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Impact assessment of cluster front line demonstration on different pulse crop in Mandya district of Karnataka

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Abstract
Present investigation was conducted by Krishi Vigyan Kendra, VC Farm, Mandya district of Karnataka to find out the yield gaps among scientific package and practices under cluster front line demonstration (CFLD pulses) and local farmer's practice (FP) of black gram, cowpea, Horse gram and pigeon pea. CFLD on different crops were performed on farmer's fields during all the season of two sequential years i.e. 2021-22 and 2022-2023 under National Food Security Mission (NFSM), Govt. of India to exhibit the impact of improved agro-techniques on production and economic benefits. CFLD's were conducted in 40 ha and 40 ha area for two years with dynamic participation of 200 farmers and technical staff of Krishi Vigyan Kendra, VC Farm, Mandya. According to observed data the highest grain yield was obtained in experimental plots with an average black gram (7.20 q/ha), cowpea (7.76 q/ha), Horse gram (7.94 q/ha) and pigeon pea (10.20 q/ha) as compared to local check with average higher B:C ratio 3.19, 2.55, 1.94 and 7.94 respectively as compared to Farmers Practice. Thus, the productivity of all the crop could be increased with the adoption of recommended developed package of practices. The study resulted in satisfying the farmers for maximum productivity and incomes.

Keywords: Cluster front line demonstration, pulse crops, yield gap, farmers practice

Introduction
Pulses are one of the important food crops globally recognized due to their higher protein content. The protein content of grain legumes is double that of wheat and three times that of rice. Therefore, pulses as a complement to cereals, make one of the best solutions to protein-calorie malnutrition. Although, being the largest pulse crop cultivating country in the World, India's production of pulses is relatively lower in comparison to total cereal crop productions. The cultivation of pulses builds-up a mechanism to fix atmospheric nitrogen in their root nodules and thus meet their nitrogen requirements to a great extent. In India, pulses can be produced with a minimum use of resources and hence, it becomes less costly even than animal protein. In comparison to other vegetables, pulses are rich in protein which are less expensive and can be cultivated as an inter-crop and also as mixed crop. Pulses are usually cultivated under rainfed conditions and do not require intensive irrigation facility and this is the reason why pulses are grown in areas left after satisfying the demand for cereals/cash crops. Even in such conditions, pulses give better returns. Apart from this, pulses possess several other qualities such as they improve soil fertility and physical structure, fit in mixed/inter- cropping system, crop rotations and dry farming and provide green pods as vegetable and nutritious fodder for cattle as well.
Addressing this concern of significance, the Ministry of Agriculture and Farmers Welfare, Govt. of India had initiated a nation-wide cluster frontline demonstration (CFLD) programme on pulses under National Food Security Mission-Pulses (NFSM- Pulses). The basic strategy of the Mission is to popularize improved technologies, i.e., seed, micro- nutrients, soil amendments, weed management, integrated pest management, farm machinery and implements, micro irrigation devices along with capacity building of farmers. The ICAR through its Krishi Vigyan Kendras (KVKs) across the country has been implementing this CFLD programme on different pulse crops to boost the production and productivity of pulses with improved varieties and location specific technologies.

Mandya district is one of the most agriculturally prosperous districts in Karnataka with the advent of irrigation from the K.R. Sagar reservoir. The prominent cropping system of Mandya district is Paddy-paddy and paddy-sugarcane. At present, this cropping system is creating lot of problems and hindererance with respect to sustainability in crop production and are increasingly becoming unproductive due to indiscriminate use of water, continuous cropping with decreased soil organic matter, over exploitation of nutrients reserve and loss of nutrients. Such cropping systems need investigations to explore the possibility of new concepts in agriculture *viz*., paddy-pulses and intercropping in sugarcane with pulses. Further, some handful farmers have a practice of cultivating pulse in mandya district after harvest of paddy but the farmers are facing problems like availability of quality seed material and proper market price. In this regard demonstration on integrated management in different pulses were taken up to popularize and apprise the knowledge among farmers with respect to the improved verities available and technologies to be adopted for sustaining productivity and improving soil health.

