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Raising Productivity and Profitability of Red Gram (*Cajanus cajan* L.) in Guntur District of Andhra Pradesh

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ABSTRACT

Krishi Vigyan Kendra, Lam, Guntur carried out cluster frontline demonstrations (CFLDs) on Red gram in the Andhra Pradesh state during the *kharif* season of 2020-2021, 2021-2022 and 2022-2023 in the villages of Guttikonda, Jullakallu, and Batluru , respectively. The variety LRG-152, when treated with imidacloprid at 2 ml/kg, carbendazim at 1g/kg, and *Rhizobium* spp. at 25 g/kg, along with plant protection (yellow sticky trap + neem oil + insecticide), fertilizer, and weed control, produced the highest average yield of 21.56 kg/ha (2016–17) compared to the farmers' usual yield of 1863 kg/ha. The fluctuation in minimum support price selling rates as announced by GOI resulted in the greatest net returns of Rs.60560 /- during the year 2022–23 and the least net returns of Rs. 58250/– during the year 2020-21. According to the study, there was an average 343 kg/ha extension gap between farmers' practices and the technology that was exhibited. Over the course of all the years, the technological gap averaged 380 kg/ha. The improved performance of suggested varieties with various treatments and the increased viability of recommended technologies during the study period were the reasons for the variations in the technology gap between years. In a similar vein, every research demonstration's technology index complied with the technological gap. It was clear from this that adopting new technologies through CFLDs could increase the production of red gram. Therefore, it's imperative to use efficient extension techniques to spread the upgraded technologies among farmers, such as trainings and demonstrations.

Key Words: Demonstration, Grain , Redgram, *Rhizobium* , Sticky trap, Yield.

INTRODUCTION

Red gram (*Cajanus cajan* L.) is India's second most important legume crop after chickpea. It makes up 22% of all pulse production in India and 1.76% of the country's gross cultivated area. Due to its special ability to fix atmospheric nitrogen in symbiotic relationship with *Rhizobium* bacteria found in the root nodules, red gram plants function as miniature fertilizer factories, replenishing and preserving soil fertility. The ability of red gram to produce high economic yields under soil moisture deficit makes it an important crop in rain fed and dry land agriculture. Red gram is an important rain fed crop in the state of Andhra Pradesh cultivated in 2,40,000 ha and suitable for inter-cropping, with different crops (Cotton, Sorghum, Pearl millet, Green gram, Black gram, Maize, Soybean, Groundnut) for increasing production and maintaining soil fertility. The active constituents in the leaves and seeds are alkaloids, cyanogenic glycosides, flavonoids, saponins and tannins. Red gram variety LRG 52 has a yield potentiality of 20- 25 q/ha and duration of 165 -170d . Its salient feature is tolerant to wilt and brown seeded variety.

Over the last few years, the area and production of pulses in Andhra Pradesh State increased tremendously due to inception of CFLD concept at farmers' field. Front Line demonstration is a long-term educational activity conducted in a systematic manner at farmers' fields to show worth of a new technology on “Seeing is Believing” principle. Traditional or farmer's practices are no longer sustainable towards pulse production as it

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Table1. Particulars showing the details of Red gram grown under CFLD and farmers' practice.

Operation	Existing practice	Improved practices demonstrated
Name of the variety	LRG-41	LRG-52
Seed rate and spacing	7.5-10.0 Kg/ ha, 120 X 30 cm	5.0-7.5 Kg/ ha, 120 X 45 cm or 180X45 cm or 90X90 cm
Seed treatment	No seed treatment	Seed treatment with Imidacloprid @ 2ml/kg + Carbendazim@1g/kg +Rhizobium spp @ 25g/kg of seed
Wilt	No tolerance	Tolerant variety
Weed management	No weed	Weeds control by using herbicide Pendimethalin 1kg / ha in 500 liter of water as preemergence treatment for effective control of weeds within two days after sowing
Plant protection measures	Not practiced	Chlorpyriphos 2.5 ml/L for Maruca
Use of pheremone traps	Not practised	Use of maruca traps 10/ha
Manures	Not applicable	20 Kg P as basal, 8 Kg N, Multi-K foliar spray at pod development stage
Whole package	Farmers are cultivating the Redg ram crop without adoption of any improved technology	All the crop (production and protection) management practices as per the package of practices for kharif crop by Andhra Pradesh State Agricultural University were followed for raising the crop

shows huge gap in yields in comparison to scientific production technologies. Constant efforts are needed to bridge this gap through demonstration of improved production technologies.

