Chickpea and potential yield of the chickpea 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 (3.96and 4.21 q/ha) during 2020-21 and 2021-22, respectively and both the years average extension gap observed was 4.08q/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 chickpea. The technology gap in the demonstration yield was (3.17 and 2.92 q/ha) during 2020-21 and 2021-22, 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 Saikia *et al*. (2018) in black gram.

Technology index

The technology index shows the feasibility of the evolved technology in the farmer's field (Table 4). The lower value of technology index means higher the feasibility of the latest technology. Average technology index is (15.85 and 14.60%) during 2020-21 and 2021-22, 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 chickpea.Similar

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

Year	Crop	Variety	Number of demonstrations	Nos. of Clusters	Area (ha)	Provide Need based input
2020-21	Chickpea	RVG-202	60	3	24	Improved seed of Chickpea, Variety: RVG 202, soil test and applied fertilizer based on soil test value and seed treatment input.
2021-22	Chickpea	RVG-202	50	2	20	
Total	-	-	110	5	44	

Table 3: Yield analysis of cluster front line demonstrations of Chickpea on farmers′ field.

Year	Technology demonstrated	Demonstration yield (Q/ha)	Farmers practice (Q/ha)	Percent increase yield
2020-21	Wilt Resistance high yielding variety RVG 202	16.83	12.87	30.76
2021-22	Wilt Resistance high yielding variety RVG 202	17.08	12.87	32.71

Table 4: Gap analysis of cluster front line demonstrations of chickpea 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
2020-21	20	16.83	12.87	3.96	3.17	15.85
2021-22	20	17.08	12.87	4.21	2.92	14.60
Average	-	16.95	12.87	4.08	3.04	15.22

Table 5: Economic analysis of cluster front line demonstrations of chickpea 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
2020-21	26885	92266	65381	2.43	23900	70762	48862	1.95
2021-22	27522	96912	69390	2.52	25100	74805	49705	1.97
Average	27203	94589	67385	2.47	24500	72783	49283	1.96

findings were reported by Kumar *et al*. 2018: Kantwa *et al*. (2024). Similar type of observation was recorded by Jha *et al*. (2020) in pigeonpea and black gram.

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 chickpea varied and was more profitable. As per the presented data in Table 5 showed high B: C ratio of demonstration plot was (2.43 and 2.52) over thefarmers plot (1.95 and 1.97) during the 2020-21 and 2021-22, respectively. The average cost and net income (Rs 27203 and Rs 67385/ha), respectively over to farmer's practice (Rs 24500 and 49283), respectively. 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 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. These results are in accordance with the findings of Singh *et al*., (2018), Jayalakshmi *et al*. (2018), Anuratha *et al.* (2019) and Jha *et al*. (2020).

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 chickpea along with latest package of practices performed well in the Ratlam district of Madhya Pradesh and adoption is also appreciable among the farmers.

ACKNOWLEDGEMENT

KrishiVigyan Kendra, Jaora, Ratlam is grateful to Agricultural Technology Application Research Institute Zone-IX, Jabalpur (M.P.) for providing fund and facilities during CFLD pulse.

Conflict of interest

All author declar that they have no conflict of interest.

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