Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(5): 2728-2731
Received: 20-07-2020
Accepted: 26-08-2020

Amrit Kumar Jha
Krishi Vigyan Kendra, Birsa Agricultural University, Sahibganj, Jharkhand, India

Kaushik Chatterjee
Krishi Vigyan Kendra, Birsa Agricultural University, Sahibganj, Jharkhand, India

Birendra Kumar Mehta
Krishi Vigyan Kendra, Birsa Agricultural University, Sahibganj, Jharkhand, India

Maya Kumari
Krishi Vigyan Kendra, Birsa Agricultural University, Sahibganj, Jharkhand, India

Corresponding Author:
Amrit Kumar Jha
Krishi Vigyan Kendra, Birsa Agricultural University, Sahibganj, Jharkhand, India

Impact of technological interventions of cluster front line demonstrations (CFLDs) on productivity and profitability of Pigeonpea (*Cajanus cajan* L.) in Sahibganj district of Jharkhand

Amrit Kumar Jha, Kaushik Chatterjee, Birendra Kumar Mehta and Maya Kumari

DOI: https://doi.org/10.22271/phyto.2020.v9.i5al.12757

Abstract
Cluster Front Line Demonstrations (CFLDs) were conducted to evaluate the performance of improved varieties along with scientific package and practices on productivity and profitability of pigeonpea during 2016-17 to 2019-20. Pigeonpea is an important kharif pulse crop in Sahibganj district of Jhakhand covering over 8,945 ha with average productivity of 4.44 q/ha which is well below the state average (11.47 q/ha) and national average (9.60 q/ha). Unavailability of improved variety as well as non-adoption of scientific cultivation practices in the district is one of the possible reasons for lower average productivity of pigeonpea in the district. To enhance productivity of pigeonpea through improved variety and scientific cultivation practices cluster frontline demonstrations (CFLDs) were conducted during kharif season from 2016-17 to 2019-20. Performance of Pigeonpea varieties ICPL 87119 (Asha), Narendra Arhar 2 and Birsa Arhar-1 in 219 locations along with improved cultivation practices like line sowing, treatment of seed with fungicide and biofertilizer, balanced nutrition and weed management were evaluated in the district. It was observed that the yield of pigeonpea in CFLD under rainfed conditions ranged from 9.7 q to 11.2 q ha^{-1}, whereas in FP it ranged between 6.4 to 7.1 q ha^{-1}. The per cent increase in yield with improved practices (IP) over FP was recorded in the range of 48.5 to 61.5. The extension gap and technological index were ranging between 3.3 to 4.1 q ha^{-1} and 37.7 to 46.1 per cent, respectively. The trend of technology gap reflected the farmer's cooperation in carrying out demonstrations with encouraging results in subsequent years. The benefit cost ratio varied from 2.18 to 2.48 under demonstration, while it was 1.77 to 1.87 under farmer's practice. Therefore, the results clearly indicate that the use of improved variety and package of practice with scientific intervention under cluster frontline demonstration programme contribute to increase the productivity and profitability.

Keywords: Extension gap, technology transfer, yield, cluster frontline demonstrations, technology index, economics

Introduction
Pigeonpea, although being native to Africa is one of the important pulse crops grown throughout the country. It is very widely used in Indian cuisine and well known by the name Tur dal in hindi. It is rich in protein and supplies a major share of the protein requirement of the vegetarian population of the country and is mainly eaten in the form of split pulse as 'dal'. Seeds are rich in iron and iodine, besides essential amino acids like lycine, tyrocene, cyctine and arginine. The outer covering of its seed together with part of the kernel provides a valuable feed for milch cattle. The husk of pods and leaves obtained during threshing constitute a valuable cattle feed. Woody parts of the plant are used for fuel. In Jharkhand Pigeonpea occupies a major position in terms of area, production and productivity among the pulses. Pigeonpea is an important pulse crop of Sahibganj district and occupies an area of 8,945 ha. Pigeonpea is mostly sown in June-July and harvested March-April. The improved varieties adopted in programme *viz*., ICPL 87119 (Asha), Narendra Arhar 2 and Birsa Arhar-1 are bold seeded crop of medium duration (180-200 days) to long duration (250 days) having wide adaptation depending upon the environmental conditions. Increasing population, consumer awareness and affordability of middle/lower middle and other category citizens up to some degree, over time the demand of pulse increased. Over a period of time, a number of improved pigeonpea varieties and production technologies have been developed, but the full potential of the varieties as well as technologies could not be exploited due to low rate of adoption and low yield. Thus, factor limiting to productivity cannot be overlooked.

