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Impact of cluster front line demonstrations on redgram yield, economics and yield gap analysis in Warangal district of Telangana

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Abstract
Cluster Frontline Demonstrations on red gram were conducted by KVK Mamnoor, Warangal during kharif season of 2017-18, 2018-19 and 2019-20 respectively at select villages spread across 60 ha covering 93 demonstrations with the objective of increasing the productivity, economics of red gram and to decrease the yield gap. Results revealed that the average red gram yield registered under the demonstration was 1480 kg $^{-1}$ ha with improved technology in comparison to 1180 kg^{-1} ha under farmer's practice with % increase of 25.4. The average gross returns (66434 Rs ha^{-1}), net returns (46769 Rs ha^{-1}) and B: C ratio (3.36:1.0) recorded was more in demonstration when compared to farmers practice (52409 Rs ha^{-1} gross returns, 31075 Rs ha^{-1} net returns and 2.45:1.0 B: C ratio). Further, there was average additional increase in income of Rs 12500 ha^{-1}, Rs 13140 ha^{-1} and Rs 16435 ha^{-1} in demonstrated technology during respective years of 2017-18, 2018-19 and 2019-20. Regarding the yield gap analysis, average extension gap of 300 kg ha $^{-1}$, technology gap of 520 kg ha^{-1} and technology index of 25.8% was recorded. The extension and technology gap could be reduced further by conducting large scale demonstrations paving the way for horizontal spread through location specific research strategies for different farming systems thereby increase farmers' income and attain self-sufficiency in pulses production in our country.

Keywords: Red gram, cluster frontline demonstrations, yield, gross returns, additional returns

1. Introduction

Redgram is commonly known as Tur or Arhar in India and is also the second important pulse crop in the country after Bengal gram. It is also called as Pigeon pea and the scientific name is *Cajanus cajan.* World major redgram producing countries are India (37.50 lakh tonnes), Myanmar (6.76 lakh tonnes), Malawi (4.34 lakh tonnes), Tanzania (3.15 lakh tonnes) and Haiti (0.87 lakh tones). India accounts for about 80% of the total world pigeon pea production and major redgram producing states are Maharashtra 7.44 lakh ha (18.88 lakh acres), Karnataka 2.37 lakh ha (5.86 lakh acres), Telangana 2.30 lakh ha (5.68 lakh acres), Madhya Pradesh 1.51 lakh ha (5.86 lakh acres) and Uttar Pradesh 0.87 lakh ha (2.15 lakh acres) Redgram Outlook Report 2020.

Pigeonpea (*Cajanus cajan* (L.) Millspaugh) is a deep-rooted and drought-tolerant leguminous food crop. Numerous nodules are present on roots and they contain a Rhizobium bacterium, which fixes atmospheric nitrogen. Red gram plant is a mini-fertilizer factory as the crop has unique characteristics of restoring and maintaining soil fertility through fixing atmospheric nitrogen in symbiotic association with Rhizobium bacteria present in the root nodules. Red gram contains about 22 percent protein, which is almost three times that of cereals and supplies a major share of the country's protein requirement of a vegetarian population. It is mainly consumed in split form as 'dal' and is a preferential pulse for Indians. Seeds are also rich in iron, iodine, and essential amino acids like lycine, tyrocene, cystine and arginine. The outer seed layer and the kernel part provide a valuable feed/concentrate to milch cattle. The husk of pods and leaves constitute a valuable cattle fodder. The dry sticks of the plant are used for fuel, thatches, storage bins (baskets) making etc. In addition to being an important source of human food and animal feed, Red gram also plays an important role in sustaining soil fertility by improving physical properties of soil and fixing atmospheric nitrogen. Besides, pigeon pea has the ability to solublize occluded P and highly insoluble calcium-bound P by their root exudates in addition to improving the soil fertility.

It is a drought-resistant crop suitable for dryland farming and predominantly used as an intercrop with other crops.

