IMPACT OF CLUSTER FRONTLINE DEMONSTRATIONS ON YIELD OF CHICKPEA (*Cicer arietinum* L.) IN PRAKASAM DISTRICT OF ANDHARA PRADESH

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 frontline demonstrations of chickpea crop in the Prakasam district of Andhra Pradesh state. Chickpea (*Cicer arietinum* L.) is a highly nutritious grain legume crop and is widely appreciated as health food as well as high return crop. Front line demonstrations were conducted at farmers' fields, to demonstrate production potential and economic benefits of improved technologies. Study revealed that improved cultivation practices comprised under CFLDs viz., recommended varieties, seed rate, timely sowing and plant protection technology resulted in increase in yield in gram crop over the check plots. The improved technologies gave higher yields and recorded a yield of 21.25, 21.75 and 19.50 q/ha chickpea yield during 2018-19, 2019-20 and 2020-21, respectively which was 13.35, 24.37, and 22.22 percent higher compared to prevailing farmers practice. Average seed yield under improved practice (IP) (20.83 q ha^{-1}) was 15.48% higher over farmer's practice (FP). The technology gap and extension gap were in the range of 3.25 to 5.50 q/ha and 1.50 to 4.25 q ha^{-1} respectively. Technology index value varied from 13.0 % to 22.0% during the study period. The benefit cost (B: C) ratio was 2.23 to 2.84 under demonstration, while it was 2.15 to 2.57 under control plots. The average B: C ratio under IP (2.53) was 39.89% higher over FP.

Keywords: Frontline demonstration, chickpea, technology gap, extension gap, technology index

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the largest produced food legume in South Asia and the third largest produced food legume globally, after common bean (*Phaseolus vulgaris* L.) and field pea (*Pisum sativum* L.). Chickpea is grown in more than 50 countries (89.7% area in Asia, 4.3% in Africa, 2.6% in Oceania, 2.9% in Americas and 0.4% in Europe). Globally, chickpea is grown in an area of 137 lakh hectares with a production of 142.4 lakh tonnes and productivity of 1038 kg/ha (FAO STAT, 2019). India contributes 70 per cent of total world bengalgram production of 116.2 lakh tonnes cultivated under 112 lakh hectares with productivity of 1036 kg/hectare in 2020-21 (agricoop.nic.in). India is the largest producer of world gram production followed by Australia, Myanmar and Ethiopia (FAO STAT, 2019). In India, bengalgram takes first position in total pulse production followed by Black gram. Andhra Pradesh produces 5.66 lakh tonnes in an area of 4.65 lakh hectares with 1218 kg/hectare productivity in 2020-21. (Third Advance Estimates, 2020-21, DES-AP). Chickpea also improves soil fertility by fixing atmospheric nitrogen, meeting up to 80% of its nitrogen (N) requirement from symbiotic nitrogen fixation. Chickpea returns a significant amount of residual nitrogen to the soil and adds organic matter, improving soil health and fertility. It has been estimated that chickpea has the capacity to fix 140 kg N ha-1 in a growing season. Chickpea is the most important pulse crop of rabi season cultivated mainly in semiarid and warm temperate regions of the world. It produces 126 kg protein from one hectare and is probably the highest protein yielding grain legume except, groundnut and soybean. A 100 g of chickpea seeds provide 360 calories more energy than any other legume except ground nut and lucerne. The high nutritional value makes chickpea an important food particularly in famine prone areas of the world. Chickpea is not only an important source of protein in the human diet, but also plays an important role in biological nitrogen fixation in the soil. Nutritionally, it contains 24% protein, 59.6% carbohydrates, and 3.2% minerals (Gaur *et al.*,).

