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Comparative performance of cluster frontline demonstration for increasing productivity of pulses in Surguja district of Chhattisgarh

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Abstract
The main objectives of CFLD's on pulses is to demonstrate and popularize the improved package of practices on farmers' fields for effective transfer of generated technology and fill the gap between recommended technology and traditional farmer's practices. For boosting the production and productivity of pulse crops in Surguja district, Krishi Vigyan Kendra, Mainpat conducted cluster frontline demonstration on pulse crops in which 94 demonstration was on pigeon pea and 43 demonstrations was on chickpea during *Kharif* and *Rabi* season 2018-19. During the study, it was observed, there was a wide yield gap between the potential and demonstration yields in both the pulse crops due to technology and extension gaps. The results revealed the increases yield of demonstrated plots that was 34.72 and 23.53 percent as compared to farmer practices for pigeon pea and chickpea, respectively due to adoption of improved package of practices. On an average, technology gap was 8.30 and 5.40 q ha^{-1} in pigeon pea and chickpea respectively and similarly the extensions gap was 2.50 and 2.40 q ha^{-1} for Pigeon pea and chickpea, respectively. The average technology index was observed 46.11% in Pigeon pea and 30% in chickpea. The economic analysis revealed that, higher net monetary return (Rs 37365 and 40610 ha^{-1}) were observed in pigeon pea and chickpea from recommended practice as compared to farmers practice (Rs 25740 and 31830 ha^{-1}). The additional returns were Rs. 11625 and 8780 ha^{-1} in pigeon pea and chickpea respectively in recommended practice. The benefit cost ratio (B:C ratio) were also recorded higher in recommended practice *i.e.,* Rs. 2.41 and 2.04 as compared to Rs. 1.46 and 1.66 in pigeon pea and chickpea respectively from farmer's practice. The higher additional returns and effective gain obtained under demonstrations could be due to improved technology, non-monetary factors, timely operations of crop cultivation and scientific monitoring. This can be seen as a positive indicator for formulating and disseminating, more extensive, technology specific and farmer centric CFLD programme to improve knowledge and adoption amongst farmers in the district to boost pulses production.

Keywords: Cluster frontline demonstrations, pulses, technology gap and index

Introduction
Cluster front line demonstrations (CFLDs) is a novel approach to provide a direct interface between researcher and farmer for the transfer of technologies interventions developed by them and to get direct feedback from farming community. 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 (Department of Agriculture, cooperation and farmers welfare, 2018) [2]. The concept of cluster frontline 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, integrated pest management, promotion of micronutrients/bio-fertilizers, and extension, training and mass media campaign. These demonstrations are conducted under the close supervision of scientists of KVKs, SAUs and their regional research stations.
Pulses are the common option for the majority of Indian house hold. The importance of pulses are realized very recently when the nutritional health benefits of pulses are expressed scientifically. Pulses are major source of proteins among the vegetarians in India. Pulses have a wide range of adaptability to soil and climatic condition.

In the production process, pulses maintaining soil fertility through biological nitrogen fixation, requires less water as compare to cereals, and release of soil bound phosphorus, and thus contribute significantly to sustainability of the farming systems. The adoption of traditional farming system, non-adoption of recommended production technologies due to paucity of knowledge and persuasion about new technologies, major abiotic and biotic stresses are responsible for declining of potential yield of pulse crops. Keeping this in view, Krishi Vigyan Kendra, Mainpat, conducted cluster frontline demonstrations on two pulse crops (*viz*., Pigeon pea & Chickpea) to popularize the improved package of practices on farmers' fields for effective transfer of generated technology for enhancement of production potential of pulse crops.

Materials and Method

Front line demonstration conducted on pulse crop (Pigeon pea and Chickpea) during *Kharif* and *Rabi* season of 2018-19 in selected cluster villages of Surguja district of Chhattisgarh. The total number of 137 pulses growers (94 of Pigeon pea and 43 of Chickpea) were selected for successful demonstration during *Kharif* & *Rabi* season 2018-19 in the Mainpat blocks of Surguja district, which comes under the jurisdiction of Krishi vigyan kendra, Mainpat under the Indira Krishi Vishwavidyalaya, Raipur, C.G. The total area of 20 ha. and 10 ha. was covered for the pigeon pea and chickpea, respectively. The improved varieties of pigeon pea and chick pea that was TJT 501 and JAKI 9218 respectively, demonstrated with full package of practices *viz*. proper tillage, proper seed rate and sowing method, balanced dose of fertilizer, *Trichoderma* and *Rhizobium* culture @ 5 gm kg^{-1} of seed as seed treatment, proper irrigation, weed management and improved plant protection measure were applied at farmers fields (Table 1). In this demonstration control plot was also kept where farmers practices was carried out. The cluster frontline demonstration was conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and technology index. The yield data were collected from the demonstrations plots and control plots (i.e., farmer's Practice) by random crop cutting method and analyzed by using simple statistical methods. The technology gap, extension gap and technological index (Samui *et al*., 2000) [7] were calculated by using following formula as given below:-

