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Impact of front line demonstration on the yield and economics of chickpea (*Cicer arietinum* L.) in Banswara district of Rajasthan

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Abstract

Cluster Front Line demonstrations (CFLDs) is a unique approach to provide an direct interface between researcher and farmers as the scientists are directly involved in planning, execution and monitoring of the demonstrations. The present study was conducted to assess the Impact of Front Line Demonstration on the yield and economics of Chickpea (*Cicer arietinum* L.) in Banswara district of Rajasthan. Chickpea (*Cicer arietinum* L.) is a highly nutritious grain legume crop and is widely appreciated as health food as well as high return crop. Cluster Front line demonstrations were conducted at 138 farmers' fields under 55 ha, to demonstrate production potential and economic benefits of improved technologies. The results shows that demonstrations produced on an average 16.50 q/ha grain yield of chickpea, which was 34.36 per cent higher as compared to prevailing local check (12.30 q/ha). The front line demonstrations fetched more average gross returns (Rs.78653/ha), net return (Rs. 44853/ha) and B:C ratio (2.33) with slightly higher investment on cost of cultivation (Rs.4067/ha) as compared to local check. The increase in gross and net returns was in the tune of Rs.19, 970 and Rs. 15,903 per hectare with incremental benefit: cost ratio of 0.36. The average extension gap, technology gap and technology index was 4.2 q/ha, 7.63 q/ha and 31.43 per cent, respectively.

Keywords: Chickpea, front line demonstrations, gap, return, yield

Introduction

Chickpea (*Cicer arietinum* L.) is the premier pulse crop widely consumed in India. It is an important *rabi* season food legume having extensive geographical distribution and contributing 39 percent to the total production of pulse in the country (Singh *et al.*, 2013) ^[17]. It is the cheapest source of protein and is the inseparable part of the daily diets of every Indians. It also plays an important role in sustainable agriculture enriching the soil through biological nitrogen fixation (BNF). It is a good source of protein (22 per cent), carbohydrate (60-70 per cent), fat (2-4 per cent), minerals (calcium, phosphorus, iron) and vitamins (Singh *et al.*, 2014) ^[18]. It is an excellent animal feed. Its straw also had good forage value. Chickpea is grown in more than 50 countries (89.7 per cent area in Asia, 4.3 per cent in Africa, 2.6 per cent in Oceania, 2.9 per cent in Americas and 0.4 per cent in Europe). In India, the area under chickpea was 8.39 million hectares with a production of 7.81million tons and productivity of 931 kg/ha during *rabi* 2016-17 (FAOSTAT, 2017) ^[4]. The major chickpea producing states are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Gujarat, Karnataka, Haryana, Bihar and West Bengal. 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/ha (Kumar and Kumawat, 2019) ^[6]. Over the last six years, the on-going National Food Security Mission (NFSM) has been converged with multi-pronged strategies to enhance the production and productivity of pulses in the country (Anonymous, 2018) ^[1] which results in enhanced per hectare productivity. The country is now trying to meet the target of 35 million tonnes by 2030 with the challenging reasons like unavailability of quality seed, lack of technical guidance, ignorance of Integrated Pest Management techniques and non-adoption of integrated nutrient management (Kumar *et al.* 2014) ^[7]. Besides this, major abiotic stress *i.e.* low organic content in soil, low moisture content in the soil, types of soils, seasonal drought due to low rainfall are also responsible for low productivity of the pulses crops

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(Dubey *et al.* 2017) ^[3]. The utmost objective of the frontline demonstration is to large scale technological demonstrate latest technologies of crop production and management practices under diverse climatic conditions as well as farming situations to fill the per cent yield gap. Therefore, the effect of frontline demonstrations on yield and economics of chickpea crop has been studied in Banswara district of Rajasthan.

Materials and Methods

Front line demonstrations on chickpea were conducted by Krishi Vigyan Kendra, Banswara, MPUAT, Udaipur during *rabi* seasons from 2020-21 to 2022-23. Total 138 demonstrations on 55 ha area were conducted in different clusters in Banswara district of Rajasthan. The district has sub-humid agro-climatic condition with average temperature of 21.3 - 40.6 °C in summer and 9.5 - 34.9°C in winter and annual rainfall of 900 mm. Soil of the area is medium red loamy soil. Cluster selections, farmer selection, problem diagnosis, layout of demonstration were carried out according to Choudhary (1999). Assessment of gap in adoption of recommended technology was done before laying out FLD's through personal discussion with selected farmers (Table 1). Trainings were organized about detailed technological intervention with improved package and practice for successful cultivation of pulses. In the demonstrated FLDs the

