Original Research Article

Performance of Cluster Front Line Demonstration on Integrated Crop Management in Red gram (*Cajanus cajan*) with variety PRG-176 in Peddapalli District under North Agroclimatic Zone of Telangana state in India

ABSTRACT

The present study was conducted under CFLD at the farmers' fields in the operational area of Krishi Vigyan Kendra (KVK), Ramagirikhilla, Peddapalli District operational area for three kharif seasons during 2016-17 to 2019-20 covering 169 locations. The demonstrated technology delineated the practices of improved selection (PRG-176), seed treatment with *Rhizobium* @ 250 g $acre^{-1}$, soil application of *Trichoderma viridii* @ 2kg $acre^{-1}$ mixing with FYM @ one hundred kilo $acre^{-1}$ and plant protection measures with installation of pheromone traps @ four per acre, spraying of neem oil @one liter $acre^{-1}$ and Profenofos 50 EC @ 400ml $acre^{-1}$. The results of demonstrations showed an increase of red gram productivity notably as 15.91 q ha^{-1} compared to the farmers practice as 13.42 q ha^{-1} with a mean increase of 19.50 per cent. Technology gap and technology index values were 4.08 q ha^{-1} and 59.57 per cent respectively. The results conjointly unconcealed that the typical increase within the net return with demonstration was 55338 Rs. ha^{-1} and 40651 Rs. ha^{-1} over farmers practice respectively. Similarly, the very best benefit cost ratio was recorded with demonstration as 2.61 as compared to 1.99 beneath farmers practice throughout all the years of trial. Adoption of improved technology as well as new selection, timely supply of essential inputs with correct steering by the human, frequent watching visits to fields diagnose the issues and take applicable corrective measures, field days etc., can be the contributive factors for prime yield with smart quality in all told demonstration plots.

Keywords: Red gram, FLD, ICM, PRG-176, BC Ratio

1. INTRODUCTION

Pulses are important crops in Indian farming system, both ecologically and in terms of human nutrition. Pulses are predominant food crops for human consumption as well as animal feeding. Being leguminous in nature, they are considered to be vital constituent of cropping systems due to their potentiality to fix atmospheric nitrogen and also add considerable quantity of organic matter to the soil and produce profitable yields with low inputs even under harsh climatic and soil conditions [1]. Pulses are predominantly cultivated in Asian countries particularly in the Indian Sub-continent. In India, pulses are grown under different agro-climatic conditions. India is the largest producer and importer as well as consumer of pulses, accounting for 25 per cent of global production from 35 per cent global area [2]. Pulse production in India is 24.51 million tonnes during 2017-18, which is highest in the country [3]. Among the different pulses, red gram (*Cajanus Cajan*) is the second most important grain legume next to chickpea with an average area of 4.05 million hectares recorded a total production and productivity of 3.27 metric tonnes and 799 kilograms per hectare [4]. Red gram occupies a prominent place in Indian dry land agriculture by covering an area of around 3.9 million hectares with productivity of 729 kilograms per hectare and is an integral component of various dry land systems of the country mainly inter cropped with cereals, pulses, oilseeds, millets and commercial crops [5]. It is important to note that the red gram continues to be the largest consumed pulse in home as well as industrial purpose comprising of about 50 per cent to the total pulse produce in India [6]. In Telangana state, Red gram is a major pulse crop occupies of an area of 251121 ha in kharif season, In Peddapalli district, Red gram occupies an area of 1138 ha with an average productivity of 20 q ha being kharif is the major season. Due to the importance of crop there have been developed few high yielding varieties and location specific package of practices by the research institutes but a proper demonstration to improve adaptability is lacking. Hence, there is an urgent need to study the impact of the high yielding varieties and also to identify the key factors influencing adoption of high yielding varieties to realize increased production in Telangana. The reasons for influencing the farmers decision to adopt improved practices also need to be explained. The variety demonstrated in the present trial is PRG-176 which is developed by PJTSAU, Hyderabad. This variety is a bold seeded with 110-115 days duration. Department of Agriculture, Cooperation and Farmers Welfare, Government of India had sanctioned the project “Cluster Frontline Demonstration on Pulses” to ICAR-ATARI, Zone-X, Hyderabad through National Food Security Mission (NFSM) which is a novel approach to provide a direct interface between researcher and farmer for the transfer of technologies developed by them and to get direct feedback from farming community and to diminish the quantity of imported pulses from other countries and as well as to sustain production and consumption of pulses. The scheme is carried out in a mission mode by way of a farmer centric approach. KVKs are grass root level organization meant for application of technology through assessment, refinement and demonstration of proven technologies under micro farming situation in a district [7]. The variety PRG-176 was demonstrated Krishi Vigyan Kendra, Ramagirikhilla, Peddapaalli District with an objective to boost the production and productivity of pulses through CFLDs by incorporating HYVs with improved package of practices.