Research and extension programme need to be diverted to produce value additive pulse. It may emphasize on quality attributes, adoption and popularization of new agro-technologies, evolving better varieties for stress conditions and improving present yield potential with an aim to raise production through transfer of farm technology.

Cluster front line demonstration (CFLD) 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 pulse by 10, 8 and 2 million tons respectively by 2011 with an outlay of Rs. 4,882 corers under National Policy for Farmers in the Eleventh Five Year Plan. The proposed centrally sponsored scheme 'National Food Security Mission (NFSM)' is to operationalize the resolution of NDC and enhance the production of food grains (Annonymous, 2011) [1]. The concept of Cluster Frontline Demonstration was put forth under this mission. The scheme implemented in a mission mode through a farmer centric approach. The basic strategy of the mission is to promote and extend improved technologies, i.e., seed, micronutrient, soil amendments, integrated pest management, farm machinery and implements, irrigation devices along with capacity building of farmers. The project was implemented by Krishi Vigyan Kendra, Sahibganj with main objective to boost the production and productivity of pulse through CFLD with latest and specific technologies.

Materials and Method

The study was carried out during Kharif season from 2016-17 to 2019-20 (4 consecutive years) by the KVK Sahibganj, Jharkhand. The villages covered under CFLDs were Murli Simaldhab (Block – Rajmahal) and Sivlidanga (Block – Barharwa) in 2016-17, Chapujan (Block – Barharwa) in 2017-18, Bichpura and Chasgama (Block – Borio) and Kauri Khutauna (Block – Mandro) in 2018-19 and Marangtand (Block – Borio) in 2019-20 of Sahibganj district of Jharkhand. Number of locations (beneficiaries) during 2016-17, 2017-18, 2018-19 and 2019-20 were 50, 62, 82 and 25, respectively totaling 214. Beneficiaries (farmers/ farmwomen) were identified through their participation and feedback received during the preliminary survey, awareness programmes and interactive meetings. Farmers were trained to follow the package and practices for pigeonpea cultivation as recommended by the Birsa Agricultural University and critical inputs for the technologies like seeds, fungicides, biofertilizers were distributed to the farmers however balanced plant nutrients on the basis of soil test value were applied by the farmers from their own resources. Detail of technological interventions are presented in table 1. Regular field visit, monitoring and need based advisories were provided by the scientists of KVK. All 219 demonstration in 80-hectare area were conducted by the active participation of the farmers with an objective to demonstrate the improved technologies of Pigeonpea production potential in different villages. In case of local check, the traditional practices were followed by using existing variety chaiti lahar. In demonstration plots, use of quality seeds of improved varieties ICPL 87119 in year 2016-17, Narendra Arhar 2 in 2017-18 as well as in 2018-19 and Birsa Arhar 1 in 2019-20 with line sowing and timely weeding, need based pesticide as well as balanced fertilizer were emphasized. In general, the soil of the experimental plots were sandy loam in texture, acidic in soil reaction (pH 5.8 to 6.2), low to medium in organic carbon (0.42 to 0.61 %), medium status in available nitrogen (310 to 360 kg/ha), low to medium in available phosphorus (8.4 to 12.6 kg/ha) and also low to medium in available potassium (108 to 131kg/ha). The farmers under the programme were facilitated by KVK scientists in performing field operations like sowing, spraying, weeding, harvesting etc. Finally, field day was conducted involving demonstration holding farmers, other farmers in the village, scientist from KVK, officials from Department of Agriculture, local extension functionaries to demonstrate the superiority of technology. The basic information was recorded from the demonstration and control plots and analyzed for comparative performance of the cluster frontline demonstrations (CFLDs) and farmer's practice. The yield data were collected both from 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) [13] along with the benefit cost ratio (Samui *et al.*, 2000) [12] were calculated by using following formula as given below.

