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Impact of Cluster Frontline Demonstrations on Yield, Knowledge Adoption and Spread of Blackgram in Tribal Belt of Rajasthan

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A B S T R A C T

Cluster front line demonstrations were conducted in Shahabad and Kishanganj block of Baran district of Rajasthan by *Krishi Vigyan Kendra*, Baran during 2012-13 to 2018-19. The total 505 demonstrations were laid out on 198 ha area of farmer's field as per recommended package of practices of Agriculture University, Kota. The farmers practice was considered as control plot in demonstration cluster. A significant enhancement in the yield of blackgram was recorded over the control by 32.78, 37.65, 47.31, 24.43, 41.30, 23.15 and 22.68 percent for the year 2012-13, 2013-14, 2014-15, 2015-16, 2016-17, 2017-18 and 2018-19, respectively. The overall adoption level of blackgran production technology was increased due to cluster front line demonstrations. The local variety replaced by PU – 31in demonstration area and covered 90.23 per cent blackgram area of the Baran district.

Introduction

Blackgram (*Vigna mungo*) is one of the important Indian origin pulse crop. The important states that cultivates blackgram are Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Orissa and Rajasthan etc. In Rajasthan area under blackgram is 2.78 lakh ha with a production of 1.46 lakh tonnes and productivity of 523 kg ha^{-1} (Commission rate of Agriculture, Rajasthan, 2017-18). The most promising feature of blackgram is rich in protein content and their ability to fix atmospheric nitrogen. It has been reported that black gram produces 22.10kg N $ha^{-1}yr^{-1}$ which supplements 59 thousand tons of urea annually (Jat *et al.*, 2017).

It is an important pulse crop grown during the month of June-July in the *Hadauti* region of Rajasthan. It is the second most important crop after soybean during *kharif* season in this region. Mostly it has grown in rainfed conditions, after its harvest farmer's mostly growing wheat, mustard and chickpea under irrigated conditions while fallow in rainfed conditions. The Baran district area under

blackgram is 15502 ha with a production of 9238 tonnes and productivity of 596 kg ha^{-1}.The poor yield of blackgram is mainly attributed to the use of poor quality seeds, water stress, no fertilizer application, no YMV management and no weed management (Meena *et al.*, 2018 and Kumar *et al.*, 2018). The reason of low productivity also may be attributed to non-adoption of improved production technology which includes the agronomic practices and socio-economic conditions of the tribal peoples. The productivity of blackgram in the district can be increase by fallowing the appropriate agronomic practices along with high yielding blackgram varieties.

Therefore, it is very essential to demonstrate the high yielding varieties, resistant to biotic and abiotic stresses and improved production technologies which the farmers generally do not adopt.

An effort was made by the KVK scientists by introducing the new agro techniques through cluster front line demonstrations (CFLDs). The CFLDs were conducted on blackgram (var. PU – 31) by KrishiVigyan Kendra, Baran on farmers field during seven consecutive years in *kharif* seasons from 2012-13 to 2018-19.

Materials and Methods

The study was conducted in Kishanganj and Shahabad Block of Baran district in the Rajasthan state. The Kishanganj and Shahabad block is located at 26.0982° N, 87.9450° E and 27.6441° N, 79.9447° E, latitude and longitude, respectively. To make crop diversification, *Krishi Vigyan Kendra*, Baran had conducted the CFLDs on pulse crops during 2012-13 to 2018-19. Before organizing actual CFLDs, the KVK scientists had collected baseline information from two adopted villages in the year 2012. During 2012-13 to 2018-19, KVK had organized CFLDs of Blackgram on 198.0 ha area. The CFLDs had organized on farmers' field according to the package of practices recommended by Agriculture University, Kota. The farmer practice was considered as local check in demonstration cluster. These control plots were maintained by the farmers according to their own traditional cultivation practices. The KVK scientists had provided critical inputs such as seed, seed treatment, herbicides, micro nutrients, IPM and bio-pesticides to the farmers for demonstration plots.

