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Impact of cluster front line demonstrations on yield levels in pigeonpea and chickpea

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Abstract
This paper is the result of pooled analysis of cluster front line demonstrations on two pulses (CFLD-P) namely Pigeonpea and Chickpea conducted at ICAR-Krishi Vigyan Kendra, Bagalkote since last five years from 2017-18 to 2021-22 at different villages and talukas. ICAR KVK Bagalkote has conducted cluster front line demonstrations on pigeon pea in 90 ha with 325 farmers and 86 ha with 215 farmers on chickpea. These demonstrations were intended to increase the area and productivity under pulses to attain food security with various recent technologies released including varieties and integrated crop production practices. It was found that, there was steady increase in net returns of Pigeonpea from 17.02 to 34.87 percent during last five years. The results with respect to pigeonpea (*Kharif* season) revealed that, there was increase in yield from 13.74% to 16.09 percent over the farmers practice except during 2019-20, where in the increase was witnessed 36.79%. The results regarding chickpea also revealed that, the increase in net returns from 31.60 to 36.75% while increase in yield levels 15.11 to 25%. These trends of increase in yield levels can be attributed to adoption of improved technology as well as improved varieties. The yield levels were considerably low under local practices because of variations in adoption of recommended package of practices depending upon the amount of risk involved in terms of cost, convenience, skill and knowledge about the concerned practice. The productivity was better over local practice under demonstrations. Hence, pulses production technology have a broad scope for increasing the area and production of pulses at each and every level i.e., Farmers, State and National level. However there were fluctuations noticed in both the crops regarding yield and net returns due to rainfall and price fluctuations.

Keywords: Cluster front line demonstrations, pigeon pea, chickpea

Introduction
For the majority of Indians who are poor, pulses form the most important source of proteins. Increasing production of pulses and improving its access will help reduce malnutrition among the poor, especially the women. These are the major source of protein when compared to cereals, oilseeds and other crops. Government of India, (GOI) is implementing need based programmes to increase pulses production from time to time, like Technology Mission on Oilseed and Pulses, Accelerated Pulse Production Programme (A3P) and National Food Security Mission (NFSM) on Pulses in 2007-08. No doubt, there has been a significant increase in production of 18.45 million tonnes (MT) during 2012-13. The recently introduced Government lead initiatives like NFSM, which has helped Indian farmers to increase the production by adoption of improved varieties and using quality seeds as well as other inputs, from time to time. Mission was launched to bridge the yield gap in pulses through dissemination of improved technologies and farm management practices with focus on districts which have high potential but low level of productivity performance, at present.
Pulses production is mostly from the crop raised under rain-fed conditions. Cultivation of pulses in marginal lands, limited area of pulses under irrigated conditions, limited high yielding responsive varieties, pests and diseases and processing loss up to 6-8% are some of the problems in the stagnation of pulses production over decades. Thus, factors limiting the productivity cannot be overlooked. There is need to emphasize on quality attributes, adoption and popularization of new agro technology, evolving better varieties for stress conditions and improving present yield potential. The present paper is an effort in the direction to raise the productivity with the introduction of new varieties and crop management strategies.

Materials and Methods

The technologies to be demonstrated for pigeon peas and chickpeas were identified based on the need analysis of farmers obtained through field visits, discussion with farmers and feedback from line departments. A cluster of villages were identified based on the major cropping system and also the farmers were identified based on their participation and feedback received during the preliminary survey and interactive meeting. Frontline demonstrations were conducted by the Krishi Vigyan Kendra, Bagalkote in *kharif* and Rabi seasons in the farmer's fields of Bagalkote district during 2017-18 to 2021-22. All 540 demonstrations in 176 ha area were conducted by the active participation of farmers with the objective to demonstrate the improved technologies of pulses production potential in different villages. The soil analysis was carried out during each year. As per the guidelines each farmer was allotted a minimum of 1 ac and maximum of 2 ac area. Each farmers was asked to maintain a check plot alongside of demonstration plot. Pre sowing trainings were organized involving the selected farmers in their village for the crops. Critical inputs including seeds, pulse magic, vermi wash and plant protection chemicals were made available to the farmers after the training. Literature was also distributed in this regard and regular visit, monitoring and pest and disease advisory services management by the KVK scientist to the demo farmers. A field day was conducted involving demonstration holding farmers, other farmers in the village, and 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. Economics was worked out to infer the superiority of the demonstration over the local practice.

Different parameters were calculated to find out the technology gaps as described by Yadav *et al*. 2004 [1]. Yield gap was analyzed using potential yield and demo yield using the formula given below.

