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Impact of Cluster Frontline Demonstrations (CFLDs) on Pulse Production Productivity, Profitability and Transfer of Technologies in Kurnool District of Andhra Pradesh, India

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A B S T R A C T

The present study was carried out to evaluate the performance of improved cultivars with scientific package of practices on production, productivity and profitability of pulses. Cluster frontline demonstrations (CFLDs) were conducted during 2016-17 and 2017-18 in total of 170 demonstrations with evaluation of the performance of TBG 104, variety of blackgram in Orvakallu and Gonegandla blocks, Red gram variety PRG-176 in Mecadona block and Chick pea Variety NBeG-3 in Ramapuram block of the district and record the feedback information of farmers. The results revealed that average yield of red gram, black gram and chick pea under cluster frontline Demonstrations were 970,1160 and 850 Kgha^{-1} as compare to 830,890 and 720 Kgha^{-1} recorded in farmer's practice in 2016-17, and in 2017-18 the average yields were1050,1280 and 950 Kgha^{-1} in demonstration fields where as 870, 910, 810 Kgha^{-1} in farmer's practice. The average yield increase of 18.7, 35.6 and 19.93 per cent and additional return of 15,753.00, 21,308.00 and 7,743.00 Rs ha^{-1} respectively. It was observed that the benefit cost ratio (B: C) of recommended practice (CFLDs) were 2.1, 2.72 and 2.09 as compared to 1.40, 1.68 and 1.59 in farmer's practice. The average extension gap 160, 320 and 130 Kgha^{-1}, average technology gap 490,790 and 600 Kgha^{-1} and technology Index 32.6, 64.3 and 61.3 were recorded. Therefore, the results clearly indicates that the use of improved varieties and package and practices with scientific intervention under frontline demonstration programme contribute to increase the productivity and profitability of pulses in Andhra Pradesh state.

Keywords

Cluster front line demonstration, Production, Productivity, Extension gap, Technology gap, Technology index

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Introduction

India's economy has been dominated by agriculture. However, Indian agriculture fiercely depends on monsoons to yield sufficient agricultural returns. India's major food crops rice and wheat have been heavily incentivized with MSP in addition to preferential treatment of Public Distribution System to benefit the Indian poor. Hence, Indian farmers are most motivated to grow either these crops or cash crops like cotton, sugarcane etc. Pulses have been a second choice for the farmers for cultivation.

Over a period of time, a number of improved pulses varieties and production technologies have been developed, but full potential of these varieties as well as technologies could not be exploited due to low rate of adoption and low yields. Thus, factors limiting the productivity cannot be overlooked. Research and extension programmes need to be diverted to produce value additive pulses. It may emphasize on quality attributes, adoption and popularization of new agro technology, evolving better varieties for stress conditions and improving present yield potential. The aim of these demonstrations in general is to raise production through transfer of farm technology. The efforts were taken with planning, execution and follow up action of the pulses production technology through front line demonstrations (Sumathi, 2012).

Cluster front line demonstrations (CFLDs) 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. To meet the growing demand for food grains, National Development Council (NDC) in its 53rd meeting adopted a resolution to enhance the production of rice, wheat and pulses by 10, 8 and 2 million tons respectively by 2011 with an outlay of Rs. 4,882 crore under National Policy for Farmers in the Eleventh Five Year Plan. The proposed Centrally Sponsored Scheme 'National Food Security Mission (NFSM) is to operationalise the resolution of NDC and enhance the production of rice, wheat and pulses (Annonymous, 2011). The concept of Cluster first line demonstrations was put forth under this mission. The scheme implemented in a mission mode through a farmer centric approach. The scheme 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/bio-fertilizers, promotion of sprinkler irrigation, and Extension, training and mass media campaign. These demonstrations are conducted under the close supervision of scientists of Krishi Vigyan Kendras, SAUs and their Regional Research Stations.

