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Enhancing Productivity of Chickpea Through Cluster Front Line Demonstration in Jaipur District of Rajasthan

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ABSTRACT

Background: Chickpea is the premier pulse crop widely grown and consumed in India. Chickpea is an important pulse crop during winter season in Rajasthan. It also plays an important role in sustainable agriculture by improving the soil health through biological nitrogen fixation and by enhancing the soil microbial populations thus it is a good source of farmer livelihood and soil security.

Methods: Krishi Vigyan Kendra, Chomu (Tankarda) Jaipur-1 conducted cluster frontline demonstrations on chickpea at farmers' field during winter season of 2019-20 and 2020-21. A total 100 demonstrations were conducted with an area of 40 hectare. A survey to get information on chickpea cultivation practices was undertaken before conducting the demonstrations. Selection of farmers and improved technology for demonstrations were done on the basis of survey information.

Result: The results of the cluster frontline demonstrations observed that average yield of chickpea under demonstrations was 24.24 q/ha, which was 26.64 percent higher as compared to farmers practices (19.14 q/ha). The extension gap, technology gap and technology index were 5.10 q/ha, 2.56 q/ha and 9.56 percent respectively. Higher net return and B:C ratio recorded as ` 95432/ha and 4.76 under demonstration plot as compared to farmers practices (` 72920/ha and 4.25). The results of demonstrations observed that the low productivity at farmers' fields may be enhanced through cluster frontline demonstrations (CFLD).

Key words: Chickpea, Cluster frontline demonstrations (CFLD), Crop productivity, Extension gap.

INTRODUCTION

Pulses are next to cereal crops and are also known as excellent option for crop diversification and intensification in sustainable farming. India is the largest producer, consumer and importer of the pulses in the world. (Jadhav *et al*., 2022). Chickpea (*Cicer arietinum*) is a prime legume which belongs to 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). In India, the major chickpea growing states are Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Andhra Pradesh and Uttar Pradesh which contributing more than 90% in production in the country (Raghav *et al.,* 2021). Chickpea is an important winter crop mainly sown in September- November and harvested in February to march.

In India, chickpea covers an acreage of 10.56 million hectares contributing 11.23 million tons of production with an average productivity of 1063 kg/ha during 2017-18 (Anonymous, 2018).

In Rajasthan state chickpea crop grown in an area of 12.35 lakh hectare with production of 7.50 lakh tones and productivity of 607 kg per ha (Kumar and Kumawat, 2019). Legumes are an important component of crop rotation as they require less fertilizer than other crops and they are a low carbon source of protein. They have a direct positive impact on soil health because they help feed soil microbes, which helps in improving soil health. 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 frontline demonstrations is to demonstrate newly released crop production and protection technologies and its management practices at the farmer's fields under the micro-farming situation.

Front-line demonstrations are most effective tool for transfer of new profitable and sustainable technologies among the farmers and making them acceptable. KVK Jaipur-1 provided training on scientific cultivation of chickpea, demonstration on new variety and other interventions. The present study was conducted to impact assessment of cluster front line demonstration on chickpea crop in the operational area of the KVK Jaipur-1.

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MATERIALS AND METHODS

Krishi Vigyan Kendra, Chomu (Tankarda) Jaipur-1 conducted cluster frontline demonstrations on chickpea at farmers' field during *winter* season of the year 2019-20 and 2020-21 with five village namely Udaipuria, Mumarkya, Kadeda, Sevapura and Lantha Dunsari in Chaksu block of Jaipur district. Total 100 demonstrations were conducted with area of 40 hectare during both the years and each demonstration size was 0.4 hectare. The improved agronomic practices using improved variety GNG-1958 during both the years. The present study with respect to CFLDs and farmers' practices (FP) are given in Table 1. The soils in selected villages were sandy loam to loamy sand in texture with average pH 7.8, organic carbon 0.39, 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 provided to the farmers and participatory mode (Table 1).

The technology gap, extension gap and technology index were calculated by using following formula as per Samui *et al.,* (2000), as given below:

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield - Farmers' practice yield

Technology Index (%)=

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

RESULTS AND DISCUSSION

Effect on seed yield

The results (Table 2) indicated that the cluster front line demonstration has given a good impact over productivity of the chickpea in the farming community of Jaipur district during winter 2019-20 and 2020-21. Results showed that the maximum average seed yield of chickpea (24.66 q/ha) and (23.82 q/ha, respectively) were recorded under cluster front line demonstrations and minimum seed yield of chickpea (19.31 q/ha and 18.97 q/ha, respectively) was observed in farmers practices. The average seed yield of chickpea under cluster front line demonstration, was 26.64 percent higher as compared to prevailing farmer's practice. The higher seed yield from demonstrated plots was due to integrated crop management practices like use of improved variety, seed treatment, optimum seed rate, balanced application of fertilizers, line sowing, weed management and plant protection measures. Similar findings were recorded by (Jat *et al.,* 2021; Meena *et al.,* 2022; Bamboriya *et al.,* 2023; Yadav *et al.,* 2023 and Kantwa *et al.,* 2024).

Technology gap

The technology gap shows the wide gap in the demonstration yield over potential yield of chickpea crop. The technology gap observed during different years was 2.14 and 2.98 q/ha during 2019-20 and 2020-21 respectively (Table 2). The average technology gap was 2.56 q/ha. The observed technology gap may be attributed to dissimilarities in their soil fertility, uneven and erratic rainfall and vagaries of weather conditions in the area as well as management of the farmers. Similar findings have also been observed by (Rachhoya *et al.,* 2018; Meena *et al.,* 2021; Meena *et al.,* 2022 and Bamboriya *et al.,* 2023).