MATERIALS AND METHODS

The present investigation was conducted by Krishi Vigyan Kendra, Guntur in villages namely Guttikonda, Jullakallu and Batluru of Andhra Pradesh state during the *kharif* season of years 2020-2021, 2021-2022 and 2022-2023. The demonstration was conducted in an area of 90 ha with 225 farmers. In 2020-21, 100 demonstrations were conducted in 40 ha of area; 75 demonstrations were conducted in 30 ha in 2021-22 and during 2019-20 about 50 demonstrations were conducted in 20 ha. The demonstrations were carried out at different locations to study the yield potential and spread the technology to a larger area. Each frontline demonstration was laid out in 0.4 ha and farmers allotted some area for carrying out their traditional practice. It was conducted with active participation of farmers to demonstrate the improved technologies of Red gram in different villages so as to establish production potentials and expand the area under the crop in the district.

Table 2. Details of need based inputs of Redgram used in CFLD

Name of the Cluster	Number of Demon.	Area in ha	variety	Technology Demonstrated	Need Based Inputs
Guttikonda	100	40 ha	LRG 52	•LRG-52 Resistant to wilt, high yielding variety w ith ICM Practices • Seed treatment with Imidacloprid @ 2ml/kg + carbendazim @1g/kg +Rhizobium spp @ 25g/kg of seed •Fertilizer recommendation based on soil test results • Neem oil + insecticide	• Treated seed •Rhizobium spp • Neem oil • Coragen • Multi -K (13:0:45)
Jullakallu,	75	30 ha	LRG 52		
Batluru	50	20 ha	LRG 52		

Present study with respect to CFLDs and farmers' practices are given in Table 1. The soils in selected villages were sandy loam.

Farmers were trained to follow the package of practices for Red gram cultivation as recommended by the State Agricultural University and need based input materials provided to the farmers (Table 2). Pre-sowing trainings were organized involving the selected farmers on the crops. Selected Red gram variety, LRG-52 was high yielding, tolerant to wilt and suitable to all seasons. Critical inputs along with technologies like seed treatment, fertilizer application, water and weed management, integrated pest and disease management etc., were demonstrated at every stage of the crop with appropriate trainings.

Regular visit by the scientist helped in proper execution of trials as well as collecting farmer's opinion on the demonstrated varieties. The performance of the variety in the trials was judged visually as well as quantitatively by farmers themselves. Crop yields were recorded from the demonstration and check plots at the time of harvest to identify the yield gaps between demonstration and check plots.

The data with respect to grain yield from CFLD plots and farmers plots of the area were collected and evaluated. Potential yield was taken in to consideration on the basis of standard plant population and average yield per plant under recommended package of practices. Different parameters as suggested by Yadav *et al* (2004) was used for gap analysis, and calculating the economics. The details of different parameters and formula adopted for analysis were as under different villages so as to establish production potentials and expand the area under the crop in the district.

Extension gap = Demonstration yield - Farmers' practice yield

Technology gap = Potential yield - Demonstration yield

$$\text{Technology index} = \frac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

Seed yield

The productivity of Red gram under improved production technology was 2150 2120 and 2090 kg/ha during the year 2020-2021, 2021-2022 and 2022-2023, respectively as against a yields of 1820,1760 and1750 kg/ha, respectively under farmers' practice. In comparison to farmer's practice there was an increase of 18, 20 and 19 per cent in productivity of red gram under improved technologies during the years 2020-2021, 2021-2022 and 2022-2023,

Table 3. Seed yield of Red gram under CFLD and FP.

Name of the Cluster	Year	Area (ha)	Demonstrations	Yield (kg/ha)		Additional yield (kg/ha) over farmer's practice	Percent increase
				Demo n.	Farmers practice		
Guttikonda	2020-21	40 ha	100	2150	1820	330	18
,Jullakallu,	2021-22	30 ha	75	2120	1760	360	20
Batluru	2022-23	20 ha	50	2090	1750	340	19

Table 4. Pooled analysis of three years yield of Redgram.

	IMPROVED PRACTICE YIELD	FARMER PRACTICE YIELD
Mean	2120	1776.66
Variance	900	1433.33
Observations	3	3
Pooled Variance	1166.6666	
Hypothesized Mean Difference	0	
df	4	
t Stat	12.3108	
P(T<=t) one-tail	0.0001	
t Critical one-tail	2.1318	
P(T<=t) two-tail	0.00025	
t Critical two-tail	2.77644	

Table 5 .Yield and yield parameters of demo and control varieties of Red gram.

Parameter	No. of Branches/plant	No. of Pods / plant	Test weight (g)	Yield (kg/ha)
LRG 52	13	104	11	2120
LRG 41	9	79	10	1776

respectively. The difference in yield observed during different years was due to variation in available irrigation facility at different places, dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers. The increased grain yield with improved technologies was mainly because of line sowing, seed treatment, nutrient management and weed management. These findings were in line with Meena *et al* (2012) and Meena and Dudi (2018) .

