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Research Paper

Assessment of chickpea productivity through cluster frontline demonstration in Zone IIIa of Rajasthan

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ABSTRACT

In the present investigation, a total of 130 demonstrations of chickpea were carried out across five villages in the Jaipur district, covering an area of 52 hectares over two years. Improved agronomic practices, including the use of the GNG-2144 variety and integrated crop management, were implemented during both years. The result revealed that the highest average seed yield (23.02 q/ha) was obtained in cluster frontline as compared to 18.29 q/ha in farmer practices (FP). This was an increase of 25.86 % due to high-yielding variety and technological intervention. The highest average gross return (₹ 1,21,610/ha) and net return (₹ 93,395/ha) with a B:C ratio of 4.31 was recorded in the cluster front-line demonstrations as compared to farmers' practice (₹ 96,620/ha, ₹ 70,970/ha and 3.77). The average extension gap, technology gap and technology index were 4.73 q/ha, 1.98 q/ha and 7.92 percent, respectively.

Key words: Chickpea, CFLD, Extension gap, Farmers practice, Variety, Yield

INTRODUCTION

India is the largest producer and consumer of pulses. Chickpea (*Cicer arietinum* L.) is an important winter season pulse crop cultivated during *Rabi* season. The chickpea is a prime legume that belongs to the family Leguminosae. It is also known as Bengal gram, gram, and Chana in Hindi. It is a good source of protein (18-22%), carbohydrate (52-70%), fat (4-10%), minerals (calcium, phosphorus, iron) and vitamins (Singh *et al.* 2014). Chickpea is a high-value legume crop suitable as a protein complement for human beings and animals. Chickpea alone accounts for about 50 percent of the total pulses production in India (Yadav, 2009). In India, chickpea is mainly grown in Madhya Pradesh, Rajasthan, Uttar Pradesh, Maharashtra, Andhra Pradesh, Gujarat, Karnataka, Haryana, Bihar and West Bengal. During 2021- 22, chickpea production in India was 13.75 million tonnes from an acreage of 10.91 million ha with productivity of 12.6 q/ha (DES 2023, MoAF&W, GoI). In Rajasthan, chickpea is grown in an area of 1.57 million hectares with an average production of 1.68 million tons and productivity of 1074 kg/ha (Anonymous 2018). It plays a significant role in improving soil fertility by fixing the atmospheric nitrogen. Chickpea meets 80% of its nitrogen (N) requirement from symbiotic nitrogen fixation and can fix up to 140 kg N/ha from air (Gaur *et al.* 2010). It leaves a substantial amount of residual nitrogen for subsequent crops and adds plenty of organic matter to maintain and improve soil health and fertility. Because of its deep tap root system, chickpeas can avoid drought conditions by extracting water from deeper layers in the soil profile.

Front-line demonstrations (FLDs) are one of the most powerful tools of extension because farmers, in general, are driven by the perception that "Seeing is believing". The main objective of the frontline demonstration is to large-scale technological demonstrate the latest technologies of crop production and management practices under diverse climatic conditions as well as farming situations to fill the percent yield gap. Front-line demonstrations are the most effective tool for the transfer of new profitable & sustainable technologies among the farmers and making them acceptable. KVK Jaipur-1 has focused on training programs for the scientific cultivation of chickpea, along with demonstrations of high-yielding varieties and other interventions. This study was conducted to enhance chickpea production and productivity through cluster front-line demonstrations in the operational area of KVK Jaipur-1.

MATERIALS AND METHODS

Krishi Vigyan Kendra, Chomu (Tankarda) Jaipur-1 conducted cluster frontline demonstrations on chickpea at farmers' fields during the R*abi* season of 2021-22 and 2022-23 with five villages namely Didawata, Mukandpura, Bhanpura, Hanootiya Khurd and Gaduda in Phagi block of Jaipur district. A total 130 demonstrations were conducted with an area of 52 hectares and each demonstration size was 0.4 hectares during both the years. The improved agronomic practices using improved variety GNG-2144 and integrated crop management during two years of demonstrations at farmers' fields. The present study with respect to CFLDs and farmers' practices (FP) is presented in Table 1. The soils in selected villages were sandy loam to loamy sand in texture with an average pH of 7.7, organic carbon 0.36, low in nitrogen, and medium in phosphorus and potash. Farmers were trained to follow the package of practices for chickpea cultivation as recommended by III A Zone of Rajasthan and need-based critical inputs were provided to the farmers and participatory mode.