The demonstrations were laid out under the close supervision of KVK scientists. Total 505farmers were selected for the conducting of CFLDs on blackgram. Therefore, 505 beneficiary farmers were selected purposively as the samples for present investigation. The study was conducted in experimental designs ('Control-Treatment' and 'Before-After') of social research. The yield data of demonstration plots as well as control plots were collected immediately after harvesting to assess the impact of CFLDs intervention on the yield of blackgram (2012-13 to 2018-19). However, structured and pre-tested interview schedule was used to elicit the information from beneficiary farmers about adoption, varietal replacement and horizontal spread of pulse crop technologies in adopted villages. The personal interview was conducted with the beneficiary farmers after the completion of each year. The following formulae were used to assess the impact of CFLDs on the different parameters of blackgram crops.

$$\text{Impact on Yield (\% Change)} = \frac{\text{Yield of Demonstration Plot (kg ha}^{-1}\text{)} - \text{Yield of Control Plot (kg ha}^{-1}\text{)}}{\text{Yield of Control Plot (kg ha}^{-1}\text{)}} \times 100$$

$$\text{Impact on Adoption (\% Change)} = \frac{\text{No. of Adopters after Demonstration} - \text{No. of Adopters before Demonstration}}{\text{No. of Adopters before Demonstration}} \times 100$$

Results and Discussion

Impact of CFLDs on Crop Yield

The finding of the impact of CFLDs on yield enhancement of blackgram is presented in this part. It is evident from table 1 that the average yield of seven years of demonstration plot of blackgram 'PU – 31' variety was 949 kg ha^{-1}over the control plot yield 714 kg ha^{-1}during 2012-13 to 2018-19.This showed that there was a positive and significant increase in the mean yield of blackgram demonstration plots over the farmer practice by 32.78, 37.65, 47.31, 24.43, 41.30, 23.15 and 22.68 per cent for the year 2012-13, 2013-14, 2014-15, 2015-16, 2016-17, 2017-18 and 2018-19, respectively. The main reasons of the low yield of blackgram control plots in adopted villages were the use of poor quality seeds, traditional cultivation methods with poor nutrient, weed, insect and pest management practices. However, KVK scientists had used improved varieties of blackgram, seed treatment with carbendazim50WP @ 2.0 g/kg, adopted improved agronomic practices for demonstration plots that resulted32.76% higher mean yield over a control plot mean yield. This finding is in agreement with the findings of Singh *et al.,* (2019).

This improvement in yield might be due to use of treated seed of improved variety PU – 31, use of bio-fertilizers, timely sowing, application of recommended dose of fertilizers, proper and timely weed management and integrated pest management practices. Similar observations were noted at by *Krishi Vigyan Kendra*, Champaduring 2016-17 with the introduction of crop production technologies through frontline demonstrations (Sahu *et al.,* 2018). Sahare *et al.,* (2018) in Umaria, Madhya Pradesh also recorded similar results in blackgram as per the mean of five consecutive years (2009-10 to 2013-14).

Impact of CFLDs on adoption of blackgram production technologies

Data on adoption of blackgram production technologies by the beneficiary farmers are presented in table 2. It was found that a number of adopters for improved variety (PU – 31) and seed rate of 18 kg ha^{-1} of blackgram were 3.96% before demonstrations, which increased to 100.00% after cluster frontline demonstrations in adopted villages. A similar trend was also observed in the case of weed management practices as an increase in the percentage of adopters from 27.03 to 95.25%.

The number of adopters for application of N: P: Zinc sulphate (20:40:25 kg ha^{-1}) fertilizers and insect management by using pesticide *viz*. Dimethoate 30% EC 1.0 l ha^{-1}/ Thiamethoxam 25% WG @200 g ha^{-1}were increased significantly during pre and post-demonstrations period from 16.28 to 85.15% and from 33.65 to 83.56%, respectively. The cercospora leaf spot diseases infestation were found due to continuous heavy rainfall and high relative humidity at reproductive stage which controlled by carbendazim 50WP @ 500 g ha^{-1}.