The major pulses producing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Andhra Pradesh and Karnataka. These six states account for 79 percent of area and 80 percent of production of pulses in India. These pulses crops can be grown in kharif and rabi seasons in India and cultivated in marginal lands under rainfed conditions. Only 15 percent of area under pulses has assured irrigation. Among these six major pulses producing states in India, the productivity per hectare vary significantly from one state to another state. In Andhra Pradesh (13 districts) the area under pulses is 14.13 lakh hectares in 2016-17 which accounted for 2.8 per cent in total food crops area, whereas the same in 2011-12 is 13.38 lakh hectares which accounted for the same 2.8 per cent of total food crops area which is very slow or stagnated over 5 years.

Hence there is need for expansion of area and production in pulses in Andhra Pradesh. Cluster Front Line Demonstrations (CFLDs) under National Food Security Mission (NFSM) playing key role in introduction of improved varieties and production technologies in pulses.

Materials and Methods

Cluster frontline demonstrations were conducted by the Krishi Vigyan Kendra, Banavasi, Kurnool district of Andhrapradesh in kharif and Rabi seasons in the farmer's fields during 2016-17 and 2017-18 with evaluation the performance of new varieties and package of practices on production and productivity of pulses demonstrated for

Redgram, Balack gram and Bengal gram were identified based on Participatory Rural Appraisal (PRA) technique. A group of co-operative farmers were identified based on their participation and feedback received during the preliminary survey and interactive meeting. All 170 demonstrations in 340ha area were conducted by the active participation of farmers with the objective to demonstrate the improved technologies of pulses production potential in different villages. A total area of 10-20 hectare in every year was fixed for the demonstration of technologies in Redgram, Black gram and Bengal gram along with farmers practice as control plot. Assessment of gap in adoption of recommended technology before laying out the cluster frontline demonstrations (CFLD's) through personal discussion with selected farmer's. The awareness programme (preseason training) was organized for selection of farmer's and skilled development about detailed technological intervention with improved package and practice for successful cultivation. Critical inputs for the technologies to be demonstrated (Table 1, 2 and 3) were distributed to the farmers after the training like improved high yielding variety, recommended chemicals and literature and regular visit, monitoring and pest and disease advisory services management by the KVK scientist to the demo farmers. Finally field day was conducted involving demonstration holding farmers, other farmers in the village, Scientists from University and ATARI, officials from Department of Agriculture and local extension functionaries to demonstrate the superiority of the technology for each crop. Crop yield was recorded from the demonstration and control plots for the crops at the time of harvest. The most feasible way by which this could be achieved is by demonstrating the recommended improved technology on the farmer's fields through front line demonstrations with the objectives to work out the input cost and monetary returns between front line demonstration and farmers methods, to identify the yield gaps between farmer's practices and front line demonstrations. The basic information were recorded from the farmer's field and analyzed to comparative performance of cluster frontline demonstrations (CFLD's) and farmer's practice. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The technology gap and technological index (Yadav *et al.*, 2004) were calculated by using following formula as given below

Extension gap = Demonstrated yield- farmer's practice yield

Technology gap= Potential yield- Demonstration yield

Additional return = Demonstration return – farmer's practice return

Technology index=

$$\frac{\text{Potential yield-Demonstration yield} * 100}{\text{Potential yield}}$$

Percent increase yield=

$$\frac{\text{Demonstration yield - farmers yield X 100}}{\text{Farmers yield}}$$

Results and Discussion

The improved package and practices is more important with technological intervention for productivity and profitability of pulses. Detailed package and practices with technological intervention for recommended practice (Table 1, 2 and 3). It was also observed that farmer's use injudicious and un-recommended insecticides and mostly didn't

use fungicides. Similar observations were reported by Singh *et al.,* (2011).

Grain yield and gap analysis of red gram

The grain yield and gap analysis of Red gram in demonstrated field's and farmer's practice is presented in table 4. Data revealed that average grain yield of demonstrated field's was higher from farmer's practice in both years. The results revealed that average grain yield of Red gram under cluster frontline demonstrations were 970 and 1050 Kg ha^{-1}as compare to 830 and 870 Kg ha^{-1} recorded in farmer's practice and average yield increase of 16.86 and 20.68 per cent, respectively. The above finding was in accordance with Singh *et al.,* (2018). The extension gap 140 and 180 Kg ha^{-1} technology gap 560 and 450 Kg ha^{-1} and technology index 35.3and 29.50 was recorded (Table 4). This Extension gap should be assigned to adoption of improved dissemination process in recommended practices which outcome in higher grain yield than the farmer's practice.