Before conducting FLDs, a list of farmers was prepared from group meetings, and specific skill training was imparted to the selected farmers regarding different aspects of cultivation (Venkattakumar *et al.* 2010).

Table 1. Technological gap analysis for chickpea crop

S. No.	Technology	Existing Farmers' Practices	Recommended Practices
1	Variety	Own available seed and Variety RSG-973	GNG-1581, RSG-974, GNG-1958, GNG-2144 and GNG-2171
2	Seed rate	Seed rate : 85-100 kg/ha	Seed rate: 75-80 kg/ha
3	Seed treatment	No proper seed treatment	Seed treatment with *Trichoderma viride* @ 5 to 10 gm/kg seed
4	Biofertilizers	No use of rhizobium and PSB culture	Rhizobium and PSB culture liquid @ 5 to 10 ml/kg seed
5	Nutrients	Non-judicious use of DAP fertilizer mixed with seed	Recommended dose of N:P (20:40) kg/ha as basal application
6.	Weed management	No hand weeding or one-hand weeding	Pre-emergence application of Pendimethalin 30 EC @ 1.0 kg a.i./ ha and one-hand weeding at 30-35 DAS
7	Plant protection	No use or improper use of insecticide	IPM techniques for pod-borer Management- pheromone trap and need-based spray of insecticide

The data were collected from both CFLD plots as well as control plots (farmers' practices). The extension gap, technology gap, technology index along with benefit-cost ratio were worked out (Samui *et al.* 2000) as given below.

Extension gap = Demonstration yield - Farmers' practice yield

Technology gap = Potential yield – Demonstration yield

$$\text{Technology Index} = \frac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

Effect on seed yield

The seed yield of chickpea crops owing to the adoption of improved technologies was assessed over a period of two years and is presented in Table 2. The results clearly showed that the cluster front-line demonstration has good impact on the farming community of Jaipur district and they were motivated by the latest agricultural technologies demonstrated at farmers' fields. The results of cluster front-line demonstrations indicated that the average seed yield of chickpea recorded a maximum of 22.89 q/ha and 23.15 q/ha and the minimum seed yield of chickpea in the control plot (farmers' practices) was 18.25 q/ha and 18.33 q/ha during *Rabi* 2021-22 and 2022-23, respectively. The average seed yield of chickpea recorded a maximum of 23.02 q/ha in cluster front line demonstration, which was a 25.86 percent higher yield as compared to the control plot (farmers practice) 18.29 q/ha. The higher seed yield obtained from demonstrated plots was due to integrated crop management practices like use of improved variety, seed treatment, optimum seed rate, line sowing, balanced application of fertilizers, weed management, and plant protection measures. The above findings are similar in line with Jat *et al.* (2021), Raghav *et al.* (2021), Bamboriya *et al.* (2023) and Yadav *et al.* (2023).

Extension gap

The extension gap refers to the difference between the demonstration yield and the farmer's yield. The extension gap was 4.64 q/ha and 4.82 q/ha for the years 2021-22 and 2022-23, respectively and an average extension gap was 4.73 q/ha over the two years (Table No. 2). The highest extension gap was recorded at 4.82 q/ha during *Rabi* 2022-23 and the lowest extension gap was observed 4.64 q/ha during *rabi* 2021-22. The extension gap under the CFLD program emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies

Table 2. Seed yield of chickpea under cluster front line demonstration and farmer practices

Year	Area (ha)	No. of Demonstrations	Variety	Yield (q/ha)			% increase over farmers practices	Extension gap (q/ ha)	Technology gap (q/ ha)	Technology index (%)
				Potential	Demonstration	Farmer Practices				
2021-22	20.0	50	GNG-2144	25.0	22.89	18.25	25.42	4.64	2.11	8.44
2022-23	32.0	80	GNG-2144	25.0	23.15	18.33	26.30	4.82	1.85	7.40
Total	52.0	130	--	--	--	--	--	--	--	--
Average	--	--	--	25	23.02	18.29	25.86	4.73	1.98	7.92

Table 3. Economics of chickpea under cluster front line demonstration and farmer practices