Number of adopters for disease control was 14.91% before demonstrations, which increased to 73.07% after cluster front line demonstrations. In this line, it was found that majority of the participant farmers in CFLDs program had full adoption of improved practices *viz*., land preparation, use of high yielding varieties, sowing time and application of manures and fertilizers. These results are in close conformity with the findings recorded in the same crop (Sahare *et al.,* 2018). Significant difference was observed between the adoption of CFLDs beneficiary farmers and non-beneficiary farmers towards blackgram production technology.

Table.1 Impact CFLDs on yield of blackgram

Year	Technology Interventions	Demo. Area (ha)	No. of Farmers	*Average yield (kg ha^{-1})*		Impact (% Change)
				Control (kg ha^{-1})	Demo. (kg ha^{-1})	
2012-13	PU – 31 variety @ 18 kg/ha; ST carbendazim50WP @ 2.0 g kg^{-1}; Fertilizers: N, P & Zinc sulphate @ 20: 40 & 25 kg ha^{-1}; Herbicide: Imazethapyr 10% SL @ 55 g a.i. ha^{-1} at 15-20 DAS & Insecticide: Dimethoate 30% EC 1.0 l ha^{-1}	20.0	50	961	1276	32.78
2013-14	PU – 31 variety @ 18 kg/ha; ST Carbendazim 50WP @ 2.0 g kg^{-1}; Fertilizers: N, P & Zinc sulphate @ 20: 40 & 25 kg ha^{-1}; Herbicide:Imazethapyr 10% SL @ 55 g a.i. ha^{-1} at 15-20 DAS & Insecticide: Dimethoate 30% EC 1.0 lha^{-1}	20.0	50	850	1170	37.65
2014-15	PU – 31 variety @ 18 kg/ha; ST Carbendazim 50WP @ 2.0 g kg^{-1}; Fertilizers: N, P & Zinc sulphate @ 20: 40 & 25 kg ha^{-1}; Herbicide: Imazethapyr 10% SL @ 55 g a.i.ha^{-1} at 15-20 DAS & Insecticide: Dimethoate 30% EC 1.0 l ha^{-1}	40.0	110	501	738	47.31
2015-16	PU – 31 variety @ 18 kg/ha; ST Carbendazim 50WP @ 2.0 g kg^{-1}; Fertilizers: N, P & Zinc sulphate @ 20: 40 & 25 kg ha^{-1}; Herbicide: Imazethapyr 10% SL @ 55 g a.i.ha^{-1} at 15-20 DAS & Insecticide: Dimethoate 30% EC 1.0 l ha^{-1}	8.0	20	614	764	24.43
2016-17	PU – 31 variety @ 18 kg/ha; ST Carbendazim 50WP @ 2.0 g kg^{-1}; Fertilizers: N, P & Zinc sulphate @ 20: 40 & 25 kg ha^{-1}; Herbicide:Imazethapyr 10% SL @ 55 g a.i. ha^{-1} at 15-20 DAS & Insecticide: Dimethoate 30% EC 1.0 lha^{-1}	20.0	50	787	1112	41.30
2017-18	PU – 31 variety @ 18 kg ha^{-1}; ST Carbendazim 50WP @ 2.0 g kg^{-1}; Fertilizers: N, P & Zinc sulphate @ 20: 40 & 25 kg/ha; Herbicide:Imazethapyr 10% SL @ 55 g a.i. ha^{-1} at 15-20 DAS, Insecticide: Dimethoate 30% EC 1.0 l ha^{-1}&*Cercospora* leaf - Carbendazim 50WP @ 500 g ha^{-1}.	50.0	125	920	1133	23.15
2018-19	PU – 31 variety @ 18 kg ha^{-1}; ST Carbendazim 50WP @ 2.0 g kg^{-1}; Fertilizers: N, P & Zinc sulphate @ 20: 40 & 25 kgha^{-1}; Herbicide:Imazethapyr 10% SL @ 55 g a.i. ha^{-1} at 15-20 DAS, Insecticide: Thiamethoxam 25% WG @200 g ha&*Cercospora* leaf - Carbendazim 50WP @ 500 g ha^{-1}.	40	100	366	449	22.68
Total/ Average		198	505	7.14	9.49	32.76