2. METHODOLOGY

The cluster frontline demonstrations on integrated crop management of red gram was conducted during rainy/kharif seasons of 2016-17, 2017-18, 2018-19 and 2019-20 by Krishi Vigyan Kendra (KVK), Ramagirikhilla, Peddapalli district in 3 blocks namely Kamanpur, Ramagiri and Kalvasrirampur covering 169 farmers with an area of 80 hectares. The ICM practices viz., land preparation, seed treatment, spacing, intercultivation, integrated nutrient management, integrated pest and disease management were demonstrated at the farmer’s field. The remaining cultivation practices were followed as per the package of practice of the State Agricultural University, Telangana and **need based input material were provided to the farmers by the KVK (Table 1) (Figure 1)**. **All the engaging farmers were educated on copious aspects of red gram production technologies.** For control plot, farmers followed conventional methods with existing local variety LRG-41. The yield data was collected from both CFLD and farmers practice plots for all the years of study and compiled (Table 2). In the present study, technology index was operationally defined as the technical feasibility obtained due to implementation of Cluster Frontline Demonstrations in red gram following procedure the employed to analyze the performance of demonstration as per the formula used by [8], [9] and [10].

Benefit cost ratio: Gross return (Rs./ha)/cost of cultivation (Rs./ha)
Technology gap: Potential Yield (Pi)-Demonstration Yield (Di)
Extension gap: Demonstration Yield (Di)-Local check Yield (Li)
Technology Index: (Potential Yield-Demonstration Yield/ Potential Yield) × 100

Table 1: Differences between farmers practice and technology demonstration for red gram

Practices	Demonstrated practice	Farmers practice
Variety	PRG-176	LRG-41
Seed treatment	Rhizobium @ 250 g ac^{-1}	No seed treatment
Land preparation	Soil application of *Trichoderma viridii* @ 2 kg $acre^{-1}$ along with 100kg FYM	No application of *Trichoderma viridii* and FYM
Intercultivation	Application of Pendimethalin @ 1 lit $acre^{-1}$	Manual weeding
IPM practices	Installation of pheromone traps @ 4 $acre^{-1}$, Spraying of Profenofos 50EC@ 400 ml $acre^{-1}$ and Neem oil @ 1 lit $acre^{-1}$	Indiscriminate use of sole Chloropyrifos 50EC @ 2 ml lit^{-1} water

Fig. 1. Distribution of critical inputs (neem oil) to the farmers

3. RESULTS AND DISCUSSION

3.1 Performance of FLD

It is evident from the data that the crop yield of demonstration plots was higher as compared to farmers practice which might be due to a complementary effect of high yielding variety and various components of ICM practices. A differentiation in yield between demonstrated practices and farmers practices is indicated in Table 2. PRG-176 variety with ICM practices has given higher yield when compared to the farmers practice with variety LRG-41. It was observed that the average seed yield with the demonstration was 15.91 q ha^{-1} as compared to 13.42 q ha^{-1} with farmers practice. The cumulative mean over four years showed an average increase of yield with demonstration (19.50 per cent) when compared to farmers practice. Similar yield enhancement through in frontline demonstrations has been illustrated in different crops by [11] and [12]. [13] stated that the increase in the yield with demonstrations might be due to narrow down the technology gap by adopting recommended agro-technologies in FLDs. Yield of the frontline demonstrations and potential yield of the variety was collated to evaluate the yield gaps which were additionally classified into technology and extension gaps [14]. Similarly, [15] reported that the selection of quality seed is necessary for achieving higher yields in pulse crops.

3.2 Technology Gap

A typical analysis of yield data (Table 2) disclosed that the average technology gap as 4.08 q ha^{-1}. The technology gap recorded in the present study may be attributed to variations in the fertility status of land, adoption levels of IPM practices, weather fluctuations, local specific crop management problems in order to harness the yield potential of demonstrated cultivar under the differential ability of farmers to follow the management practices [16]. Accordingly, locality peculiar suggestions appear to be requisite to bridge the gap between the yields. These results are more or less similar to the findings of [17] and [18].