recommended package of practices were followed for crop cultivation and compared with the farmer's practices (Table 1). In case of farmers practice plots, existing practices being used by farmers were followed. Scientists visited regularly demonstrated fields and farmer's fields. The feedback information from the farmers was also recorded for further improvement in research and extension programmes. The extension activities i.e. trainings, interaction with farmers and field days were organized at the cluster frontline demonstration sites. The basic information were recorded from the farmer's field and analysed to comparative performance of demonstrated plot and local check. Data on yield parameters from demonstrated plots and farmers practices were collected by random crop cutting method. The technology gap, extension gap and technology index were calculated using the following formulae given by (Samui *et al.*, 2000).

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - yield under existing practice

Technology index = {(Potential yield - Demonstration yield)/Potential yield} x 100

Table 1: Gap analysis between recommended practices and farmer's practices in chickpea

Components	Demonstration of recommended technology	Farmer's practices	Gap analysis (%)
Variety	GNG-1958 and GNG- 2144	Local	50-60
Seed rate	75 kg/ha	90-95 kg/ha	50-55
Seed treatment	<i>Trichoderma viride</i> @ 6-8 gm/Carbendazim 50WP @ 2 gm/kg seed, PSB+Rhizobium culture@ 500 gm/ha	30-40 per cent farmers do seed treatment with Carbendazim	60-70
Sowing method	Line sowing (30 x 10 cm)	Broadcasting/ line sowing	50-60
Irrigation	irrigation at flowering and pod formation	No irrigation	65-75
Nutrients (N:P:K Kg/ha)	20:40:00	Improper use of fertilizers	70-80
IPM measures	Pendimethalin @ 0.6 kg/ha as pre-emergence, manual weeding @ 30-35 DAS, Emamectin Benzoate 5 SG @ 250 gm/ha for pod borer management.	40-50 per cent farmers use irrelevant IPM measures	50-60
Trainings	Audio-video On & Off campus training	No training	100

The satisfaction level of participating as well as neighbouring farmers' for the performance of improved variety demonstrated was also assessed. In all, 138 participating farmers were selected to measure satisfaction level of farmers' for the performance of improved variety demonstrated. The selected respondents were interviewed personally with the help of a pre-tested and well structured interview schedule. Client Satisfaction Index was calculated as below. The data collected were tabulated and statistically analysed to interpret the results. The economic-parameters (gross return, net return and C: B ratio) were worked out on the basis of prevailing market prices of inputs and Minimum Support Prices of outputs.

Results and Discussion

Yield

Cluster Frontline demonstrations (CFLD) are effective tools in introducing various new technologies to the farmers and education them and to increase the farmer's knowledge and confidence level by comparison of productivity levels between improved production technologies in demonstration trials. The data (Table 2) indicated that the cluster front line demonstration has given a good impact over the farming community of Banswara district of Rajasthan as they were motivated by the new agricultural technologies applied in the demonstrations.

Results of 138 frontline demonstrations indicated that the cultivation practices comprised under CFLDs viz., use of improved variety (GNG-1958, GNG-2144), balanced application of fertilizers @ 20:40:0:20 kg NPKS per ha, line sowing, timely weed management, water management at critical stages and control of pod borer through IPM module, produced on an average 17.40 q/ha, 15.80 q/ha and 16.30 q/ha chickpea yield during 2020-21, 2021-22 and 2022-23, respectively which was 46.22 per cent, 29.51 per cent and 27.34 percent, respectively higher compared top revailing Local check (Table 2). The results indicated that the cluster front line demonstrations have given a good impact over the farming community of Banswara district as they were motivated by the new agricultural technologies applied in the CFLD (Table 1). This finding is in corroboration with the findings of Poonia and Pithia (2011) ^[13] and Raj *et al.* (2013) ^[14]. The data presented in Table 2 indicated that the average yield of chickpea under demonstration was 16.50 q/ha whereas that the yield under Local check was 12.30 q/ha. This indicated that use of improved technology for chickpea production contributed 34.36 per cent higher production than the local check. The above findings were also similar to the findings of Singh (2002) ^[16], Poonia and Pithia (2011) ^[13], Patel *et al.*, (2013) ^[12] and Raj *et al.*, (2013) ^[14].