$$\text{Extension Gap} = \text{Demonstration Yield} - \text{Farmer's Practice Yield}$$

$$\text{Technology Gap} = \text{Potential Yield} - \text{Demonstration Yield}$$

$$\text{Additional Return} = \text{Demonstration Return} - \text{Farmer's Practice Return}$$

$$\text{Technology Index} = \frac{\text{Potential Yield} - \text{Demonstration Yield}}{\text{Potential Yield}} \text{x } 100$$

$$\text{Percent increase in yiels} = \frac{\text{Demonstration Yield} - \text{Farmer's Practice Yield}}{\text{Farmer's Practice Yield}} \text{ x } 100$$

Results and Discussion

Results of the Cluster Frontline Demonstrations conducted during 2016-17 to 2019-20 in different villages of Sahibganj revealed that the improved package and practices is more important with technological intervention for productivity and profitability of pulse. The cultivation practices comprised under CFLD *viz* use of improved variety, seed treatment, line sowing, balanced application of fertilizers, proper weed control and control of pest through insecticide at economic level evidentially proved superiority over farmer's practice (Table 2). It was found that the average grain yield of pigeonpea under cluster frontline demonstrations were ranged from 9.7 q to 11.2 q ha^{-1} as compared to 6.4 to 7.1 q ha^{-1} in case of Farmer's Practice during 2016-17 to 2019-20. As far as per cent increase in demonstration yield over yield obtained under Farmers Practice is concern, an average of 54.8 per cent increase was found during the four years of demonstrations. Similar observations were reported by Jayalakshmi *et al.* (2018) [5] and Kolhar *et al.* (2020) [9]. Positive impact of technological interventions of CFLDs on black gram was also observed by Jha *et al.* (2020) [6]. Data presented in table 2 also indicates that the yield of pigeonpea fluctuated little over the years in demonstration plots. Similar yield enhancement in different crops in cluster frontline demonstrations were documented by Hiremath *et al.*, (2007) [4] in Onion; Mishra *et al.*, (2009) [10] in Potato; Kumar *et al.*, (2010) [8] in Bajra; Dhaka *et al.*, (2015) [2] in Coriander. The increase in percent of yield was ranged from 48.5 to 61.5 during the four years of study. The results were in conformity with the findings of Katare *et al.*, (2011) [7] and Saikia *et al.* (2018) [11]. The extension gap ranging from 3.3 to 4.1 q ha^{-1}

over the years of study emphasizes the need to educate the farmers through various means for adoption of improved agriculture practices to reverse the trend of wide extension gap. The trend of technology gap ranging between 6.8 to 8.3 q ha^{-1} reflects the farmers cooperation in carrying out demonstrations with encouraging result in subsequent years. Similar findings were recorded by Katare *et al.*, (2011) [7] in oilseeds and Saikia *et al.*, (2018) [11] in black gram. The technology gap over the years of study may be attributed to dissimilarity in soil fertility status, rainfall distribution, pest infestation, weed intensity and change in locations of cluster frontline demonstration sites. However, the result observed is an evidence of the better performance in varied environmental condition over farmers practice. The technology index showed the feasibility of the evolved technology at the farmers field. The technology index ranging from 37.7 to 46.1 during the years of study exhibited a decreasing trend over the years with low fluctuation which may be attributed to the dissimilarity in weather condition, soil fertility status and non-availability of water in the crop. The lower the value of technology index the more is the feasibility of technology.