$$\text{Percent increase yield} = \frac{\text{Demonstration yield-farmers yield}}{\text{Farmers yield}} \times 100$$

Technology gap = Potential yield - Demonstrated yield

Extension gap = Demonstrated yield – Yield under existing practice

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

Results and Discussion

The gap between the farmer's existing and recommended technologies of pulse crops in Surguja district was given in Table 1. During the study, full gap was observed in case of use of varieties, seed rate, sowing method, seed treatment and fertilizer dose, whereas partial gap was observed in weed management and plant protection measures, which may be the reason of not achieving potential yield. Farmers were not aware about recommended technologies. Farmers in general used very old or local varieties instead of the recommended high yielding varieties because of the inaccessibility of seed on time and lack of awareness. Farmers applied higher seed rate than the recommended and they were not using seed treatment before sowing for wilt and collar rot management and to better nodulation for biological nitrogen fixation of the plants because of paucity of knowledge and interest. The farmers were much concerned about importance of sowing method and land preparation. Burman *et al.* (2010) [1] reported that there is a gap in adoption of technology in major pulse crops both in rainfed and irrigated cropping system. The perusal of data from the cluster frontline demonstration revealed that, the recommended practice observed higher average pods per plant i.e., 312 and 42 in Pigeon pea and chickpea respectively, whereas the lowest was observed in farmer practice i.e., 215 and 35 in pigeon pea and chickpea respectively. The average grain yield of cluster frontline demonstration of pulse crops was higher i.e., 9.70 and 12.60 q ha^{-1} in pigeon pea and chickpea respectively from recommended practice, as compared the farmers practice i.e., 7.20 and 10.20 q ha^{-1} in pigeon pea and chickpea respectively during demonstration period. The percent increase in grain yield were recorded 34.72 and 23.53 in pigeon pea and chickpea respectively under recommended practice over farmers practice (Table 2). Singh (2002) [1, 3, 5, 8] reported that high yielding variety with production and protection measures that improve the yield of pulse crops.

Table 1: Difference between technological interventions and farmer's practices under cluster frontline demonstrations in pulses

S. No.	Particulars	Farmer's practices	Recommended technological intervention		Technology gap
			Pigeon pea	Chickpea	
1.	Variety	Very old and Local	TJT 501	JAKI 9218	Full gap
2.	Land preparation	One cultivator ploughing and 2 ploughing	One cultivator ploughing and 2 ploughing	One cultivator ploughing and 2 ploughing	No gap
3.	Seed rate (Kg/ha)	Higher seed rate	20	75	Full gap
4.	Sowing method	Broadcasting-Un-uniform plant population	Line sowing 60 x 15 cm (R x P) Sowing with seed cum fertilizer drill	Line sowing 30 x10 cm (R x P) Sowing with seed cum fertilizer drill	Full gap
5.	Seed treatment	No seed treatment	*Trichoderma* powder and *Rhizobium* culture @ 5 g kg^{-1} seed	*Trichoderma* powder and *Rhizobium* culture @ 5 g kg^{-1} seed	Full gap
6.	Fertilizer dose (Kg ha^{-1})	Imbalance use of fertilizers	18:46:: N: P_2O_5	18:46:: N: P_2O_5	Full gap
7.	Weed management	No weed management	Pendimethalin 30% EC @ 3.3 lit.ha^{-1} + One hand weeding at 45-60 days after sowing	Pendimethalin 30% EC @ 3.3 lit.ha^{-1} + One hand weeding at 60 days after sowing	Partial gap
8.	Plant protection measures	Injudicious use of insecticides and fungicides	Need based Plant protection measure Indoxacarb (15.8% E.C.) @ 500ml ha^{-1})	Need based Plant protection measure Indoxacarb (15.8% E.C.) @ 500ml ha^{-1})	Partial gap

The technology gap, the difference between potential yield and demonstration yield was 8.30 and 5.40 q ha^{-1} in pigeon pea and chickpea respectively during cluster frontline demonstration (Table 3). The technology gap observed may be attributed due to variability in the soil fertility, agricultural practices and local climatic condition (Singh *et al.* 2007) [1, 3, 5, 8]. Extensions gap for pulse crops were observe as 2.50 and 2.40 q ha^{-1} for pigeon pea and chickpea, respectively during cluster frontline demonstration. The more extension gap 2.50 q ha^{-1} was recorded in chickpea, which emphasized the need to educate the farmers through various means of adoption of improved production and protection technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of extension gap. This finding is inconformity with the findings of Joshi *et al.*, 2014 [4] and Kumar *et al.*, 2014 [5].