- Extension gap= Demo yield-Farmers' practice yield
- Technology gap=Potential yield-Demo yield
- Additional return= Demo return-Returns in farmers' practice
- Technology index (yield gap-1)= potential yield-Demo yield/potential yield*100
- Yield gap-II = Demo yield-Check yield/Demo yield*100

Results and Discussion

Results presented in Table 1. with respect to yield levels of Pigeon Pea under Cluster Front Line Demonstrations since last five years indicated that, there was a steady increase in yield (%) except for the year 2019-20. The increase ranged from 13.74% to 16.09 percent. The highest increase (36.79%) in the yields may be due to lowest yield in farmers practice due to high incidence of pest and disease, rainfall and local variety. The cost benefit ratio indicated that, the demonstrations were always economical when compared to farmers' practice. The increase in net return ranged from 17.02% to 41.58 percent indicated that, transfer of technology on integrated crop management practices has given the better results when compared to farmers' practice.

Table 1: Yield levels of Pigeonpea under Cluster Front Line Demonstrations

Year	Yield obtained (q/ha)						Yield increase (%)	Expenditure and returns (Rs./ha)								Net returns increase (%)
	Check			Demo				Check				Demo				
	Max.	Min.	Avg	Max.	Min.	Avg		Gross Cost (Rs/ ha)	Gross return (Rs/ ha)	Net Return (Rs/ha)	BCR	Gross Cost (Rs/ha)	Gross return (Rs/ha)	Net Return (Rs/ha)	B:C ratio	
2017-18	10.60	8.50	10.02	13.20	10.80	11.62	13.74	27993	60132	32139	2.15	27993	69708	41715	2.49	22.96
2018-19	10.20	8.80	9.50	12.20	9.80	11.00	15.79	30861	53814	22953	1.74	32197	61951	29754	1.92	22.86
2019-20	8.75	6.00	7.37	13.11	10.21	11.66	36.79	31090	56855	25765	1.82	31900	62052	30152	1.94	17.02
2020-21	13.50	8.00	11.27	16.3	9.50	13.07	15.96	36309	68071	31762	1.87	36309	78413	42104	2.16	32.56
2021-22	14.00	7.50	11.32	16.25	10.00	13.21	16.09	38130	68568	30438	1.80	36525	79620	43095	2.18	41.58

Table 1 A: Yield gap analysis of pigeon pea

Year	Extension gap (Demo yield-Check yield)	Technology gap Potential yield-Demo yield	Additional return Demo return-Return from Farmer's practice	Technology Index (Yield gap-1)= Potential yield-Demo yield/Potential yield*100	Yield gap-II = Demo yield-Check yield/Demo yield*100
2017-18	1.60	4.63	9576	28.49	13.77
2018-19	1.50	5.25	6801	32.31	13.64
2019-20	4.29	4.59	4387	28.25	36.79
2020-21	1.80	3.18	10342	19.57	13.77
2021-22	1.89	3.04	12657	18.71	14.31

- The potential yield of pigeon pea was 12.5 q/ha

The yield gap analysis of pigeon pea showed that (Table 1 A), the yield gap was 1.6, 1.5, 4.29, 1.8 and 1.89 during last five years. The yield gap was highest during 2019-20, which was also reflected in highest increase in yield. The technology gap also indicated that, there is still scope to increase the yield levels. Both technology index and (Yield gap-I) and yield gap –II also reveal the need to bridge the gap between the potential and demo yield. The 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. The similarly observations were also obtained in greengram crop by Patil *et al*., (2015) [2] and in blackgram by Sahare *et al*., (2018) [3]. The higher grain yield was attributed to higher potential with improved variety, seed & soil treatment, timely sowing, nutrient management, weed management, insect-pest and disease management in accordance of scientific package and practices.

Table 2: Yield levels of Chick pea under Cluster Front Line Demonstrations since last five years

Year	Yield obtained (q/ha)						Yield increase (%)	Expenditure and returns (Rs./ha)								Net returns increase (%)
	Check			Demo				Check				Demo				
	Max.	Min.	Avg	Max.	Min.	Avg		Gross Cost (Rs/ ha)	Gross return (Rs/ ha)	Net Return (Rs/ha)	BCR	Gross Cost (Rs/ ha)	Gross return (Rs/ ha)	Net Return (Rs/ha)	B:C ratio	
2017-18	12.25	9.50	11.02	15.25	11.25	13.87	20.56	26401	48466	22065	1.84	26401	61006	34605	2.31	36.24
2018-19	13.25	10.00	11.87	15.50	12.75	13.98	17.77	29225	47493	18268	1.63	29225	55933	26708	1.91	31.60
2019-20	13.75	8.75	10.98	15.75	10.50	12.64	15.11	26800	44837	18037	1.67	27221	51450	24230	1.89	34.33
2020-21	15.00	8.75	11.05	17.50	10.00	12.96	17.25	30844	55517	24673	1.80	31225	64926	33701	2.08	36.59
2021-22	10.00	5.00	6.57	12.50	6.25	8.36	25.00	22700	41820	19120	1.84	24011	50160	26149	2.09	36.75