Table.2 Impact of CFLDs on adoption of blackgram production technologies

S. No.	*Technology*	Number of Adopters (N=505)		Change in No. of adopters	Impact (% Change)
		Before demonstration	After demonstration		
1.	Improved variety: PU – 31 & Seed rate @ 18 kg ha^{-1}	20 (3.96)	505 (100.00)	+ 485	2425.00
2.	Seed treatment:Carbendazim 50WP @ 2.0 g kg^{-1}	40 (10.10)	396 (78.42)	+ 356	890.00
3.	Spacing: 30×10 cm	25 (6.17)	405 (80.20)	+ 380	1520.00
4.	Nutrient management: N: P:K: Zinc sulphate @ 20: 40:25 kg ha^{-1}	70 (16.28)	450 (85.15)	+ 360	542.86
5.	Weed management: Imazethapyr 10% SL @ 55 g a.i. ha^{-1} at 15-20 DAS	130 (27.03)	481 (95.25)	+ 351	270.00
6.	Insect management: Dimethoate 30% EC 1.0 l ha^{-1}/ Thiamethoxam 25% WG @200 g ha^{-1}	142 (33.65)	422 (83.56)	+ 280	197.18
7.	Disease management (Cercospora leaf spot): Carbendazim 50WP @ 500 g ha^{-1}.	55 (14.91)	369 (73.07)	+ 314	570.91

* Figures in parentheses indicate percentage Source: Field survey of 2018-19

Table.3 Impact of CFLDs on horizontal spread of PU – 31 variety of blackgram in the district

S. No.	Year	Area (ha) ofblackgram in district	Area (ha) of PU 31 after demonstration	% share of PU 31 after demonstration
1.	2012-13	5429	20	0.37
2.	2013-14	1212	102	8.42
3.	2014-15	6662	1105	16.59
4.	2015-16	20897	11004	52.66
5.	2016-17	43308	36300	83.82
6.	2017-18	136502	119901	87.84
7.	2018-19	104211	94033	90.23

Impact of CFLDs on varietal replacement of blackgram

The CFLDs are proven extension intervention for changing existing/traditional practice of farmers. Therefore, efforts were made to know the varietal replacement in selected cluster due to CFLDs and data depicted in table 3. It was found that the previously grown varieties of blackgram such as T 9, PU 19 and RBU 18 were replaced by improved varieties *viz* PU – 31on a large scale in adopted villages.

The *KrishiVigyan Kendra*, Baran first time introduced this variety in the district due to its unique tract like resistant to YMV and synchronize maturity. KVK demonstrated this variety in 20 ha area during 2012-13 and before to that district farmers were not aware about this variety. There was a significant increase in area from 20.0 (1st year demo) to 119901 ha under PU – 31variety of blackgram crop in demonstration cluster. The share of PU – 31variety increased from 0.37 to 90.23 % area of the district. The reasons might be their agronomical attributes such as high yielding nature, short duration and especially resistant to YVMV. Similarly, the CFLDs beneficiary farmers had received a good yield in demonstration plots by the adoption of improved agronomic practices. Therefore, they have motivated and continued the adoption of improved varieties on a large scale for succeeding years. The replacement of local varieties with improved varieties of maize, paddy and wheat due to CFLDs was reported (Balai *et al.*, 2013). The yield of soybean was increased with the intervention on varietal replacement (JS-97-52) in the Umaria district (Tiwari *et al.*, 2013).

In conclusion the blackgram is a potential *Kharif* pulse crop in Baran district of Rajasthan but its productivity is very meagre due to unavailability of improved technology in the district. It is found from the study that there exists a wide gap between the potential and demonstration yields in blackgram mainly due to technology and extension gaps and also due to the lack of awareness about new technology in blackgram cultivation among tribes of the district. The higher average yield was recorded in demonstration plots over the years compared to local check due to increased knowledge and adoption of full package of practices. Hence, it is concluded that the CFLDs programme is a successful tool in improving the production and productivity of blackgram crop.

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