Economics analysis of red gram

Economic performance of red gram under cluster frontline demonstration was depicted in table 5. The economic analysis results revealed that the red gram recorded higher total return from recommended practice (CFLD's) were 48,985.00 Rsha-1 in 2016-17and 57,225 00 Rsha-1 in 2017-18 as compared to 24,335.00 Rsha-1 and 26,980.00Rsha-1 farmer's. practice respectively. The net returns were 24,650.00 Rsha-1 in 2016-17 and 30, 245.00 in 2017-18 in recommended practice in comparison to 9,463 Rsha-1 and 13,926 Rsha-1 respectively in farmer's practice. It was economically observed that additional returns were 15187.00 and 16139.00 Rsha-1 in recommended practice in both the years. The benefit cost ratio also recorded higher in recommended practice with 2.01 and 2.12 as compared to 1.29 and 1.42 in farmer's practice in both the years.

The higher net returns and B: C ratio in red gram demonstration might be due to the higher grain yield and better pricing of the produce in the market.

Grain yield and gap analysis of black gram

The grain yield and gap analysis of black gram in demonstrated field's and farmer's practice is presented in table 6. The results revealed that average grain yield of Black gram under cluster frontline demonstrations were 1160 and 1280 Kg ha^{-1} as compare to 890 and 910 Kg ha^{-1} recorded in farmer's practice and average yield increase of 30.33 and 40.65 per cent, respectively. These results also supported by Bairwa *et al.,* (2013) and also Hiremath and Nagaraju (2010) in blackgram crop. The extension gap 270 and 380 Kg ha^{-1}, technology gap 340 and 220 Kg ha^{-1} and technology index 22.6 and 17.18 was recorded.

The observed technology gap may be attributed dissimilarity in soil fertility status, rainfall distribution, disease, insect, pest infestations and weed intensity well as the change in the locations of cluster frontline demonstration sites. The technology index shows the feasibility of the variety at the farmer's field. The lower value of technology index more is the feasibility of technology. This indicates that a gap existed between technology evolved and technology adoption at farmer's field

Economics analysis of black gram

Economic performance of Black gram under cluster frontline demonstration was explained in table 7. The economic analysis results revealed that the black gram recorded higher

total return from recommended practice (CFLD's) were 58,400.00 Rsha-1 in 2016-17and 69,120. 00 Rsha-1 in 2017-18 as compared to 44,500.00 Rsha^{-1} and 49,140.00 Rsha-1 farmer's. Practice respectively. The net returns were 35,500.00 Rsha-1 in 2016-17 and 44,980.00 in 2017-18 in recommended practice in comparison to 17,625.00 Rsha^{-1} and 20,240.00 Rsha^{-1} respectively in farmer's practice. It was economically observed that additional returns were 17,875.00 and 24,740.00 Rsha-1 in recommended practice in both the years. The benefit cost ratio also recorded higher in recommended practice with 2.58 and 2.86 as compared to 1.66 and 1.70 in farmer's practice in both the years. These results in accordance with the findings of Gurumukhi and Mishra (2003), Dhaka *et al.*, (2010) and Singh *et al.*, (2018).

Table.1 Differences between technological intervention and farmers practices under FLD on Red gram

Particulars	Technological intervention in FLD	Farmers practices	Gap
Variety	PRG-176	Local/own seed	Full gap
Seed rate	7.5 kg/ha	10 kg/ha	High seed rate
Sowing method /Spacing	150 X 20 cm, sowing with seed cum fertilizer drill	Broad casting, un even plant population	Partial gap
Time of Sowing	June 15th to 31st July	June 15th to 15th July	Partial gap
Seed treatment	Seed treatment was done with *Rhiozibium*	Seed treatment was not by done	Full gap
Fertilizer Dose	Balanced fertilization as per soil test values 44 kg of urea in split doses and 312.5 kg of SSP as basal dose.	Imbalance use of fertilizer 20 Kg urea as basal and 50 Kg DAP as top dressing.	Full gap
Weed management	Imazethapyr 10SL 75g a.i. ha-1 at15-20 DAS.	Manual weeding / weeding with bullocks	Full gap
Plant Protection	Neem oil @ 5ml/lit and Cholrophyriphos @2.5 ml/lit for control of sucking pest.	Injudicious use of and insecticides and fungicides.	Full gap

