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RESEARCH ARTICLE

Impact of Cluster Frontline Demonstrations on Chickpea for Productivity Enhancement and Dissemination of Technology in Hisar District of Haryana

Vikas Hooda[1], Pooja Jangra[2]

[1]Krishi Vigyan Kendra, Hisar, Haryana, India, [2]Department of Soil Science, CCS Haryana Agricultural University, Hisar, Haryana, India

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ABSTRACT

The present study was conducted at farmer fields in two clusters of district Hisar to demonstrate the production potential and economic benefit of improved production technologies comprising sowing method, nutrient management, chemical weed control, and insect pest and disease management in respect of integrated crop management (ICM) mode. A total of 50 demonstrations were conducted in 1-acre size plot and also maintained same size check plot. Sown the crop after seed treatment with fungicide and culture and applications of pendimethalin for effective controls of the weeds during rabi season 2019–2020. The finding of the study revealed that improved technology recorded an average yield of 7.66 q/ha which was 22.56% higher than obtained under farmer practice (6.25/ha). A higher net income of Rs. 17283/- per ha with a benefit–cost ratio of 2.00 was obtained with improved technology in comparison to farmer practices (10500/- per ha benefit–cost ratio was 1.62). The technology gap was observed at 1634 kg/ha between the potential yield of variety and the demonstrated plot yield. The technology index for demonstration in the study was 68.08 kg/ha in accordance with the technology gap. From the above findings, it can be concluded that the production and productivity of chickpea crops can be increased through cluster frontline demonstrations by motivating the farmers for the adoption of scientific production technologies which were demonstrated in cluster frontline demonstration plots.

Key words: Cluster frontline demonstrations, extension gap, green gram, innovation, technology gap, technology index

INTRODUCTION

Chickpea (*Cicer arietinum L.*) commonly known as black gram is an important pulse crop and widely consumed in India. It is an important rabi season food legume having extensive geographical distribution and contributing 39% to the total production of pulse in the country (Singh *et al*. 2013). It is the cheapest source of protein and is an inseparable part of the daily diets of every Indian. It also plays an important role in sustainable agriculture by enriching soil through biological nitrogen fixation. It is a good source of protein (18–22%), carbohydrates (52–70%), fat (4–10%), minerals (calcium, phosphorus, iron), and vitamins (Singh *et al*., 2014). Its straw also had good forage value. Chickpea is grown in more than 50 countries (89.7% area in Asia, 4.3% in Africa, 2.6% in Oceania, 2.9% in the Americas, and 0.4% in Europe). In India, the area under chickpeas was 8.39 million ha with a production of 7.81 million tons and productivity of 931 kg/ha during Rabi 2016–2017 (FAOSTAT, 2017). The major chickpea-producing states are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Gujarat, Karnataka, Haryana, Bihar, and West Bengal. In Gujarat, the area under chickpeas was 0.295 million

Address for correspondence:
Pooja Jangra
E-mail: poojajangra.hau@gmail.com

ha with a total production of 0.364 million tones and productivity of 1235 kg/ha during 2017–2018 (Anon., 2017). Mehsana district of Gujarat occupies 597 ha of land and 7670 qt. production with an average productivity of 1285 kg/ha of chickpea (Anon., 2017). Its productivity is far below the potential yield. Biotic and abiotic stresses are responsible for declining yield potential (Singh *et al*. 2013). For making the nation self-sufficient in pulses, the productivity levels need to be increased substantially from 598 kg/ha to 1200 kg/ha by 2020 (Ali and Kumar, 2005). Cluster front-line demonstrations (CFLDs) were introduced by the Indian Council of Agricultural Research with the inception of the technology mission of pulse and oil seed crops during the mid-eighties. Understanding the concept, this field demonstration took place under the close supervision of scientists of the Krishi Vigyan Kendras (KVKs). Across the survey, farm diagnostic visit, and farmers' meeting, it was realized that the reason behind the lower productivity was due to the lack of improved variety, no seed treatment, imbalance use of inorganic fertilizers, lack of knowledge about Integrated Pest Management (IPM) practices, improper use of pesticides, etc. Among the biotic stress, the gram pod borer is a major pest occurring for 75% of pod damage in the crop (Krishan Kant *et al*. 2007). To mitigate the causes of yield reduction and the technology gap, CFLDs were laid out at farmers' fields during 2019–2020.