Extension gap

The difference between yield of demonstration and local check plots was determined to know the extension gap. The study (Table 2) found that an extension gap of 4.85 q/ha to

Table 1: Technological gap analysis for chickpea.

Technology	Existing farmers' practices	Recommended practices	Gap (%)
Variety	Own available seed and Variety RSG-973.	GNG-1581, RSG-974, GNG-1958 and GNG-2144.	65
Seed rate	Seed rate : 85-100 kg/ha.	Seed rate : 75-80 kg/ha.	60
Seed treatment	No proper seed treatment.	Seed treatment with *Trichoderma viride* @ 10 gm/kg seed.	80
Bio-fertilizers	No use of Rhizobium and PSB culture.	Rhizobium and PSB culture Liquid @ 5-10 ml/kg seed.	90
Nutrients	Non-judicious use of DAP fertilizer mixed with seed.	Recommended dose of N:P (20:40) kg/ha as basal.	45
Weed management	No hand weeding or one hand weeding.	Pre-emergence application of Pendamethalin 30 EC @1.0 kg a.i./ha. and one hand weeding at 30-35 DAS.	65
Plant protection	No use or improper use of insecticide.	IPM techniques for pod-borer Management- pheromone trap and need based spray of insecticide.	75

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

Year	Area (ha.)	No. of Demo.	Variety	Yield (q/ha)			Percent increase over farmers practices	Technology gap (q/ ha)	Extension gap (q/ha)	Technology index (%)
				Potential	Demo.	Farmer practices				
2019-20	30.0	75	GNG-1958	26.80	24.66	19.31	27.71	2.14	5.35	7.99
2020-21	10.0	25	GNG-1958	26.80	23.82	18.97	25.57	2.98	4.85	11.12
Total	40	100	-	-	-	-	-	-	-	-
Average	-	-	-	26.80	24.24	19.14	26.64	2.56	5.10	9.56

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	
	Demo.	Farmer practices	Demo.	Farmer practices	Demo.	Farmer practices	Demo.	Farmer practices
2019-20	24600	21550	120218	94136	95618	72586	4.89	4.37
2020-21	26237	23494	121482	96747	95245	73253	4.63	4.12
Average	25419	22522	120850	95442	95432	72920	4.76	4.25

5.35 q /ha was found difference between demonstrated technology and farmers' practice and average extension gap of 5.10 q/ha in the two years of demonstrations. The highest extension gap was found 5.35 q/ha during *rabi* 2019-20 and the lowest extension gap was found 4.85 q/ha during *rabi* 2020-21. Yield gap might be due to adoption of improved technology especially high yielding variety, seed treatment, nutrient management, weed management and plant protection measures in demonstrations site so, that the higher seed yield and economic returns than the farmers' practices. The results of our study corroborate with the findings of (Meena *et al.,* 2021; Jat *et al.,* 2021; Meena *et al.,* 2022; Bamboriya *et al.,* 2023 and Yadav *et al.,* 2023).

Technology index

Technology index shows the feasibility of the technological package at the farmer's field. The lower value of technology index performed the feasibility of the technology. The minimum technology index value 7.99 per cent was observed in the year 2019-20 and maximum value of technology index of 11.12% in the year 2020-21. It may be due to uneven weather conditions in the area. The above findings were also similar to the findings of (Rachhoya *et al.,* 2018; Jat *et al.,* 2021; Meena *et al.,* 2022 and Bamboriya *et al.,* 2023).

Economics analysis

The economics (cost of cultivation, gross return, net return and B:C ratio) of chickpea under cluster front line demonstrations were estimated and the results have been presented in Table 3. The results of CFLDs economics were better in two years' demonstrations. The results of chickpea economics found that the maximum gross return, net return and benefit cost ratio (B:C ratio) under cluster front line demonstration were ` 120218/ha, ` 121482/ha, ` 95618/ha, ` 95245/ha and 4.89, 4.63 respectively, during *rabi* 2019-20 to 2020-21. The minimum gross return, net return and benefit cost ratio (B:C ratio) under farmer practices were ` 94136/ha, ` 96747/ha, ` 72586/ha, ` 73253/ha and 4.37, 4.12 respectively, during both the years.

The average gross return, net return and benefit cost ratio (B:C ratio) were recorded higher under cluster front line demonstration as ` 120850/ha, ` 95432/ha and 4.76, respectively. 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 market. The results confirmed the findings by (Rachhoya *et al.,* 2018; Jat *et al.,* 2021; Meena *et al.,* 2022; Bamboriya *et al.,* 2023 and Yadav *et al.,* 2023).

CONCLUSION

Based on the two years results of cluster front line demonstration on chickpea crop, the adoption of integrated crop management practices along with improved variety GNG-1958 performed better than farmer practices in all the demonstrations. So that, there is a need to disseminate the improved variety with recommended technologies in the farmers field with extension methods such as training, field visits and field day. The farmers should be encouraged to adopt the recommended package of practices realizing for higher returns. The beneficiary farmers of demonstrations also play an important role as source of information and quality seed for wider dissemination of the high yielding variety of chickpea for other nearby farmers.

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Conflict of interest

There is no conflict of interest among all authors.

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