Table.2 Differences between technological intervention and farmers practices under FLD on Black gram

Particulars	Technological intervention in FLD	Farmers practices	Gap
Variety	TBG-104	Local/own seed	Full gap
Seed rate	20 kg /ha	22 kg/ha	High seed rate
Sowing method /Spacing	30 X 10 cm, sowing with seed cum fertilizer drill	Broad casting, un even plant population	Partial gap
Time of Sowing	June 15 to 15 July	June 15 to 30 July	Partial gap
Seed treatment	Seed treatment was done with 2.5 gm of Carbendizum and 5 ml of Imidacloprid per one kg to control sucking pest and diseases up to one month	Seed treatment was not done	Full gap
Fertilizer Dose	Balanced fertilization as per soil test values 44 kg of urea in split doses and 312.5 kg of SSP as basal dose/ha	Imbalance use of fertilizer 20 Kg urea as basal and 50 Kg DAP as top dressing	Full gap
Weed management	Imazethapyr 10SL 75g a.i. ha^{-1} at15-20 DAS.	Manual weeding	Full gap
Plant Protection	Neem oil @ 5ml/lit and Cholrophyriphos @2.5 ml/lit for control of sucking pest. Practiced Integrated measures to control Yellow mosaic virus like growing of maize and Jowar as border crops, removal of weeds on bunds, erecting of sticky traps and finally chemical control measures.	Injudicious use of and insecticides and fungicides based on advice of input dealers	Partial gap with high cost.

Table.3 Differences between technological intervention and farmers practices under FLD on Chick pea

Particulars	Technological intervention in	Farmers practices	Gap

	FLD		
Variety	NBeG-3 (Nandyal shanaga 1)	Local/own seed	Full gap
Seed rate	100 kg/ha	120 kg/ha	High seed rate
Sowing method /Spacing	30 X 10 cm, sowing with seed cum fertilizer drill	Bullock drawn drill, un even plant population	Partial gap
Time of Sowing	October 1st 15th November	October 1st 30th October	Partial gap
Seed treatment	Seed treatment was done with 3 gm of Carbendizum and 1.5 gm of Tibuconazole per one kg seed to control sucking pest and diseases up to one month. Trichoderma @5 gm /kg of seed to control wilt.	Seed treatment was done with *Trichoderma viride*	Full gap
Fertilizer Dose	Balanced fertilization as per soil test values 44 kg of urea in split doses and 312.5 kg of SSP as basal dose and 50 kg/ha $ZnSO_4$ as basal to improve quality of seed	Imbalance use of fertilizer 20 Kg urea as basal and 50 Kg DAP as top dressing.	Full gap
Weed management	Pendimethalin l litre per acre as pre emergence application	Manual weeding	Full gap
Plant Protection	Practiced Integrated measures to control wilt and root rot like summer deep ploughings, Following crop rotation etc.	Injudicious use of and insecticides and fungicides.	Full gap

Table.4 Grain yield and gap analysis of cluster frontline demonstrations on Red gram

Year	No. Of Demonstrations	Average yield Kg ha^{-1}		% Increase in Recommended Practice (RP)	Extension gap (Kg ha^{-1})	Technology gap (Kg ha^{-})	Technology Index
		Recommended practice	**Farmers practice**				
2016-17	25	970	830	16.86	140	560	35.3
2017-8	25	1050	870	20.68	180	450	29.5
Average	25	1010	850	18.82	160	490	32.6