There is urgent need to enhance the productivity of chickpea to meet the rising demand, of pulses in India. Majority of farmers in India usually grow pulses on marginal land with indiscriminate use of chemical fertilizers without biofertilizers and other faulty management practices like intensive tillage unscientific application of irrigation etc. that has threatened the sustainability of the crop. There is decline in soil fertility due to reduction of soil organic matter and multi nutrient deficiency. This has become a major limitation for pulse crop production particularly in low-input agricultural systems around the world (Lynch, 2007) . Biofertilizers, a type of organic fertilizers, are emerging as an ecologically safe means of fertilization. Commonly used biofertilizer are *Rhizobium and* phosphate solubilizing bacteria (PSB). Biofertilizer augment the biochemical processes in soil such as nitrogen fixation, phosphorus solubilization and mo-bilization, zinc solubilization, production of plant growth promoting substances and pathogen control. Biofertilizers provide an economically judicious, attractive and ecologically sound means of fertilization (Patel *et al*., 2013) and are important for making agriculture more sustainable. Therefore, there is a need to find out eco-friendly, feasible and cheaper options to meet the nutrient needs of the chickpea grown in rainfed conditions for maintaining soil fertility and crop productivity. For which, Krishi Vigyan Kendra, Darsi, Prakasam district organized cluster frontline demonstrations(CFLDs) successfully by the with an objective to demonstrate and popularize the improved agro-technology on farmers' field under varied existing farming situations and also to enhance the pulse productivity and farm gains through pulses intensification and diversification for sustaining the production systems.

Materials and Methods

The cluster frontline demonstrations(CFLDs) were conducted on chickpea cultivation in different mandals of Praksam district. Based on the information collected, production of chickpea is decreasing day by day because farmers not adopting the improved production technologies. Krishi Vigyan Kendra, Darsi, Prakasam district, Andhra Pradesh state conducted on conducted frontline demonstrations on chickpea at farmers' field to assess its performance during *rabi* seasons of the year 2018-19, 2019-20 and 2020-21in different villages viz., lingam gunta, Sudivaripalem, Korosapadu, Pothavaram and Bollapalli of Prakasam district. A total 25 farmers were selected for conducting of Cluster frontline demonstrations(CFLDs) with an area of 10 ha. The soil of the demonstration field was clay loam in texture, slightly alkaline in reaction (pH 8.2) In general, the soil of the area under study was clay loam in texture, slightly alkaline in reaction (pH 8.2) with low to medium fertility status. Each Cluster frontline demonstrations(CFLD) was conducted with components of demonstration comprised of improved variety (NBeG-49), proper tillage, proper seed rate, line sowing using seed cum fertilizer drill, proper fertilization, seed treatment with chemical fungicide, dual inoculation of Rhizobium + PSB, soil application of Trichoderma, weed management and protection measures. In the demonstration one control plot was also kept in which the farmers practices were carried out. The sowing was done during Mid November under rainfed. A common dose of 20 kg nitrogen and 50 kg P_2O_5 ha^{-1} were applied before sowing the crop. The yield data were collected from both the demonstration and farmers practice using random crop cutting method and analysed. The technology gap, extension gap and technological index (Samui *et al.* 2000) were calculated by using following formula (Eq. 1 to 4) as given below

1. Percent increase yield = $\frac{\text{Demonstration yield} - \text{Farmers yield}}{\text{Farmers yield}} \times 100$
2. Technology gap = Potential yield – Demonstration yield