Economic performance of pigeonpea under cluster frontline demonstration presented in table 3. Results of economic analysis parameter revealed that the pigeonpea recorded higher total return of Rs. 48,985/-, Rs. 57,225/-, Rs. 63,560/- and Rs. 60,320/- per ha during 2016-17, 2017-18, 2018-19 and 2019-20, respectively under CFLDs as compared to Rs. 32,320/-, Rs. 35,425/-, Rs. 40,293/- and Rs. 40,600/- per ha, respectively under farmers practice. Technologies demonstrated under CFLDs also had positive influence on net return and thereby benefit cost ratio (B:C ration) over farmer's practice. The net return ranged from Rs. 26,585/- to Rs. 37,960/- per ha under recommended practice as compared to Rs. 14,320/- to Rs. 18,793/- per ha in farmer's practice. It was observed that the additional returns ranged from Rs. 16,665/- to Rs. 23,267/- per ha under recommended practices during the years. The higher benefit cost ratio was also recorded under recommended practices and the observed B:C ratio was 2.18, 2.36, 2.48 and 2.21 during 2016-17, 2017-18, 2018-19 and 2019-20, respectively as compared to 1.79, 1.77, 1.87 and 1.80, respectively under farmers practice. These results are in accordance with the findings of Gurumukhi and Mishra (2003) [3], Jayalakshmi *et al.*, (2018) [5] and Jha *et al* (2020) [6].

Table 1: Difference between technological intervention and farmer's practices under CFLD on Black gram

Particulars	Technological intervention in CFLD	Farmers practices	Gap
Variety	ICPL 87119 (Asha), Narendra Arhar 2 and Birsa Arhar-1	Chaiti Lahar (local)	Full gap
Seed rate	20 kg/ha	30 kg/ha	High seed rate
Sowing method/ spacing	Line sowing (75 × 15 cm)	Broadcasting, uneven plant population	Partial gap
Time of sowing	June 1 to 30 June	June 15 to 15 July	Partial gap
Seed Treatment	Seed treatment was done with 2.5 gm of Carbendazim, 5 ml of Imidachloprid per kg seed and with Rhizobium culture and *Trichoderma viride* @ 5gm/ kg seed.	No seed treatment	Full gap
Trichoderma viride	Applied developed *Trichoderma viride* (80 kg decomposed FYM + 20 kg neem cake + 2 kg *Trichoderma viride* incubated for 25-30 days in shade)	Not used	Full gap
Fertilizer	Balanced fertilizer application as per soil test values, 50 kg of urea as basal dose, 250 kg of ssp and 34 kg of mop as basal dose/ha	Imbalanced use of fertilizer 50 kg urea as top dressing and 5o kg of DAP as basal dose/ha	Full gap
Weed management	Application of Imazethapyr 10 SL 75 g a.i. ha^{-1} at 15-20 DAS	Manual weeding at 45-60 DAS	Full gap
Plant Protection	Spraying of Neem seed kernal Extract (NSKE) 5% at 50% flowering stage and Emamectin benzoate5% SG@ 220 g/ha for control of sucking pest.	Injudicious use of insecticides and fungicides based on advice of input dealers	Partial gap with high cost

Table 2: Grain yield and Gap analysis of cluster frontline demonstration on Black gram

Year	Sample Area (ha)	Sample No. of farmers	Average yield (Q/ha)			% increase over FP	Technology gap (q/ha)	Extension gap (q/ha)	Technology Index (%) CFLD
			Potential	CFLD	FP				
2016-17	20	50	18	9.7	6.4	51.5	8.3	3.3	46.1
2017-18	20	62	18	10.5	6.5	61.5	7.5	4.0	41.6
2018-19	30	82	18	11.2	7.1	57.7	6.8	4.1	37.7
2019-20	10	25	18	10.4	7.0	48.5	7.6	3.4	42.2
Average	-	-	18	10.45	6.75	54.8	7.55	3.7	41.9

Table 3: Economic analysis of the cluster frontline demonstrations on Black gram

Year	Total return (Rs. ha^{-1})		Input cost (Rs. ha^{-1})		Net return (Rs. ha^{-1})		Additional return (Rs. ha^{-1}) CFLD	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	48,985	32,320	22,400	18,000	26,585	14,320	16,665	2.18	1.79
2017-18	57,225	35,425	24,200	20,000	33,025	15,425	21,800	2.36	1.77
2018-19	63,560	40,293	25,600	21,500	37,960	18,793	23,267	2.48	1.87
2019-20	60,320	40,600	27,200	22,500	33,120	18,100	19,720	2.21	1.80
Average	57,523	37,160	24,850	20.500	32,673	16,660	20,363	2.30	1.80

Note: MSP of Pigeon Pea @Rs 5,050 qt^{-1} in 2016-17, Rs 5,450 qt^{-1} in 2017-18, Rs 5,675 qt^{-1} in 2018-19 and Rs 5,800 qt^{-1} in 2019-20.