The seed yield of red gram under FLD and FP was given in table 3. Pooled analysis of three years yield of Redgram is presented in table 4. Yield and yield parameters of demonstrations and control varieties of Red gram were detailed in table 5.

Since the p-value (0.0002) (table 4) was less than 0.01, hence it can be concluded that there was significant difference between two practices with regard to yield in which improved practice significantly more yield (2120 kg/ha) than that of farmers' practice (1776 kg/ha).

Economics

Economic returns as a function of gain

Table 6. Economics Analysis of Redgram under CFLD and FP.

	Demonstrated plot				Farmers' plot			
Year	Gross Cost (Rs ha-1)	Gross returns (Rs ha-1)	Net return (Rs ha-1)	B:C ratio	Gross Cost (Rs ha -1)	Gross returns (Rs ha-1)	Net return (Rs ha-1)	B:C ratio
2020-2021	29000	87250	58250	1.80	33540	69870	36330	1.08
2021-2022	28650	87730	59080	2.06	32420	67870	35450	1.09
2022-2023	28000	88560	60560	2.16	34000	68470	34470	1.01

Table 7. Technological gap analysis of frontline demonstrations on Redgram farmers' field.

Year	Number of FLDs	Potential yield (kg/ha)	FLD yield (kg/ha)	FP yield (kg/ha)	EG (kg/ha)	TG (kg/ha)	TI (kg/ha)
2020-21	100	2500	2150	1820	330	350	14
2021-22	75	2500	2120	1760	360	380	15.2
2022-23	50	2500	2090	1750	340	410	16.4
AVERAGE		2500	2120	1776	343	380	15

EG= Extension gap; TG= Technology gap; TI= Technology index; FP= Farmers practices

yield and MSP sale price varied for LRG 52 (Demon.) LRG 41 (farmers' practice) . The maximum gross returns of Rs. 88,560/- and net returns of Rs. 60560/- during the year 2022-23 and minimum of Rs. 87250/- and net returns of Rs. 58250/- during the year 2020-21 were obtained due to variation in MSP sale rates as declared by GOI. The higher additional returns and effective gain obtained under demonstrations could be due to improved technology, nonmonetary factors, timely operations of crop cultivation and scientific monitoring and also sale of seed to other farmers as a seed. The lowest and highest benefit cost ratio were 1.80 and 2.16 in 2020-21 and 2022-23, respectively (Table 6) depends on produced grain yield and MSP sale rates. The results were in confirmity with the findings of front line demonstrations on pulses by Chaitanya *et al* (2020).

Performance of CFLD

Yield of frontline demonstration trials and potential yield of the crop was compared to estimate the yield gap further it was categorized into extension gap, technology gap and technology index. The extension gap and technology gap observed that it may be attributed due to dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers. Hence, to narrow down the yield gaps location specific technologies needs to be adopted. The study revealed that an extension gap of 330 to 360 kg/ha was found between demonstrated technology and farmers' practice and on average basis the extension gap was 343 kg/ha. The extension gap was highest (360 kg/ ha) during 2021-22 and lowest (330 kg/ha) during 2020-21. Such gap might be attributed to adoption of improved technology especially with high

yielding new varieties sown in line with balanced nutrition, weed management and appropriate plant protection measures in demonstrations which resulted in higher grain yield than the traditional farmers' practices.

The study further exhibited a wide technology gap during different years. The average technology gap of all the years was 380 kg/ha. The difference in technology gap in different years was due to better performance of recommended varieties with different interventions and more feasibility of recommended technologies during the course of study. Similarly, the technology index for all demonstrations in the study was in accordance with technology gap. Higher technology index reflected the inadequate transfer of proven technology to growers and insufficient extension services for transfer of technology. Hence, it can be inferred that the awareness and adoption of improved varieties with recommended scientific package of practices have increased during the study period. These findings were in the conformity of the results of study carried out by Meena and Sing (2017), Meena and Dudi (2018).

CONCLUSION

Cluster frontline demonstrations on Red gram conducted in three villages resulted average highest yield 21.20 q/ha in demonstration plot compared to farmers plot 17.76 q/ha. The cluster frontline demonstrations conducted on Red gram at farmer's field revealed that the adoption of improved technologies significantly increased the yield as well as gross and net returns to the farmers. Improved technologies can be spread by the successful implementation, demonstration and various extensions activities like training programme, field day, exposure visit organized in CFLDS programmes in the farmers' fields.

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