Pigeonpea is a multi-purpose crop that fits very well in cropping systems as intercrop with black gram, green gram, castor, sorghum, soybean, cotton, maize and groundnut in states Maharashtra, Karnataka, Andhra Pradesh, Telangana, Madhya Pradesh, Uttar Pradesh, Gujarat, Jharkhand, Rajasthan, Odisha, Punjab and Haryana. These cropping systems increase production and improve soil fertility, thus aid in sustainable agriculture. With climate variability and the occurrence of prolonged drought, pigeonpea offers resilience to cropping systems and its cultivation is expected to expand to new areas.

Despite the fact that many high yielding varieties have been released, the productivity of redgram remains stagnant around 700 kg/ha compared to its potential yield (1500-3000 kg/ha). This gap may be attributed to several biotic and abiotic factors. Since it is mainly a rainfed crop, unfavorable rainfall (Delayed, erratic, improper distribution) leads to terminal drought or heavy downpour (Kaushik Prasad *et al*., 2018) [6]. In addition, the crop is cultivated on marginal land by resource-poor farmers, who commonly grow traditional medium and long-duration varieties with fewer inputs of fertilizers, irrigation, weeding and pesticide.

The Ministry of Agriculture and Farmers Welfare, Govt. of India had initiated a nationwide Cluster Frontline Demonstration (CFLD) programme on pulses under National Food Security Mission-Pulses (NFSM Pulses) operational from 2007-08. The cluster front line demonstration aims to target the select districts by making available the improved technologies like promotion of Integrated Nutrient Management (INM), Integrated Pest Management (IPM), promotion of micronutrients/gypsum/biofertilizers, promotion of sprinkler irrigation, and Extension, training and mass media campaign Under this NFSM project, total pulses recorded an increase of 40.37% with 22.95 m.t. production during 2016-17. A maximum increase of 86.72% was recorded in pigeon pea.(Ministry of Agriculture and Farmers Welfare, Final report 2017) [4].

To meet the projected demand of 32 million tonnes of pulses by 2030, as per the Vision 2030 paper prepared by the Indian Institute of Pulses Research, Kanpur, a growth rate of 4.2% has to be ensured. In this regard, the CFLD's were conducted by Krishi Vigyan Kendra, Mamnoor, Warangal to increase the productivity and economics of redgram and lessen the yield gap compared to farmers' fields with the concept of seeing believes.

2. Material and Methods

The CFLD's on Redgram were carried out by KVK, Mamnoor, Warangal in Kyathampalli and Tatikayala during 2017-18, Perikaveedu and Singaram during 2018-19 and Errabelli during 2019-20, respectively. In 2017-18, 30 demonstrations were conducted in 20 ha of area; 38 demonstrations were conducted in 30 ha in 2018-19 and during 2019-20 about 25 demonstrations were conducted in 10 ha. The demonstrations were carried out at different locations to study the yield potential and spread the technology to a larger area. The soils under demonstration were sandy loams with medium fertility status. Each frontline demonstration was laid out in 0.4 or 0.8 ha and farmers allotted some area for carrying out their traditional practice. The data on the growth, performance of the crop, pest and disease incidence, farmer's feedback was recorded from time to time to assess the comparative performance.

2.1 KVK intervention: Awareness programmes on the importance of pulses were conducted by KVK staff before start of Kharif season at all locations. The beneficiary farmers were selected and training programme was conducted on the production technology of redgram as recommended by Professor Jayashankar State Agricultural University. The technological interventions with the improved package of practices are presented given in Table 1. Critical inputs like enhanced high yielding variety PRG-176, which is drought tolerant and of 160 days duration, seed treatment with bio-fertilizer Rhizobium, pheromone traps and recommended chemicals were provided to farmers. Literature on package of practices was distributed to farmers. Monitoring and follow-up visits were conducted at regular intervals; pest and disease incidence was observed, and need-based agro advisories were recommended to farmers and their feedback was also recorded. In the case of local checks, the traditional practices were followed using existing varieties.