3.3 Extension Gap

The refinement of the data presented in Table 2 divulged that the average extension gap between demonstration and farmers practice was recorded as 2.49 q ha^{-1}. Greater extension gap in the present study indicates a strong need to create mass awareness and motivate the farmers for adoption of improved farm technologies precisely over local existing practices. Refinement in the local farmers practices for higher adoption of specific improved farm technology for sustaining crop productivity is another option for the research scientists [19]. Extension yield gaps are the indicators of lack of awareness for the adoption of improved farm technologies by the farmers [20]. The results are in close conformity with [17] and [18], who reported that, location specific problems and the interventions may have immense proposition in the enhancement of crop productivity.

3.4 Technology Index

As technology index denotes the gap between technology generated at research farm and farmer's field, lower the technology index more feasible will be the technology [21]. Further investigation of the data disclosed that the mean technology index was reported to be 59.57 per cent (Table 2). This value shows that there is a great gap present between technology developed and technology adopted at farmers field and depicts the feasibility in conducting a demonstration. However, farmer perception towards the technology involving high initial costs and adverse climatic conditions resulted in the radical trend of increasing and decreasing technology index values during the demonstration years (Figure 2). The social environment in terms of irrational frame of mind, ignorance and inscrutable behaviors towards the adoption of new technologies is also a major limiting factor to the improvement in agricultural productivity [15]. It emphasizes to promote the improved technologies for a longer period over the years with more penetration at field level to achieve decreasing trend of the technology index with précised use of demonstrated technologies in the field more suitable for those climatic conditions during demonstration period. The present results in terms of technology index are in close conformity with [22] and [23].

3.5 Economics of Front-Line Demonstration

The analyzed data regarding the economic analysis for the red gram was illustrated in Table 3. With the scrutiny of data, we found that the mean cost of cultivation (Rs. ha^{-1}) with demonstration was Rs. 33773 ha^{-1} which is lower than farmers practice (Rs. 34433 ha^{-1}). The data infer that, gross monetary returns (Rs. ha^{-1}) as well as net monetary returns (Rs. ha^{-1}) were increased with the technology demonstrated over farmers practice during the course of study. The outcome babble that the mean gross capital returns of Rs. 89021 ha^{-1} and average net monetary returns of Rs. 55338 ha^{-1} obtained with the demonstration over farmers practice with average gross returns of Rs. 75084 ha^{-1} and average net returns of Rs. 40651 ha^{-1}. In the same manner, the average benefit cost ratio of demonstration plot was 2.61 which was more than the farmers practice (1.99) (Figure 3). The increase in the yield and monetary returns with demonstration might be due to the selection of improved variety, seed treatment with Rhizobium, soil application of *Trichoderma viridii* along with FYM, good intercultivation as well as integrated pest management practices. Non adaption of up to date technologies due to carrying out of old age technology as they are unable to bear costly inputs which results in squat returns and meagre incomes, which ultimately leads to low monetary benefits to the farmers [15]. The results pertained to the ultimate monetary benefits are in confirmation with the earlier findings of [24]. However, the demonstrated technology resulted in higher returns as compared to farmers practice during the course of study. The higher returns and effective gain obtained under demonstration might be due to adoption of improved variety, recommended technologies, timely operations of crop cultivation as well as scientific monitoring under supervision of KVK scientists (Figure 4). Similar results were also reported by [25].

Table 2: Productivity, technology gap, extension gap and technology index in red gram under CFLD

Crop	Year	Area (ha)	Yield (q ha^{-1}) Potential	Yield (q ha^{-1}) Demonst-ration	Yield (q ha^{-1}) Farmers practice	% Increase in yield	Technology gap (q ha^{-1})	Extension gap (q ha^{-1})	Technology Index (%)
Redgram	2016-17	20	20	18.05	16.42	9.90	1.95	1.63	70.25
	2017-18	20	20	14.11	11.02	28.1	5.89	3.09	50.55
	2018-19	20	20	16.25	13.01	25.0	3.75	3.24	61.25
	2019-20	20	20	15.25	13.25	15.0	4.75	2.00	56.25
	Average		20	15.91	13.42	19.5	4.08	2.49	59.57