Materials and Methods

The study was carried out by Krishi Vigyan Kendra on different pulse crops like Blackgram, Cowpea, Pigeon pea and Horse gram at B-Hullukere, Kanahatti, Goravale, Keragodu Burudugutte, H-Kodahalli and Biliguli villages of mandya district were selected as cluster villages during 2021-2022, 2022-2023. Under the NFSM scheme of CFLD Total 200 numbers of demonstration were conducted in twenty villages. One variety of each crop namely; LBG-791 (Black gram), BRG-3 (Pegion pea), KBC-9 (Cowpea) and PHG-9 (Horse gram) were considered for the study which have paramount significance in terms of production potential and wide acceptance by the farmers in their local farming systems. In general, soil of the area under study was loam or sandy-loam with low to medium fertility status.

Major technological interventions were taken as per prescribed unless packages of practices for selected crops (Table 1) by the University of agricultural Sciences, Bangalore. Knowledge and Skill development of farmers were imparted through trainings at KVK as a part of technological interventions with improved package of practices in demonstration fields along with active participation of farmers at farmers' fields. The farmer practice was considered as control field/local check which was maintained by the farmers according to their own traditional cultivation practices. The KVK as per the mandate of the scheme had provided critical inputs such as seeds, fertilizers, IPM, implements and bio-fertilizers to the farmers for demonstration fields with technical support. The necessary steps for selection of site, selection of farmers, layout of demonstrations etc. were followed as suggested by Choudhary (1999) [1]. The KVKs Scientists used to frequent visit to demonstrations fields and farmer's field (control) for intensive supervision and data collection during the entire period of study. The study was conducted in experimental designs ('Control-Treatment') of social research.

The data on listed parameters of demonstration fields as well as control fields were collected on fixed interval till harvesting of crops to assess the overall performance of selected pulse crops. The data output was collected from both CFLD plots as well as control plots and finally the extension gap, technology gap, technology index along with the benefit cost ratio were work out (Samui *et al*., 2000) [4] as given below:

Extension Gap = Demonstrated Yield-Farmers' practice yield

Technology Gap= Potential yield- Demonstration yield

Additional Return = Demonstration return – Farmers practice return

$$\text{Technology Index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \text{ X } 100$$

$$\text{Benefit} - \text{Cost Ratio} = \frac{\text{Gross Return}}{\text{Gross Cost}}$$

The basic information from the farmer's field as well as feedback information were chronologically recorded and analyzed to see the comparative performance of cluster frontline demonstrations (CFLDs) and farmer's practice (control).

Table 1: Details of recommended package of practices for Black gram, Pigeon pea, Cowpea and Horse gram

Technological Intervention	Recommended packages of Practice followed in CFLDs			
	Black gram	**Cowpea**	**Pigeon pea**	**Horse garm**
Variety	LBG-791	KBC-9	BRG-3	PHG-9
Seed rate	10-12.5 kg ha^{-1}	12.5-15 kg ha^{-1}	12.5-15 kg ha^{-1}	10 kg ha^{-1}
Seed treatment	Rhizobium culture @ 500 g/ ha seeds	Rhizobium culture @ 500 g/ ha seeds	Rhizobium culture @ 500 g/ ha seeds	Rhizobium culture @ 500 g/ ha seeds
Sowing method and spacing	Line sowing @ 30 X 10 cm	Line sowing @ 45 X 10 cm	Line sowing @ 90-120 X 30 cm	Line sowing @ 30 X 10 cm
Time of sowing	April-May (*Kharif*) January-February (Summer)	April-May (*Kharif*) August-September (Late *Kharif*) January-February (Summer)	May- July	August-September
Nutrient management	Application of 25 kg N, 50 kg P_2O_5 and 25 kg K_20	Application of 25 kg N, 50 kg P_2O_5 and 25 kg K_20	Application of 25 kg N, 50 kg P_2O_5 and 25 kg K_20	Application of 25 kg N, 37.5 kg $P_2O_5$and 25 kg K_20
Weed management	Two intercultural operations within 40 DAS	Two intercultural operations within 40 DAS	Application of weedicide (Pendimethalin @1.0 l ha^{-1}) immediately after sowing	Two intercultural operations within 40 DAS
Water management	Irrigation at flowering stage and grain filling stage	Irrigation at flowering stage and grain filling stage	Irrigation at Germination, flowering stage and grain filling stage	Irrigation at flowering stage and grain filling stage
Pest and disease management	Need based plant protection measures			

Results and Discussion

Table 2: Details of pulses growing under Cluster frontline demonstrations (CFLDs) and farmers Practices