Field days were conducted in demonstration fields at each location where beneficiary farmers of CFLD's and other farmers in the village, officials from the Department of Agriculture and local extension functionaries participated and observed the technology's superiority over farmers practice. Redgram crop yields were recorded from the demonstration and control plots at the time of harvest to visualize the technology difference and disseminate the technology on a large scale.

The gross returns, net returns and B: C ratio was calculated based on the prevailing prices of inputs and outputs.

The technology gap, extension gap and technology index were worked out (Samui *et al.,* 2000) as given below

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – Farmers yield

Technology index = [(Potential yield – Demonstration yield) / Potential yield] X 100

Additional return = Demonstration return – Farmers practice return

3. Results and Discussion

3.1 Grain yield

Data from Table 2 revealed that the highest grain yield of 17.3 q/ha was obtained under demonstration during 2017-18 as against 14.2 q/ha in farmers' practice. The average redgram yield under the demonstration with improved technology registered is 14.8 q/ha in comparison to 11.8 q/ha under farmer's practice. The percent increase in grain yield of the demonstrations over farmers' practice was 21.8, 24.1 and 30.3 during the respective years of the study period, with an average increase of 25.4%. The difference in yield observed during different years was due to variation in rainfall distribution, dissimilarities in soil fertility levels at different locations, pest and disease incidence. Improvement in yield under demonstration over the farmer's practice might be due to high yielding variety PRG-176. And it is of short duration, suitable to areas of low rainfall and red chalka soils, seed treatment for control of pests and diseases up to 20 days after sowing, use of an optimum dose of fertilizers, timely weed control and nipping practice. The present findings conform with Chaitanya *et al.,* 2020 [1], Ganga Devi *et al*., 2020 [3], Dinesh *et al*., 2021 [2], Jayalakshmi *et al*., 2018 [5].

3.2 Economics

From the economics of red gram presented in Table 3, it was evident that of the study period of 2017-18, 2018-2019 and 2019-20, the highest gross returns of 70576 Rs $ha^{-1}$and net returns of 49076 Rs ha^{-1} were registered during 2019-20 while highest B:C ratio of 3.50:1.0 was obtained during 2018-19 under the demonstration. In farmer's practice, the highest gross returns (54141Rs ha^{-1}), net returns (33453 Rs ha^{-1}) and B: C ratio (2.61:1.0) was recorded during the year 2019-20. Similar B: C ratios were recorded in demonstration among three years and in farmers' practice also, during all the three years under study similar B: C ratios were recorded. This was because of variation in the cost of cultivation and price of redgram though yield difference was prominent in 2017-18, 2018-2019 and 2019-20, respectively. The average gross returns (66434 Rs ha^{-1}), net returns (46769 Rs ha^{-1}) and B: C ratio (3.36:1.0) recorded was more in the demonstration when compared to farmers' practice (52409 Rs ha^{-1} gross returns, 31075 Rs ha^{-1} net returns and 2.45:1.0 B: C ratio). Further, there was an additional increase in Rs 12500 ha^{-1}, Rs 13140 ha^{-1} and Rs 16435 ha^{-1} in demonstrated technology during 2017-18, 2018-19 and 2019-20. The higher additional returns obtained under demonstrations could be due to higher yield with improved technology. Similar observations were reported by Chaitanya *et al*., 2020 [1]; Ganga Devi *et al*., 2020 [3]; Dinesh *et al*., 2021 [2]; Jayalakshmi *et al*., 2018 [5].

3.3 Yield gap analysis

The extension gap is the difference between demonstration yield and farmers yield and Table 4 depicts that the gap ranged from 2.5 to 3.4 with an average gap of 3.0 q/ha. The gap is attributed to improved technology with high yielding variety in the demonstration. This gap advocates the need of KVKs to educate non-beneficiary farmers through various extension means like awareness programmes, training programmes on scientific practices in cultivation, demonstration of seed treatment, timely ago advisories and complete adoption of demonstrated technology.