MATERIALS AND METHODS

Indian government imparts large quantities of pulses to fulfill domestic requirements of pulses. In this regard to sustain this production and consumption system, the department of agriculture, corporation, and farmer welfare had sanctioned the project cluster frontline demonstration on pulses to ICAR Atari, Jodhpur, through a national food security mission. This project was implemented by KVK of Zone-2 with the main objective to boost the production and productivity of chickpeas through CFLD's with the latest and specific technology. The main objective of the CFLDs is to demonstrate newly released crop variety, crop protection technologies, and management practices at farmer's fields under different agroclimatic regions and farming situations. Keeping in view, the present study has undertaken to increase green gram productivity by conducting the CFLD and simultaneously feedback from the farmers may be generated on the demonstrated technology (Yadav, *et al*. 2007 and Singh, *et al*. 2011).

To increase the area and productivity of chickpeas in the district, CFLDs on chickpeas were conducted by KVK, Sadalpur (Hisar) in two clusters of districts during the rabi season, 2019–2020 [Table 4]. 50 demonstrations in 20 ha area were conducted to demonstrate the integrated crop management (ICM) technology of chickpea in the rabi season. The demonstrations were conducted in sandy loam soil during rabi 2019–2020. Sowing was done in the 2nd week of October with a seed rate of 40 kg/ha. The study was conducted at farmers' fields to demonstrate the production potential and economic benefit of improved production technologies comprising of newly improved variety (CSJ-515), seed treatment with fungicide (carbendazim) and culture (Rhizobium and PSB), pre-emergence weed management with pendimethalin at 3.3 L/ha in 500 L of water used for effective control of weeds during rabi season and IPM practices. The method used for the present study with respect to CFLDs and farmer's practices is given in Table 1. In the case of local check plots, existing practices being used by farmers were followed. Other management practices were applied as per CCS HAU, the package of practices for *rabi* crops. The demonstrations at the farmer's field were regularly monitored at different stages of crops by a multi-disciplinary team of KVK, scientists. Technical observation was also noted, i.e., plants per square meter, pods per plant, and seeds per pod. The yield data from CFLD plots and fields cultivated following local practices adopted by the farmers of the area were collected and evaluated. Different parameters as suggested by Yadav *et al*. (2004) were used for gap analysis, calculating the economy. The details of different parameters and formulas adopted for analysis are as under.

Extension gap = Demonstration's yield–Farmer practices yield

Technology gap = Potential yield–Demonstration yield

Technology index = (Potential yield–Demonstration yield)/Potential yield×100

Table 1: Particular showing the details of chickpeas under CFLD and farmer practices

Technology	Farmer practices	Improved practices demonstrated under CFLD's	Percentage gap
Variety	HC-1, HC-3	CSJ-515	50
Seed rate	25 kg/ha	40 kg/ha	70
Seed treatment	No seed treatment	Carbendazim 50 WP (2.5 g/kg seed)/chlorpyriphos (15 mL/kg seed)	90
Biofertilizer	No seed treatment	Rhizotica (250 mL) and PSB (250 mL)	100
Fertilizers (kg/ha)			
N	No application	15 kg/ha	100
P	20 kg/ha (40%)	40 kg/ha	60
Weed management	One hoeing–50%	Two hoeing and pendimethalin 30 EC at 1 lt/ha	50
Insect management	Based on availability in the local market	Novaluraon 10 EC (375 mL/ha)	50