3. Extension gap = demonstration yield-farmer's practice yield

4. Technology index = $\frac{\text{Potential yield – Demonstration yield}}{\text{Potential yield}} \times 100$

RESULTS AND DISCUSSION

Seed Yield

It is evident from Table.1 that indicated that the cluster front line demonstration has given a good impact over the farming community of Prakasam district as they were motivated by the new agricultural technologies applied in the demonstrations. Results of cluster frontline demonstrations indicated that the cultivation practices comprised under CFLD viz., use of improved variety (NBeG-49), balanced application of fertilizers (N: P: K @ 20:50:0:20 kg NPKS ha^{-1}, line sowing, timely weed management and control wilt and chickpea pod borer through fungicide and insecticide, produced on an average 21.25, 21.75 and 19.50 q ha^{-1} chickpea yield during 2018-19,2019-20 and 2020-21, respectively which was 13.35, 24.37, and 22.22 percent higher compared to prevailing farmers practice (Table 2). Average seed yield in the demonstration plot (20.80 q ha^{-1}) was 15.48 per cent higher over control plot (18.08 q ha^{-1}). Highest increase in seed yield in the demonstration plot was recorded during 2019-20 (27.37%), while the lowest yield increase (13.35%) was observed in 2018-19. The results indicated that the front line demonstrations have given a good impact over the farming community of Prakasam district as they were motivated by the new agricultural technologies applied in the CFLD plots (Table 1). This finding is in corroboration with the findings of Tiwari *et al.* (2003), Poonia and Pithia (2011) and Raj *et al.* (2013).

Technology gap

The technology gap in the demonstration ranged from 3.25 to 5.50 q ha^{-1} yields over potential yield (Table 2). 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. Similar findings was recorded by Mitra *et al.* (2010).

Extension gap

The extension gaps ranged from 1.50 to 4.25 q ha^{-1} during the period of demonstration 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). This finding is in corroboration with the findings of Hiremath and Nagaraju, (2010).

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). The average technology index was 16.68 %, while 22.00 % maximum technology index was during 2018-19 but lowest 13.0 % was during 2019-20 (Table 2).

B: C ratio

The finding clearly indicates the positive effects of CFLDS over the existing farmer's practices towards the yield enhancement of chickpea. Benefit- cost ratio was recorded to be higher under demonstration against control during all the years of study. The average B: C ratio under demonstration (2.53) was 15.48% higher over farmer's practices.

Conclusion

The findings of front line demonstrations showed that the yield of chickpea can be enhanced by 13.35 to 24.37 % with the use of improved technologies in Prakasam district. Higher benefit cost ratio has confirmed the economic viability of the demonstration and the adoption of improved technologies by the farmers. These demonstrations create a confidence and friendly relationship between farmers and scientists. The participated farmers in CFLDs act as source of information and improved seeds for larger spreading of the improved varieties of gram (Chickpea) for other adjoining areas of farmers. The improved technologies are very important for increasing the yield of chickpea crop and other crops. It will also help in disseminating other technical information by extension agencies for the benefit of the farmers.

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Table 1: Comparison between demonstration packages and existing practice under chickpea CFLDs

S. No.	Chickpea		
	Particulars	**Demonstration package**	**Farmers practice**
1.	Farming situation	Rainfed	Rainfed
2.	Variety	NBe-49	JG-11
3.	Time of sowing	First week of November	First week of December
4.	Method of sowing	Line sowing	Line sowing
5.	Seed treatment	Vitavax powder (Carboxin 37.5% + Thiram 37.5%) @ 2g/kg seed and *Trichoderma harzianum* @10 gm/kg seed	Not adopting
6.	Fertilizer dose	20:50:0 kg N:P:K ha-1 + Sulphur @ 20 kg/ha (N in form Urea and P inform of SSP)	Farmers are using DAP only
7.	Biofertilizers application	Seed inoculation with Rhizobium 5 g and soil application of biofertilizer consortium @ 12.5 kg ha^{-1} at time of sowing	Not adopting
8.	Weed management	Pre-emergence application of Pendimethalin @ 1.5 lit ha^{-1} at 2 DAS	Manual weeding
9.	Plant protection	Need based application	Non judicious use of pesticides

Table 2: Seed yield, technology gap, extension gap, technology index and B: C ratio of chickpea under CFLD

Year	Seed yield (q/ha)			% increase over control	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)	B:C ratio	
	Potential	Demo	Control					Demo	Check
2018-19	25.0	21.25	18.75	13.35	3.75	2.50	15.00	2.52	1.78
2019-20	25.0	21.75	17.50	24.37	3.25	4.25	13.00	2.84	1.62
2020-21	25.0	19.50	18.00	22.22	5.50	1.50	22.00	2.23	2.01
Mean	**25.0**	**20.83**	**18.08**	**15.48**	**4.17**	**2.75**	**16.68**	**2.53**	**1.80**