The technology gap significantly differs between potential and demonstration yields ranging from 2.7 to 7.4, with an average of 5.2 q/ha. The difference in technology gap in different years was due to more feasibility of the variety to the recommended technologies during the study period. The technology gap might be due to dissimilarity in soil fertility status, pest and disease incidence and local climatic conditions as varieties respond distinctly to diversified environments. Hence to narrow down the technology gap, location-specific high-yielding varieties with a specific package of practices addressing higher yields, weed population, fertility status, drought tolerance, pests, and diseases have to be developed.

The technology index shows the feasibility of the demonstrated technology, including the variety in the farmer's field. The lower the value of the technology index, the more the feasibility of the technology. The data presented in Table 4 indicated that the technology index was high, ranging from 13.5 to 37, with an average of 25.8. The gap between technology evolution and technology adoption in farmer's fields is because of differences in yields in different years due to varied rainfall distribution. During the year 2017-18, the lowest technology index of 13.5% was attained because of less difference between potential and demonstration yields due to less variation in climate. However, the technology index was high in the rest of the years due to irregular rainfall distribution, which resulted in fewer demonstrated yields. The present findings of extension gap, technology gap and technology index are in accordance with Jayalakshmi *et al*., 2018 [5]; Dinesh *et al*., 2021 [2]; Chaitanya *et al*., 2020 [1].

Table 1: Details of recommended package of practices for Red gram

S. No.	Particulars	Demonstration	Farmers practice
1	Seed	PRG-176	LRG-51
2	Seed rate	5 kg/ha	7. 5 kg/ha
3	Seed treatment	Fungicide Thiram @3g/kg, insecticide Imidacloprid @ 5 ml/kg seed and Biofertilizer Rhizobium culture @ 500g/ ha	No seed treatment
4	Fertilizers	50 Kg P as basal and 20 Kg N/ha, foliar spray with Multi-K @ 2.5 kg/ha at flowering to pod initiation stage	40 N, 100 DAP kg/ha
		Application of phosphorus in the form of SSP as basal	Application of phosphorous in the form of DAP
5	Weed management	Pendimethalin 30 EC @ 2.5 L/ha as pre-emergence herbicide followed by post-emergence application of Imazethapyr @ 750 ml/ha at 20 to 25 days after sowing	Hand weeding during the initial stage and neglecting at 20-25 days after sowing
6	Nipping practice	Removal of terminal branches to enhance side branches	Not practiced
6	Pest management	Spray with neem oil @ 5 ml/L for sucking pests, bird perches @ 20/ha, pheromone traps @ 20/ha (Helicoverpa 10 and Spodoptera 10), Chlorantraniliprole @ 0.4 ml/L for maruca pod borer	No neem oil and only chemical control when severe

Table 2: Red gram yield under demonstration and farmers practice

Year	Area (ha)	Number of demonstrations	Yield under demonstration (q/ha)	Farmers yield (q/ha)	% Increase in yield
2017-18	20	30	17.3	14.2	21.8
2018-19	30	38	12.6	10.1	24.1
2019-20	10	25	14.6	11.2	30.3
Average			14.8	11.8	25.4

Table 3: Economics of red gram under demonstration and farmers practice

Year	Demonstration plot				Farmers practice				Additional return (Rs ha^{-1})
	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 returns (Rs ha^{-1})	B: C ratio	
2017-18	18600	62500	43900	3.36:1.0	21800	50000	28200	2.29:1.0	12500
2018-19	18894	66226	47332	3.50:1.0	21515	53086	31571	2.46:1.0	13140
2019-20	21500	70576	49076	3.28:1.0	20688	54141	33453	2.61:1.0	16435
Average	19665	66434	46769	3.38: 1.0	21334	52409	31075	2.45:1.0	14025

Table 4: Yield gap analysis of redgram under CFLD

Year	Potential yield (q/ha)	Demonstration yield (q/ha)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
2017-18	20	17.3	3.1	2.7	13.5
2018-19	20	12.6	2.5	7.4	37
2019-20	20	14.6	3.4	5.4	27
Average	20	14.8	3.0	5.2	25.8