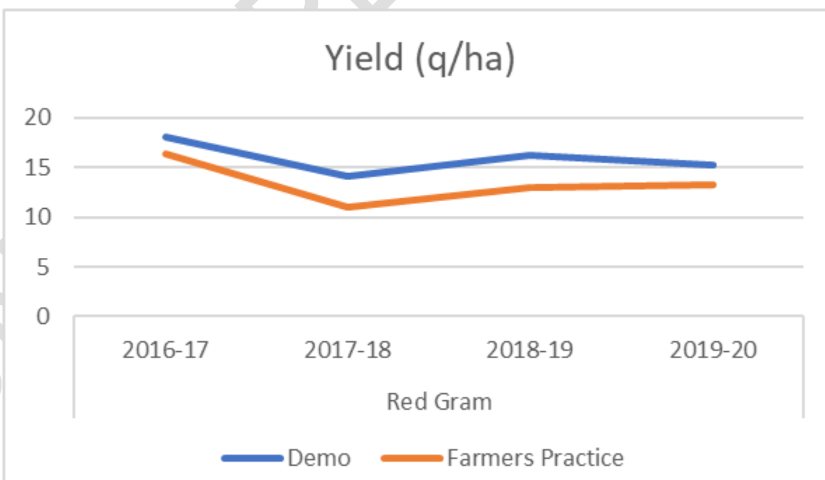

Fig. 2. Radical trend of increasing and decreasing yield of Red gram in demonstration and farmers practice over four years

Table 3: Average economics of red gram under CFLD

Crop	Year	Treatments	Cost of cultivation	Gross	Net return	B:C Ratio

			(Rs. ha^{-1})	return (Rs. ha^{-1})	(Rs. ha^{-1})	
Redgram	2016-17	Demonstration	45840	99275	53795	2.00
		Farmers practice	45200	90310	45110	1.18
	2017-18	Demonstration	27802	76140	48338	2.73
		Farmers practice	29560	59400	29840	2.00
	2018-19	Demonstration	28950	92218	63268	3.00
		Farmers practice	29220	73775	44555	2.50
	2019-20	Demonstration	32500	88450	55950	2.72
		Farmers practice	33750	76850	43100	2.28
	Average	Demonstration	33773	89021	55338	2.61
		Farmers practice	34433	75084	40651	1.99

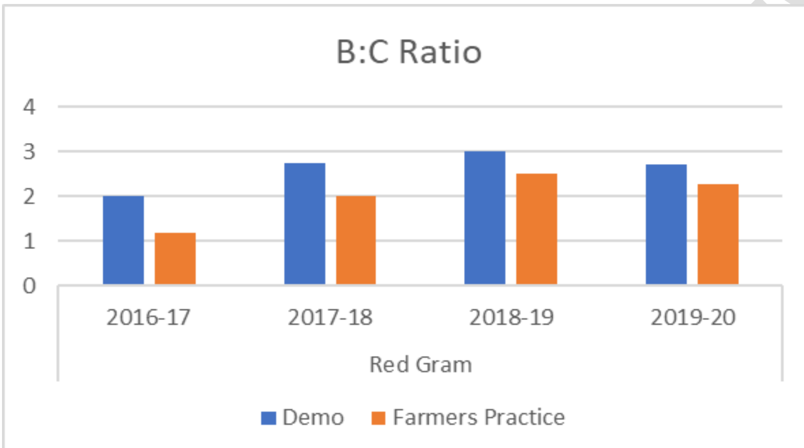

Fig. 3. Benefit Cost Ratio of red gram in demo and farmers practice during the period of study

Fig. 4. Field day and Scientific Monitoring of farmers red gram fields

4. CONCLUSION

Cluster frontline demonstrations on red gram during 2016-17, 2017-18, 2018-19 and 2019-20 concluded that highest yield of 18.05 q ha^{-1}, 14.11 q ha^{-1}, 16.25 q ha^{-1} and 15.25 q ha^{-1} obtained with demonstration followed by 16.42 q ha^{-1}, 11.02 q ha^{-1}, 13.01 q ha^{-1} and 13.25 q ha^{-1} with farmers practice for the respective years. Similarly, financial benefits were also recorded inflated with demonstrations as compared to farmers practice. The average rise in yield of red gram to the extent of 19.50 per cent in demonstration over the farmers practice created greater awareness and motivated the other farmers to adopt the improved package of practices for red gram. These demonstrations built the relationship and confidence between farmers and KVK scientists. It is culminated that the Cluster Front Line Demonstration programme is a worthwhile tool for upscaling the production and productivity of red gram and swapping the knowledge, perspective and ability of the farmers. This has not only resulted in socio-economic security but also helped in attaining food and nutrition security to the community. The benefit cost ratio of the demonstration is clearly in line with the aim of doubling farmers income by 2022 as suggested by Ashok Dalwai Committee on Increasing Farmers Income, Government of India.

CONSENT (WHERE EVER APPLICABLE)

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

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