CFLD: Cluster Frontline demonstrations, EG: Extension gap

Table 2: Yield and economics of chickpea crop in the year 2019–2020

Treatments	Average yield (q/ha)	Percentage increase	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	BC ratio
Farmer practices	6.25	-	17000	27500	10500	1.62
Demonstration	7.66	22.56	17263	34546	17283	2.00

Table 3: Technological gap analysis of cluster frontline demonstration on chickpeas at farmer field

Year	Number of Demo	Potential yield kg/ha	Demonstrations yield kg/ha	Farmer practices yield kg/ha	EG kg/ha	TG kg/ha	TI kg/ha
Rabi 2019–2020	50	2400	766	625	141	1634	68.08

EG: Extension gap, TG: Technology gap, TI: Technology index

Table 4: Meteorological data during the crop season (2019–2020)

Month	Rainfall (mm)	Temperature (Oc)		
		Minimum	Maximum	Average
October, 2019	2.6	17.9	32.6	25.3
November, 2019	12.3	12.9	26.9	19.9
December, 2019	4.5	5.7	17.1	11.4
January, 2020	10.4	5.2	17.1	11.2
February, 2020	10.9	6.8	22.7	14.8
March, 2020	93.5	12.4	25.9	19.2

RESULTS AND DISCUSSION

The findings of the study revealed that a higher average yield of chickpea (7.66 q/ha.) in the demonstrated field was observed as compared to the farmer's practice (6.25 q/ha.) [Table 2] which was 22.56% higher than the farmer's practice. The economic analysis of CFLD observed that higher gross income can be obtained by the adoption of improved production technology of chickpea which reflects from the gross income of demonstrated field (Rs.34546/ha) over farmer's practice (Rs. 27500/ha). Further analysis of data revealed that a benefit–cost ratio of 2.00 was obtained in CFLD fields in comparison to farmer's practices (1.62).

The technology gap was observed at 1634 kg/ha between potential yield of variety and demonstrated plot yield while an extension gap of 141 kg/ha was found between demonstrated technology and farmer practices. The technology index for demonstration in the study was 68.08 kg/ha. [Table 3] in accordance with the technology gap. Such a gap might be attributed to the adoption of improved technology, especially high-yielding varieties sown with the help of seed cum fertilizer drill with balanced nutrition, seed treatment, weed management, and appropriate plant protection measures in demonstration which resulted in higher yield than the traditional farmers practices. The technology gap was recorded at 1634 kg/ha between the potential yield of variety and the demonstrated plot yield. This gap is due to the better performance of recommended varieties with different interventions and more feasibility of recommended technologies during the course of the study. The higher technology index reflected the inadequate transfer of proven technology to growers and insufficient extension services for the transfer of technology. Similarly, result has earlier being reported on moong by Bhan *et al*. (2014), Gaur *et al*. (2020) and on chickpea by Tomar *et al*. 1999, Tomar 2010, Mokidue *et al*. 2011, and Singh *et al*. 2014. These findings were in confirmative with the results of the study carried out by Meena and Dudi (2012), Meena and Singh (2016), Meena and Singh (2017), and Dayanand *et al* (2012). Hence, on the basis of the above findings, it can be concluded that the adoption of improved technologies significantly increases the yield as well as yield attribute traits of chickpea crop and also net returns of farmers. Hence, there is a need to disseminate the improved technologies of chickpea among farmers using effective extension methodologies such as frontline demonstrations and trainings. Farmers should be encouraged to adopt ICM technologies to get higher returns.[1-17]

CONCLUSION

It may be concluded that the CFLDs conducted on chickpeas at the farmer's field revealed that the adoption of improved technologies significantly increased the yield and also the net returns to the farmers. Hence, there is a need to disseminate the improved technologies among the farmers with effective extension methods such as training and demonstrations. The farmers should be encouraged to adopt the recommended package of practices for realizing high net returns. chickpea has a strong root system and capacity to fix the atmospheric nitrogen into the soil and improves soil health and contributes significantly to enhancing the yield of subsequent crops.

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