Pulses	Variety		2021-22		2022-23	
	CFLD	Farmer Practice	Area (ha.)	No. of farmers	Area (ha.)	No. of farmers
Black gram	LBG-971	Local	20	50	20	50
Cowpea	KBC-9	Local	10	25	10	25
Pigeon pea	BRG-3	Local	10	25	-	-
Horse gram	PHG-9	Local	-	-	10	25

The demonstration on integrated crop management in pulses was carried under cluster frontline demonstration during the year 2021-22 and 2022-23. The crop selected were Blackgram, Cowpea, Pigeon pea and Horse gram in an area of 20 ha, 10 ha and 10 ha and blackgram, cowpea, pigeon pea respectively during 2021-22 and 20 ha, 10 ha, 10 ha blackgram, cowpea, horsegram respectively during 2022-23. The results from the demonstrations indicated that there were an increase in yield (blackgram 54.87%, cowpea-42.76%, pegion pea-39.73% and horse gram-36.19%) in demonstrations over farmer practice indicating the superiority of the intervention through improved production practices and the integrated approach with respect to the pest and disease management. In addition to use of biofertilizers rhizobium was found to be beneficial and farmer could witness the change in crop yield and quality of the crop and farmers opined of adopting the technology and motivate others to adopt the same (SHISHIR KUMAR AND WILSON KISPOTTA) [5].

Table 3: Productivity, extension gap, technology gap and technology index of pulses under CFLDs (average over years).

Pulse	No. of demo.	Area (ha)	Average productivity (q ha^{-1})			% increase over FP (control)	Technology Gap (Rs. ha^{-1})	Technology Index (%)
			Potential	CFLD	FP			
Black gram	100	40	12.5	7.20	4.78	54.87	5.3	42.40
Cowpea	50	20	15	7.76	5.44	42.76	7.24	48.26
Pigeon pea	25	10	12.5	10.20	7.30	39.73	2.3	18.40
Horse gram	25	10	10	7.94	5.83	36.19	2.06	20.60

CFLD = Cluster Frontline Demonstration FP=Farmers Practice

The results revealed that an average seed yield of 7.20 q/ha, 7.76 q/ha, 10.20 q/ha and 7.94 q/ha recorded for blackgram, cowpea, pigeon pea and horse gram respectively under demonstrated plots as compared to farmers practice. These results clearly indicated that the higher average seed yield in demonstration plots over the farmers practice due to integrated crop management practices and with improved high yielding disease resistance varieties. Adoption of scientific package of practices like seed treatment, integrated nutrient management, micro irrigation at critical growth stage, seed treatment with biofertilizers and need based right plant protection practices resulted in higher yields. The above findings are similar in lines with (Ojha and and Bisht, 2020) [3].

Table 4: Economics of cluster frontline demonstrations on pulses under CFLDs (average over years)

Pulse	Gross returns (Rs. ha^{-1})		Gross cost (Rs. ha^{-1})		Net return (Rs. ha^{-1})		Additional gain (Rs. ha^{-1}) in CFLD's		B:C ratio	
	CFLD	FP	CFLD	FP	CFLD	FP	CFLD	FP	CFLD	FP
Black gram	58732	39348	18064	16263	40668	23084	119.56	-	3.19	2.34
Cowpea	53643	37167	21479	20627	32509	16540	59.89	-	2.55	1.81
Pigeon pea	36720	26280	18860	18500	17860	7780	129.56	-	1.94	1.40
Horse gram	50022	35539	23308	21432	26714	14107	89.36	-	2.15	1.66

In the present study average cost of cultivation of Farmer's practice for Black gram (Rs. 16263/ha), Cowpea (Rs. 20621/ha), Pigeon pea (Rs. 18500/ha) and Horse gram (Rs. 21432/ha), was lesser as compare to demonstration plot Black gram (Rs. 18064/ha), Cowpea (Rs. 21479/ha), Pigeon pea (Rs. 18860/ha) and Horse gram (Rs. 23308/ha) and the finding shown in table 4 which clarified the implication of Cluster Frontline Demonstration at Farmer's field during the period of investigation in which higher average net return were found under Demonstration plots as compared to farmer's practice. The Benefit cost ratio was also higher in demonstration plots Black gram (3.19), Cowpea (2.59), Pigeon pea (1.94) and Horse gram (2.15), as compared to farmer's practice. Increased monetary returns as well as Benefit cost (B:C) ratio through upgraded farm technology have also been reported by various scientists.

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