Table 2: Performance of Chickpea yield under FLDs and Local Check

Year	Area of demo. (ha)	No. of demo.	Variety	Potential yield (q/ha)	Demo. yield (q/ha)	Local Check yield (q/ha)	% yield increase over FP
2020-21	10	25	GNG-1958	26.8	17.40	11.90	46.22
2021-22	15	38	GNG-2144	22.8	15.80	12.20	29.51
2022-23	30	75	GNG-2144	22.8	16.30	12.80	27.34
Total	55	138	Average	24.13	16.50	12.30	34.36

Extension gap

The yield gaps presently ranging 3.5 q/ha to 5.5 q/ha. The average extension gap during the period of study was 4.2 q/ha (Table 3). This emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and to adopt new technology (Table 1).

Technology gap

The technology gap in the demonstration ranged from 6.5q/ha to 9.4 q/ha yields over potential yield and average technological gap during the period of study is 7.63 q/ha (Table 3). The technology gap observed may be attributed to the dissimilarity in soil fertility, salinity and erratic rainfall and other vagaries of weather conditions in the area. Hence, variety wise location specific recommendation appears to be necessary to minimize the technology gap for yield level in different situations and similar finding were found by Mukherjee (2003) ^[11] and Mitra and Samajdar (2010) ^[9].

Technology index

The technology index shows the feasibility of the evolved technology at the farmer's fields and the lower the value of technology index more is the feasibility of the technology (Jeengar *et al.* 2006) ^[5]. As such, fluctuation in the technology index was 35.07 per cent, 30.70 per cent and 28.51 per cent during 2020-21, 2021-22 and 2022-23, respectively and average technology index during the period of study is 31.43 per cent (Table3). These findings corroborate with the findings of Mokidue *et al.*, (2011) ^[10] and Tomar (2010) ^[20].

Table 3: Extension gap, Technology gap and Technology index of chickpea production under FLDs

Year	Variety	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (per cent)
2020-21	GNG-1958	5.5	9.4	35.07
2021-22	GNG-2144	3.6	7.0	30.70
2022-23	GNG-2144	3.5	6.5	28.51
Average		4.2	7.63	31.43

Economics of chickpea

The economics (Cost of cultivation, gross & net return and B:C ratio) of chickpea under front line demonstrations were estimated and the results have been presented in Table- 4. The front line demonstrations fetched more average gross returns (Rs. 78,653/ha), net return (Rs. 44,853/ha) and B:C ratio (2.33) with slightly higher investment on cost of cultivation (Rs. 4067/ha) as compared to Local check. The average increase in gross return, net return, B:C ratio and cost of cultivation was 34.03 per cent, 54.93 per cent, 18.27 per cent and 13.68 per cent, respectively over local check. The results are the supportive evidences of improved interventions/ technologies under demonstrations practices. Farmers can adopt the demonstrated technology to improve his monetary returns from their fields and leads to improve socio economic status and livelihood, increasing in monetary returns and benefit: cost ratio in pulses crops have been also reported by earlier workers (Ram *et al.* 2014; Dayanand *et al.* 2014; Lathwal, 2010) ^[15, 2, 8]. Similarly, demonstrations of improved technologies at farmer's field proven best to a great extent in enhancing the production and productivity of chickpea crop (Singh *et al.* 2017; Tomar, 2010) ^[19, 20]. The results suggested that higher profitability and economic viability of chickpea demonstrations under local agro-ecological situation.

Table 4: Economic performance of chickpea cultivation under front line demonstrations and Farmers practice

Year	Cost of Cultivation (Rs./ha)		Gross Return (Rs./ha)		Net Return (Rs./ha)		Benefit: Cost ratio	
	Demo	Local Check	Demo	Local Check	Demo	Local Check	Demo	Local Check
2020-21	32,100	28,400	81,780	55,930	49,680	27,530	2.55	1.97
2021-22	34,100	29,900	72,680	56,120	38,580	26,220	2.13	1.88
2022-23	35,200	30,900	81,500	64,000	46,300	33,100	2.32	2.07
Average	33,800	29,733	78,653	58,683	44,853	28,950	2.33	1.97

Conclusion

It may be concluded that integrated crop management technology in chickpea has found more productive, profitable and feasible in Banswara district of Rajasthan as compared to prevailing farmers practice. Even though up to 34.36 per cent yield increase of chickpea crop over local check are witnessed of creating confidence and friendly relationships between farm scientists and farming community. Farmers were motivated by results of demonstrations of integrated crop management practices in chickpea and they would adopt these technologies in the coming years. Now, National Food Security Mission a government initiative tried to bridges a connection to enhance the same due to popularization of improved technologies though KVKs at farmer's fields. But, there is still a wide gap between

potential and demo yield which needs more extension service among farming community for better crop production, productivity and net monetary returns of pulses with more emphasis.

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