The technology index shows the feasibility of the evolved technology at the farmers' field. Higher technology index reflected the insufficient extension services for transfer of technology. The lower value of technology index shows the efficacy of good performance of technological interventions. The average technology index was observed 46.11 percent in pigeon pea and 30.00 percent in chickpea (Table 3). This variation in technology index indicates that, the result differ according with soil fertility status, climatic condition and mismanagement of pulses crop. Similar findings were also reported by Joshi *et al.*, 2014 [4] and Kumar *et al.*, 2014 [5].

Economic performance

Economic performance of cluster frontline demonstration was depicted in table 4. The economic analysis revealed that, the pigeon pea recorded higher gross monetary return i.e., Rs 52865 ha^{-1} from recommended practice as compared to Rs 39240 ha^{-1} from farmer's practice. Similarly, higher gross monetary return was in chickpea i.e., Rs 60480 ha^{-1} from recommended practice as compared to Rs 39240 ha^{-1} from farmer's practice. The net monetary return were higher i.e., Rs 37365 and 40610 ha^{-1} in pigeon pea and chickpea respectively from recommended practice as compared to Rs 25740 and 31830 ha^{-1} in pigeon pea and chickpea respectively from farmer's practice. It was economically observed that, the additional returns were Rs. 11625 and 8780 ha^{-1} in pigeon pea and chickpea respectively in recommended practice. The benefit cost ratio (B:C ratio) also recorded higher in recommended practice i.e., Rs. 2.41 and 2.04 as compared to 1.46 and 1.66 in pigeon pea and chickpea respectively from farmer's practice. Similar findings were also reported in frontline demonstrations on pulse crops by Lathwal (2010) [6] and Dwivedi *et al.*, 2014 [3].

Table 2: Grain yield production of pulses crop under cluster frontline demonstrations

Name of Crops	CFLD programme		Pods per plant		Average yield (q ha^{-1})		% yield increased
	No. of demo.	Area (ha)	RP	FP	RP	FP	
Pigeon pea	94	20	312	215	9.70	7.20	34.72
Chickpea	43	10	42.0	35.3	12.60	10.20	23.53

Table 3: Technology, extension gap and technology index of cluster frontline demonstrations over the farmers practice

Name of Crop	Technology gap (q ha^{-1})	Extension gap (q ha^{-1})	Technology Index
Pigeon Pea	8.30	2.50	46.11
Chickpea	5.40	2.40	30.00

Table 4: Impact of improved technology on economics of pulses under field situation

Name of crop	Cost of cultivation (Rs. ha^{-1})		Gross return (Rs. ha^{-1})		Net return (Rs. ha^{-1})		Additional net return (Rs ha^{-1})	B:C ratio (Rs.)	
	RP	FP	RP	FP	RP	FP			
Pigeon Pea	15500	13500	52865	39240	37365	25740	11625	2.41	1.91
Chickpea	19870	17130	60480	48960	40610	31830	8780	2.04	1.86

Conclusions

It is concluded that the CFLD programme is an effective tool for increasing the production and productivity of pulses crops and changing the knowledge, attitude and skill of farmers. There was a technological gap between technological intervention and existing practices in pulse production technology due to lack of knowledge and persuasion of improved technologies. Technology and extension gap showed that, the farmers were not aware about improved package and practices of pulse production technologies. Therefore, it is recommended that the farmers should be aware for adoption of improved technologies through various extension activities (i.e., trainings and demonstration). The technology index shows the feasibility of the technology demonstrated at farmer's field. The lower technology index showed that the good performance of technological intervention. So, it is concluded that introduction of improved technologies can fulfil the technological and extension gap and extension agencies can also play a significant role to transfer of improved technologies among farming communities for higher production. Thus, it can be said, that the adoption of improved package of practices of pulse production technology may result in higher productivity per unit area.

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