Conclusion

The cluster frontline line demonstrations (CFLDs) conducted by KVK had enhanced the yield of Pigeonpea vertically and ensured rapid spread of recommended technologies of Pigeonpea production horizontally by implementation of various extension activities like training programmes, field days, exposure visits etc. organised under CFLD programmes in farmer's field. The CFLDs made a positive impact on yield of pigeonpea gram by 54.8 %. It was observed that the potential yield of Pigeonpea varieties ICPL 87119 (Asha), Narendra Arhar 2 and Birsa Arhar-1 can be achieved by imparting scientific knowledge to the farmers, providing the quality need-based inputs and their proper utilization. Therefore, it is suggested that policy maker may provide adequate financial support to frontline extension system for organising CFLD under the close supervision of agricultural scientists and extension professionals. This strategy may help to increase the pulse crop productivity at micro, meso and macro level.

References

1. Annonymous. Agricultural statistics at a glance, DAC Government of India, 2011, 118.
2. Dhaka BL, Poonia MK, Meena BS, Bairwa RK. Yield and economic viability of coriander under frontline demonstrations in Bundi district of Rajasthan. J Hortl. Sci. 2015; 10(2):226-228.
3. Gurumukhi DR, Mishra S. Sorghum frontline demonstration- A success story. Agriculture Extension Review. 2003; 15(4):22-23.
4. Hiremath SM, Nagaraju MV, Shasidhar KK. Impact of frontline demonstration on onion productivity in farmer's field. Paper Presented *In:* National Sem. Appropriate Extn. Strat manag Rural Resource, Univ. Agric. Sci., Dharwad, 2007, 100.
5. Jayalakshmi Mitnala G, Prasad Babu K, Ragavendra Chowdary B, Vijayabhinandana, 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. Int. J Curr. Microbial. App. Sci. 2018; 7(12):937-947.
6. Jha, Amrit Kumar, Chatterjee Kaushik, Mehta Birendra Kumar, Kumari Maya. Effect of technological interventions of cluster frontline demonstrations (CFLDs) on productivity and profitability of black gram (*Vinga mungo* L.) in Sahibganj district of Jharkhand. International Journal of Chemical Studies. 2020; 8(5):2124-2127.
7. Katare S, Pandey SK, Mustaafa M. Yield gap analysis of rapeseed-mustard through frontline demonstrations. Agric. Update. 2011; 6:5-7.
8. Kumar A, Kumar R, Yadav VPS, Kumar R. Impact assessment of frontline demonstration of bajra in Haryana state. Indian Re. J Ext. Edu. 2010; 10(1):105-108.
9. Kolhar BC, Biradar SA, Devarnavadagi VS, Hotkar S. Impact of large scale demonstration of pigeonpea variety TS-3R CFLD programme in Vijayapur district. Journal of Pharmacognosy and Phytochemistry. 2020; 9(4):1336-1338
10. Mishra DK, Paliwal DK, Tailor RS, Deshwal AK. Impact of frontline demonstrations on yield enhancement of potato. Indian Res. J Ext. Edu. 2009; 9(3):26-28.
11. Saikia N, Deb Nath K, Chowdhury P. Impact of cluster frontline demonstrations on popularization of blackgram *var*. PU 31 in Cachar district of Barak Valley region of Assam. Journal of Pharmacognosy and Phytochemistry. 2018; 7(4):940-942.
12. Samui SK, Maitra S, Roy DK, Mandal AK, Saha D. Evaluation of frontline demonstration on groundnut. J. Indian Soc. Coastal Agri. Res. 2000; 18(2):180-183.
13. Yadav DB, Kamboj BK, Garg RB. Increasing the productivity and profitability of sunflower through frontline demonstrations in irrigated agro-ecosystem of eastern. Haryana. J Agron. 2004; 20:33-35.