Year	Cost of cultivation (₹/ha)		Gross return (₹/ha)		Net return (₹/ha)		B:C ratio	
	Demonstration	Farmer Practice	Demonstration	Farmer Practice	Demonstration	Farmer Practice	Demonstration	Farmer Practice
2021-22	27500	24750	119715	95448	92215	70698	4.35	3.86
2022-23	28930	26550	123505	97791	94575	71241	4.27	3.68
Average	28215	25650	121610	96620	93395	70970	4.31	3.77

to revert the trend of the wide extension gap. The use of the latest production technologies with high-yielding varieties will subsequently change this alarming trend of galloping extension gap. The present finding is in corroboration with the findings of Raghav *et al*. (2021) and Yadav *et al*. (2024).

Technology gap

The technology gap indicates the gap between the demonstration yield and potential yield. The technology gap of demonstration plots was recorded at 2.11 q/ha and 1.85 q/ha during *rabi* 2021-22 and 2022-23, respectively, and an average technology gap was recorded at 1.98 q/ha during both years (Table 2). The maximum technology gap was found 2.11 q/ha in *Rabi* 2021-22 and the minimum technology gap was found at 1.85 q/ha in *Rabi* 2022-23. The technology gap observed may be attributed to the dissimilarities in the soil fertility, and vagaries of weather conditions in the area as well as management of the farmers. So, improved variety and location-specific recommendations appear to be necessary to minimize the technology gap for yield levels in different farming situations. The above findings are similar to line with *Garud et al.* (2023) and Sharma and Singh (2024).

Technology index

The technology index shows the feasibility of the evolved technology at the farmers' fields as the lower the value of the technology index more is the feasibility of the technology. The result presented (Table 2) noted that the technology index was 8.44 and 7.40 percent during *rabi* 2021-22 and 2022-23, respectively, and an average technology index was found 7.92 percent.

The maximum value of the technology index was 8.44 % in the year 2021-22 and the minimum technology index value of 7.40 percent was observed in the year 2022-23. It may be due to uneven weather conditions in the area and it is shown the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield of chickpea. These results corroborate the findings of Rachhoya *et al.* (2018), Meena *et al.* (2022) and Yadav *et al.* (2024).

Economics analysis

The economic analysis (cost of cultivation, gross return, net return, and B:C ratio) of cluster front-line demonstration on chickpea was presented in Table 3. The results of CFLDs economics were better in two years of demonstrations. The results of chickpea economics observed that the maximum gross return, net return, and benefit-cost ratio (B:C ratio) under cluster front-line demonstration were ₹ 1,19,715 /ha, ₹ 1,23,505 /ha, ₹ 92,215 /ha, ₹ 94,575 /ha and 4.35, 4.27 respectively, during *rabi* 2021-22 to 2022-23. The minimum gross return, net return, and benefit-cost ratio (B:C ratio) were ₹ 95,448 /ha, ₹ 97,791 /ha, ₹ 70,698 /ha, ₹ 71,241/ha and 3.86, 3.68 respectively, recorded in farmer practice (FP).

An average gross return, net return, and benefit-cost ratio (B:C ratio) were recorded as the highest ₹ 1,21,610 /ha, ₹ 93,395 /ha, and 4.31 in cluster front line demonstration. The average gross return, net return, and benefit-cost ratio (B:C ratio) were recorded as lowest ₹ 96,620 /ha, ₹ 70,970 /ha, and 3.77 in farmer practice (FP). The higher returns and effective gain obtained under demonstrations could be due to improved technology, timely operations of crop cultivation, regular scientific monitoring, higher seed yield, and good price of produce in the market. The above findings were in agreement with the findings of Meena *et al.* (2022), Garud *et al.* (2023), Kantwa *et al.* (2024) and Yadav *et al.* (2024).

CONCLUSION

The two-year results of cluster front-line demonstrations on chickpea showed that adopting integrated crop management practices and the improved variety GNG-2144 led to higher yields compared to traditional farmer practices. The successful implementation of frontline demonstrations, along with extension activities like training programs and field visits, can help in the wider adoption of improved technologies. Encouraging farmers to follow recommended practices will enhance productivity and profitability. Additionally, beneficiary farmers play a crucial role in disseminating quality seeds and information to others, promoting the expansion of high-yielding chickpea varieties.

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