Table.5 Economic analysis of the cluster frontline demonstrations on Redgram

Year	Total returns(Rs.ha^{-1})		Input cost(Rs.ha^{-1})		Net return(Rs.ha^{-1})		Additional return (Rs.ha-1) FLD's	B:C ratio	
	Recommended Practice (RP)	**Farmer's Practice (FP)**	**Recommended Practice (RP)**	**Farmer's Practice (FP)**	**Recommended Practice (RP)**	**Farmer's Practice (FP)**		**Recommended Practice (RP)**	**Practice (FP)**
2016-17	48,985	41,915	24,335	32,452	24,650	9,463	15,187	2.01	1.29
2017-18	57,225	47,415	26,980	33,489	30,245	13,926	16,319	2.12	1.42
Average	53,105	44,665	25,658	32,971	27,448	11,965	15,753	2.1	1.4

Note: MSP of red gram @Rs.5050.00 qt-1 in 2016-17 and Rs.5450.00 qt-1in 2017-18.

Table.6 Grain yield and gap analysis of cluster frontline demonstrations on Black gram

Year	No. Of Demonstrations	Average yield Kg ha^{-1}		% Increase in Recommended Practice (RP)	Extension gap (Kg ha^{-1})	Technology gap (Kg ha^{-1})	Technology Index
		Recommended practice	**Farmers practice**				
2016-17	25	1160	890	30.33	270	340	22.6
2017-8	35	1280	910	40.65	380	220	17.18
Average	30	1220	900	35.6	320	280	18.66

Table.7 Economic analysis of the cluster frontline demonstrations on Black gram

Year	Total returns(Rs.ha-1		Input cost(Rs.ha-1)		Net return(Rs.ha-1)		Additional return (Rs.ha-1) FLD's	B:C ratio	
	Recommended Practice (RP)	**Farmer's Practice (FP)**	**Recommended Practice (RP)**	**Farmer's Practice (FP)**	**Recommended Practice (RP)**	**Farmer's Practice (FP)**		**Recommended Practice (RP)**	**Farmer's Practice (FP)**
2016-17	58,400	44,500	22,500	26,875	35,500	17,625	17,875	2.58	1.66
2017-18	69,120	49,140	24,140	28,900	44,980	20,240	24,740	2.86	1.70
Average	63,560	46,820	23,320	27,888	40,240	18,933	21,308	2.72	1.68

Note: MSP of black gram @Rs.5000.00 qt-1 in 2016-17 and Rs.5400.00 qt-1in 2017-18.

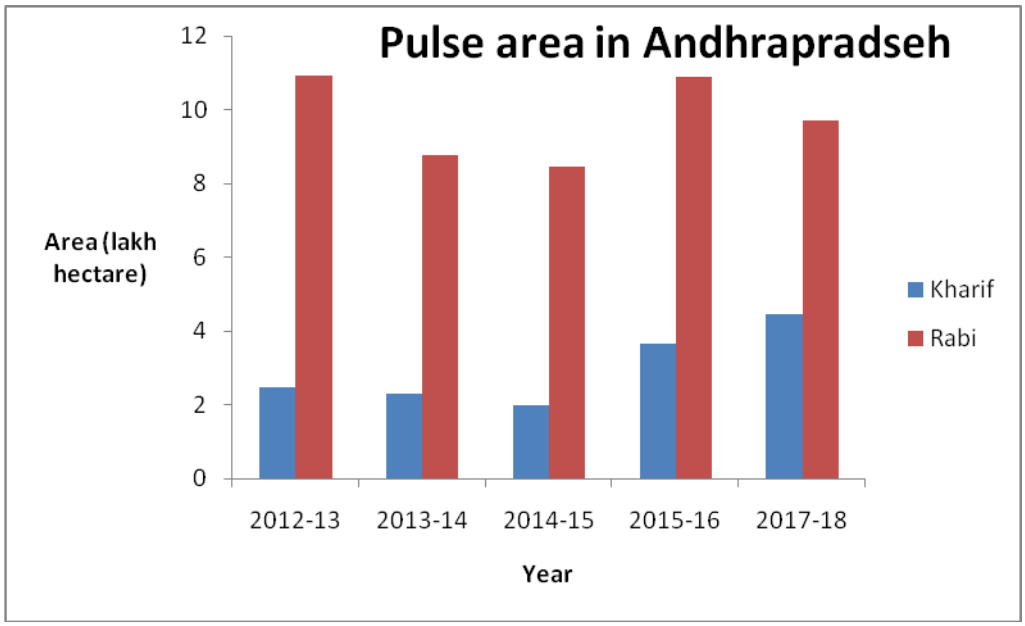
Table.8 Grain yield and gap analysis of cluster frontline demonstrations Chick pea

