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Research Article

EVALUATION OF YIELD PERFORMANCE OF CHICKPEA THROUGH CLUSTER FRONT LINE DEMONSTRATION AT CHAMARAJANAGAR DISTRICT, KARNATAKA

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Abstract- Chickpea (*Cicer arietinum*) is an important pulse crop of Chamarajanagar district next to horsegram, greengram and blackgram. The productivity of chickpea in district is (328 kg/ha) very less as compared to state (718 kg/ha) and national average (859 kg/ha). To establish the production potential of crop the cluster front line demonstration (CFLD) is a good tool. To increase the production and productivity of chickpea the ICAR-Krishi Vigyan Kendra, Chamarajanagar district has conducted 225 (90 ha) demonstrations on chickpea during 2017-18, 2018-19 and 2019-20 on chickpea in three villages. The critical inputs were identified in existing production technology through farmers meeting and group discussions with the farmers. The study revealed that the demonstrated technology recorded a mean yield of 13.22 q/ha which was 25.82 % higher than farmers' practice (10.50 q/ha). The yield parameters *viz*., no. of pods/plant and 100 seed weight were also higher in demonstration plot than farmers practise. Average extension gap, technology gap and technology index were found 1.77 q/ha, 4.78 q/ha and 26.55% respectively. Higher mean gross and net returns and Benefit: Cost ratio of Rs. 57575/ha, Rs.30298/ha and 2.13 was obtained with improved technologies in comparison to farmers' practices (Rs.45788/ha, Rs.19396/ha and 1.73). Seed treatment of seeds with *trichoderma* and Integrated pest and disease management has reduced the incidence of wilt (4.60%), no. of larvae per m row (1.67) and no. of damaged pods per plant (4.27) as compared to local check (14.1%, 6.50 and 16.8). Therefore, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. The farmers should be encouraged to adopt the recommended package of practices for realizing higher returns.

Keywords- *Cluster Frontline Demonstration, Technology gap, Extension gap*

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Introduction

Pulses are mostly cultivated under rainfed conditions and do not require intensive irrigation facility and this is the reason why pulses are grown in areas left after satisfying the demand for cereals/ cash crops. Further, are rich in protein, improve soil fertility and physical structure, fit in mixed/intercropping system, crop rotations and dry farming and provide green pods for vegetable and nutritious fodder for cattle as well [1]. India is the major pulse producing country in the world which shares 30-35% and 27-28% of the total area and production of pulse, respectively. Even though pulse production increased significantly during last decade growth but maintaining that trend is a challenge for researcher, extension agencies and policy makers to full fill the domestic demand. In India, during 2017 -18 the total pulse area was 29.99 m ha with a production and productivity of 25.23 million tonnes and 841kg ha^{-1}, respectively. In Karnataka, the area, production and productivity were 3.02 m ha, 1.86 m t and 614 kg ha^{-1}, respectively [2].

Most of the agricultural area under Chamarajanagar district comes under rainfed situation. Therefore, most of the agricultural operations are depending on monsoon. Around 50 percent of the cropped area is under cereals and 22 percent under pulses. Thus, food grain crops cover almost three fourth (73 percent) of the cropped area. Among different pulses grown in district, Chickpea occupies an area of 2780 ha next to horsegram (15386 ha), green gram (3265 ha) and black gram (2961 ha). The productivity of chickpea of state is 718 kg ha^{-1}. Whereas the district productivity is 328 kg ha^{-1} [3]. The major reasons for the lower productivity of chickpea are use of local varieties, non-availability of season-based quality seeds resulting in increased pest and disease incidence particularly incidence of wilt and pod borer, no seed treatment with bioagents (*Trichoderma*) and bio-fertilizers (*Rhizobium* and PSB) erratic rainfall, cultivation of crops under salt affected soils, not practicing application of micronutrients, Poor management of pests and diseases. To address these issues ICAR-KVK, Chamarajanagar intervened since from 2017-18 to 2019-20 to improve the production and productivity of crops CFLDs. With this background the present study was designed with following objectives; To evaluate the impact of Cluster Front Line Demonstration on yield enhancement of chickpea. To investigate the impact of Cluster Front line demonstration on technology adoption. To find out the role of technology in minimizing the disease and insect infestation.