4. Conclusion

The Cluster Frontline demonstrations conducted by KVK, Mamnoor recorded higher yields and economic returns compared to farmers' practice. The percent increase of the demonstrated technology of about 25.4 over farmers' practice was because of selection of high yielding variety with drought tolerance, improved production technology of redgram like optimum seed rate, seed treatment to ward off pests and diseases during initial stages, weed control, timely nutrient management and pest control. The higher benefit-cost ratios proved the economic viability of the technological interventions and with respect to yield gap analysis, the demonstrations acted as an effective tool for disseminating the scientific production technology by creating greater awareness and motivating non-beneficiary farmers for complete adoption by building confidence in them.

The study emphasizes the need of KVKs to educate more farmers through various innovative extension means, including ICT's, FPO's, awareness programmes, skill oriented training programmes, field days at demonstration fields, farmers fairs, and exposure visits organized for the adoption of scientific practices in the cultivation of crop. Further, location-specific research strategies for different farming systems and extension programs could reduce the extension and technology gap. The cluster frontline demonstrations could be popularized by conducting more FLD's for wider adoption among the farming community, paving the way for horizontal spread of technology, since they can double production, increasing farmers' income and attaining self-sufficiency in pulses production in our country.

5. Further Research

Cultivars with shorter duration, high grain yielding, drought tolerant, pest resistant varieties for pod borer and wilt disease resistance varieties, have to be developed. Technology for Seed to seed mechanization must be developed. Prospects of transplanted red gram must be worked out under black soils. Studies should be conducted on water conservation technologies during period of uncertainty of rainfall.

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7. References

1. Chaitanya T, Rammulamma A, Sunil Kumar M, Sarala Kumari A, Jagan P, Mohan Rao. Impact of cluster frontline demonstrations on redgram productivity in Mahabubabad district of Telangana. Journal of Pharmacognosy and Phytochemistry. 2020;9(2):1510-1513.
2. Dinesh K, Navab Singh, Shivmurat M, Madho Singh, Laxman Prasad B, Lokendra B. Impact of cluster frontline demonstrations in productivity enhancement and dissemination of pigeon pea production technology in Dholpur, Rajasthan. The Pharma Innovation Journal. 2021;10(6):1305-1308.
3. Ganga Devi M, Anil Kumar Ch, Yugandhar Kumar M. Transfer of ICM technologies in enhancement of Redgram production through frontline demonstrations in Guntur district of Andhra Pradesh. Journal of Entomology and Zoology Studies. 2020;8(5):620-622.
4. Government of India Ministry of Agriculture and Farmers Welfare, Final report on Impact Evaluation Study of Centrally Sponsored Scheme National Food Security Mission Submitted by Spectrum planning (India), 2017, October.
5. Jayalakshmi M, Prasad Babu G, Ragavendra Chowdary K, Vijayabhinandana B, Subba Rao M. Impact of Cluster Frontline Demonstrations (CFLDs) on Pulse Production Productivity, Profitability and Transfer of Technologies in Kurnool District of Andhra Pradesh, India. International Journal of Current Microbiology and Applied Sciences. 2018;7(12):937-947.
6. Kaushik Prasad, Doharey RK, Subodh Kumar, Sanjeev A, Verma AK, Manoj Kumar. Constraints and Suggestions in Adoption of Scientific Cultivation in Pigeonpea: International Journal of Pure and Applied Bioscience. 2018;6(3):606-610.
7. Narendra Singh, Singh AK. Yield gap and economics of Cluster Frontline Demonstrations (CFLDs) on pulses under rain-fed condition of Bundelkhand in Uttar Pradesh. International Journal of Advanced Research in Biological Sciences. 2020;7(8):1-7.
8. Singha AK, Deka Bidyut C, Parisa Divya, Nongrum C, Singha Amrita. Yield gap and economic analysis of cluster frontline demonstrations (CFLDs) on pulses in Eastern Himalayan Region of India. Journal of Pharmacognosy and Phytochemistry. 2020;9(3):606-610.