Year	No. Of Demonstrations	Average yield Kg ha^{-1}		% Increase in Recommended Practice (RP)	Extension gap (Kg ha^{-1})	Technology gap (Kg ha^{-1})	Technology Index
		Recommended practice	**Farmers practice**				
2016-17	25	850	720	18.06	130	450	34.61
2017-8	35	950	810	21.9	140	350	26.92
Average	30	900	765	19.93	135	400	30.76

Table.9 Economic analysis of the cluster frontline demonstrations on Chick pea

Year	Total returns(Rs.ha-1		Input cost(Rs.ha-1)		Net return(Rs.ha-1)		Additional return (Rs.ha-1) FLD's	B:C ratio	
	Recommended Practice (RP)	**Farmer's Practice (FP)**	**Recommended Practice (RP)**	**Farmer's Practice (FP)**	**Recommended Practice (RP)**	**Farmer's Practice (FP)**		**Recommended Practice (RP)**	**Farmer's Practice (FP)**
2016-17	34,000	28,800	17,500	19,750	16,500	9,050	7,450	1.94	1.46
2017-18	41,800	35,640	18,750	20,625	23,050	15,015	8,035	2.23	1.73
Average	37,900	32,200	18,125	20,188	19,775	12,033	7,743	2.09	1.59

Note: MSP of Chick pea @Rs.4000.00 qt-1 in 2016-17 and Rs.4400.00 qt-1in 2017-18



Grain yield and gap analysis of chick pea

The grain yield and gap analysis of Chick pea in demonstrated field's and farmer's practice is presented in table 8. The results revealed that average grain yield of chick pea under cluster frontline demonstrations were 850 and 950 Kg ha^{-1} as compare to 720 and 810 Kg ha^{-1} recorded in farmer's practice and average yield increase of 18.06 and 21.9 per cent, respectively. The above finding was accordance with Lakshmi *et al.*, (2017). The extension gap 130 and 140 Kg ha^{-1}, technology gap 450 and 350 Kg ha^{-1} and technology index 34.61 and 26.92 was recorded.

Economics analysis of chick pea

Economic performance of chick pea under cluster frontline demonstration was depicted in table 9. The economic analysis results revealed that the red gram recorded higher total return from recommended practice (CFLD's) were 34,000.00 $Rsha^{-1}$ in 2016-17 and 41,800.00 $Rsha^{-1}$ in 2017-18 as compared to 28,800.00 $Rsha^{-1}$ and 35,640.00 $Rsha^{-1}$ farmer's. Practice respectively. The net returns were 16,500.00 $Rsha^{-1}$ in 2016-17 and 23,050.00 in 2017-18 in recommended practice in comparison to 9,050.00 Rsha-1 and 15,015.00 Rsha-1respectively in farmer's practice. It was economically observed that additional returns were 7,450.00 and 8035.00 Rsha-1 in recommended practice in both the years. The benefit cost ratio also recorded higher in recommended practice with 1.94 and 2.23 as compared to 1.46 and 1.66 in farmer's practice in both the years.

It is concluded that the CFLD programme is an effective tool for increasing the production and productivity of pulses and changing the knowledge, attitude and skill of farmers. The per cent increment in yield of pulses to the extent of 16.86 to 20.68 in Red gram and 30.33 to 40.65 in Black gram and 18.06 to 21.90 in Chick pea FLDs over the farmers practice created greater awareness and motivated the other farmers to adopt the improved package of practices of pulses. These demonstrations also built the relationship and confidence between farmers and scientists. The beneficiary farmers of FLDs also play an important role as source of information and quality seeds for wider

dissemination of the high yielding varieties of pulses for other near by farmers.

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