Materials and Methods

Present study was conducted by ICAR-Krishi Vigyan Kendra and 225 demonstrations were conducted on farmers' field in villages of Kotamballi, K. Mookkalli, Hanahalli, of Chamarajanagar district of Karnataka during *Rabi* season of 2017-18, 2018-19 and 2019-20. Each demo was conducted in 0.4 ha and thus 225 demonstrations were conducted from 2017-18 to 2019-20. For the adoption of village PRA technique and for the selection of farmers the purposive sampling design from frequently organised group meetings was exercised in each village. Before conducting the CFLDs, a list of farmers was prepared. Package of practices-oriented training to be imparted to the selected farmers [4]. During meeting, receptive and innovative farmers were selected for technological intervention. Improved technologies released from UAS, GKK, Bengaluru was adopted *viz*., line sowing, integrated nutrient management includes micro nutrient application (Zinc sulphate and Borax), seed treatment with *Trichoderma, Rhizobium* and PSB and whole package was demonstrated.

Table-1 *Particulars showing the details of chickpea grown under FLD and farmers' practice*

Particulars	Farmers Practice	Technology intervention	Gap
Farming situation	Rainfed	Rainfed	No gap
Variety	JG-11 (susceptible to wilt disease and long duration)	Jaki-9218 (Resistant to wilt, root rot & color rot and medium duration)	Full Gap
Sowing	Broadcasting/line sowing	Line sowing	Partial Gap
Seed rate	90-95.0 kg/ha	62.5 kg/ha	Full Gap
Seed Treatment	No seed treatment	Seed treatment with *Trichoderma, Rhizobium* and PSB @ 500 g/ha each.	Full Gap
Nutrient Management	Only FYM applied and no fertilizers.	Application of FYM 7.5t/ha, RDF @ 12.5:25:25 NPK kg/ha, $ZnSO_4$ @ 10 kg/ha, Borax @ 5 kg/ha, Foliar application DAP @ 2 % during flowering stage	Partial Gap
Weed Management	Manual weeding	Manual weeding	No Gap
Plant protection	Use of indiscriminate and non-recommended insecticides	IPM: Use of Pheromone traps, bird perches, Yellow sticky traps, Spreading puffed rice in the field, Application of profenophos (2ml/l) flowering and Emamectin Benzoate (0.5 g/l) at pod development stage.	Full Gap

Table-2 *Performance of technological interventions (CFLDs) on yield and yield attributes of gram*

SN	Year	Area (ha)	No. of Farmers	No. of pods/plant		100 seed weight (g)		Seed yield (q/ha)		Additional yield over check (q/ha)	% increase over check
				IT	FP	IT	FP	IT	FP		
1	2017-18	20	50	69.2	64.7	24.26	23.56	11.06	9.29	1.77	19.05
2	2018-19	30	75	67.4	62.0	24.12	23.53	13.9	11.5	2.40	20.86
3	2019-20	40	100	64.1	53.1	24.38	23.69	14.7	10.7	4.00	37.56
Average				66.9	59.9	24.25	23.59	13.22	10.50	2.72	25.82

Table-3 *Economics of cluster frontline demonstrations on chickpea in farmers' field*

SN	Year	Cost of Cultivation (Rs. /ha)		Gross returns (Rs. /ha)		Net returns (Rs. /ha)		B:C Ratio	
		IT	FP	IT	FP	IT	FP	IT	FP
1	2017-18	22100	23100	49761	41849	27661	18749	2.25	1.79
2	2018-19	27787	28950	59770	49450	31983	20500	2.15	1.70
3	2019-20	31945	27196	63195	46064	31250	18938	1.98	1.70
Average		27277	26415	57575	45788	30298	19396	2.13	1.73

Table-4 *Performance of technological interventions (CFLDs) on pest and disease infestation*

SN	Year	Area (ha)	No. of Farmers	% wilt incidence		No. of larvae per m row		No. of damaged pod per plant	
				IT	FP	IT	FP	IT	FP
1	2017-18	20	50	5.7	13.6	1.5	6.5	4.5	22.5
2	2018-19	30	75	4.0	12.9	1.5	6.0	4.0	17.5
3	2019-20	40	100	4.2	15.8	2.0	7.0	4.3	10.4
Average				4.6	14.1	1.67	6.50	4.27	16.80

Note: IT: Improved Technologies; FP:Farmers' practices

Table-5 *Technological gap analysis of cluster frontline demonstrations on chickpea in farmers' field*

SN	Year	Area (ha)	Seed Yield (q/ha)			Technology Gap (q/ha)	Extension Gap (q/ha)	Technology Index (%)
			Potential	Demonstration	Control			
1	2017-18	20	18.0	11.06	9.29	6.94	1.77	38.55
2	2018-19	30	18.0	13.9	11.5	4.10	2.40	22.77
3	2019-20	40	18.0	14.7	10.7	3.30	4.00	18.33
Average			18.0	13.2	10.5	4.78	2.72	26.55