Results presented in Table 2. With respect to yield levels of chickpea under Cluster Front Line Demonstrations since last five years indicated that, there was fluctuation in the yield levels of chickpea, however the yield increased from 20.56% during 2017-18 to 25.00% during 2021-22. The minimum yield increase was registered during 2019-20 and maximum was during 2021-22. The increase ranged from 15.11% to 25.00%. The highest increase (25.00%) in the yields may be due to lowest yield in farmers practice due to high incidence of pest and disease, rainfall and local variety. The cost benefit ratio indicated that, the demonstrations were always economical when compared to farmers' practice. The net returns increase also revealed that, transfer of technology on integrated crop management practices has given the better results when compared to farmers' practice.

Table 2 A: Yield gap analysis in chickpea

Year	Extension gap (Demo yield-Check yield)	Technology gap (Potential yield-Demo yield)	Additional return (Demo return-Return from Farmer's practice)	Technology Index (Yield gap-1)= Potential yield-Demo yield/Potential yield*100	Yield gap-II = Demo yield-Check yield/Demo yield*100
2017-18	2.85	1.13	12540	7.53	20.55
2018-19	2.11	1.02	8440	6.80	15.09
2019-20	1.66	2.36	6193	15.73	13.13
2020-21	1.91	2.04	9028	13.60	14.74
2021-22	1.79	6.64	7029	44.27	21.41

The yield gap analysis in chickpea revealed that, the extension gap witnessed declining trend over the years. The highest yield gaps was observed during 2017-18 and lowest extension gap was observed during 2019-20. Technology gap increased over the years from 1.13 to 6.64 as the heavy rainfall received during these years (Table 3) might have resulted this gap. The results regarding technology gap and yield gap –II also indicate the similar trend i.e., due to heavy rains there exists gap in these indices.

Table 3: Month wise Rainfall from 2018-2022 (Standard deviation Compared with Average RF).

Month	Station Average RF (mm) (1985-2010)	2018 Rainfall (mm)	SD	2019 Rainfall (mm)	SD	2020 Rainfall (mm)	SD	2021 Rainfall (mm)	SD	2022 Rainfall (mm)	SD
January	1.9	0.0	1.3	0.0	1.3	0.0	1.34	5.6	2.6	0	1.3
February	0.3	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0	0.2
March	7.9	0.0	5.5	0.0	5.5	9.9	1.4	0.0	5.5	3.2	3.3
April	20.8	3.7	12.0	1.2	13.8	18.8	1.4	36.7	11.2	3.5	12.2
May	48.5	48.5	0.0	39.0	6.7	9.4	27.6	36.0	8.8	171.2	86.7
June	98.9	99.0	0.0	153.0	38.2	100.4	1.0	149.6	35.8	62.0	26.0
July	43.1	58.0	10.5	105.0	43.7	131.8	62.7	131.4	62.4	129.4	61.0
August	73.0	132.5	42.0	66.2	4.8	132.5	42.0	137.6	45.6	147.6	52.7
September	118.9	53.6	46.1	147.0	19.8	271.0	107.5	65.0	38.1	176.8	40.9
October	99.0	12.0	61.5	203.4	73.8	188.3	63.1	8.8	63.7	145.0	32.5
November	16.0	2.2	9.7	14.2	1.2	1.4	10.3	74.2	41.1	0	0
December	8.8	0.0	6.2	0.0	6.2	0.0	6.2	30.4	15.2	0	0
Total	537.0	409.5	-6.2	729.0	+17.9	863.5	+27.0	675.3	+27.5	808.5	+31.7

Conclusion

It is inferred from the above results that, Cluster Front Line Demonstrations have an impact on yield levels. The farmers under demonstrations got to know about the improved crop production practices and newly released varieties in pulses. However, there was an impact of heavy rainfall on yield levels as the pigeon pea and chickpea are susceptible to wilt when there is high rainfall. The additional return varied over the years since there were fluctuations in the selling rates.

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