Chickpea variety Jaki-9218. The technologies demonstrated under FLDs and details of farmers' practices are given in [Table-1]. In the similar way the farmers' practices were also carried out separately. In general, soils of the area under study were medium black soils and medium to low in fertility status. The spacing was 30 cm between rows and 15 cm between plants in the rows. Thinning (within 10-15 DAS) and weeding operations were done invariably 35-40 days after sowing to ensure recommended plant spacing (10 cm) within a row (30 cm) because excess population adversely affects growth and yield of crop. The yield attributes from 25 plants were selected randomly from five places by using quadrate and recorded during harvesting stage. The procedure followed was same in both demos plot as well as farmers' practice plot. 100 seed weight was recorded by counting 100 seeds selected randomly and finally it was weighed expressed in grams. The gross returns were calculated based on the market price prevailing and finally net returns and B:C ratios were calculated.

In the present study the data on output of greengram crop were collected from CFLD plots, besides the data on local practices commonly adopted by the farmers of this region were also collected to estimate the technology gap, extension gap and the technology index by adopting suitable formulae [5 and 6]. The details of different parameters and formula adopted for analysis are as under:

Extension gap = Demonstration yield - Farmers' practice yield

Technology gap = Potential yield - Demonstration yield

Technology index = Potential yield - Demonstration yield/Potential yield x 100

Results and Discussion

Yield and Yield Parameters

Adoption of all the improved production technologies resulted in increased mean yield (19.05-37.56 %) over farmers' practice during the three years of demonstration. The mean yield obtained in demonstrated plots was 13.22 q/ha as compared to the farmers' practice [Table-2]. This increase in yield is mainly attributed to good yield parameters [Table-2] *viz.*, no. of pods per plant (66.9) and 100 seed weight (24.25 g) as compared to farmers' practice (59.9 and 23.59 g respectively). This might be due to balance nutrition as per soil test value, integrated approach involving fertilizers and biofertilizers which play a vital role in making availability of plant nutrients [7, 8].

Economics

The average cost of cultivation was higher in demonstration plot (₹27277/ha) as compared to farmers' practice (₹ 26415/ha) because of additional input applied in demonstration. The gross returns (₹45788/ha) and net returns (₹19396/ha) in farmers practice was lower than the demonstration plot (₹ 30298 and ₹ 57575/ha).

Similar trend was also observed with B:C ratio [Table-3]. Yearly fluctuations in cost of cultivation, which consequently reflected the benefits were on account of variability in cost of inputs and outputs. These results were in conformity with the results of Deshmukh and his co-workers [9].

Disease Incidence

The percent wilt incidence was lower with demonstration plot (4.6%) as compared to farmers' practice (14.1%) due to seed treatment with *Trichoderma* bioagent [Table-4]. This was mainly attributed to the production of antibiotics *viz*., trichodermin, gliotoxins, viridin, cell wall-degrading enzymes, and certain biologically active heat-stable metabolites like ethyl acetate as a result it inhibits the activity of soil-borne pathogens [10].

Insect infestation

During the study [Table-4], data recorded on Infested no. of pods/plant (4.27) and no. of larvae per m row (1.67) was less in demonstration plot as compared to farmers' practice (16.8 and 6.50 respectively). The infestation of pod borer (*Helicoverpa armigera*) caused premature dry and shading of pods in farmers' practice [7 & 11].

Extension gap, Technology gap and Technology index

Data presented in [Table-5] showed the variation in extension gap and it varied from 1.77 to 4.00 q/ha with its average 2.72 q/ha. Variations in technology gap (3.3-6.94q/ha) reflected the impact of recommended technology used in cluster front line demonstrations in subsequent years. Fluctuations in technology gap as observed may be due to several biotic and abiotic factors [7].

Technology index showed the feasibility of the evolved technology at the farmers' fields. Lower value of technology index meant more feasibility of disseminated technology. Variations in technology index during the CFLDs were found 18.33-38.55%. However, its average of three year was 26.55% [Table-5]. This might be due to variations in soil fertility, environmental hazards and infestation of pest [12].

Application of research: Adoption of integrated crop management practices by farmers helps in enhancing the production and productivity of the chickpea under rainfed condition of Chamarajanagar district.

Research Category: Cluster Front Line Demonstration

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Study area / Sample Collection: Kotamballi, K.Mookkahalli and Hanahalli, Chamarajanagar Taluk and District, Karnataka state, India

Cultivar / Variety / Breed name: JAKI-9218

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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