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Impact of cluster frontline demonstrations on black gram production in Samba district, Jammu and Kashmir

NEERJA SHARMA[1*], SAURAV GUPTA[1], ABHAY KUMAR SINHA[1] and SUNIL MISHRA[2]

[1]ICAR – Krishi Vigyan Kendra
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu
Samba 184121 Jammu and Kashmir, India
[2]Division of Agronomy
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu
Jammu 180009 Jammu and Kashmir, India
[*]Email for correspondence: neerja1975@gmail.com

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ABSTRACT

The study evaluated the impact of cluster frontline demonstrations (CFLDs) on black gram cultivation in Samba district, Jammu and Kashmir, conducted by Krishi Vigyan Kendra (KVK) from 2020 to 2022. The demonstrations introduced were improved varieties, seed treatment, water management and integrated pest and disease management. Results showed a significant increase in yield, ranging from 58.9 to 62.0 per cent over farmers' practice. The technology gap, extension gap and technology index were analyzed, revealing the need for enhanced extension services to bridge the yield gap. Economic analysis demonstrated higher gross and net return and benefit-cost ratio for demonstrated technologies. Farmers expressed high to medium satisfaction with the interventions. The study highlighted constraints such as traditional farming practices, lack of quality seeds and limited access to modern inputs and knowledge, underscoring the importance of KVK's role in technology transfer and farmer education.

Keywords: Black gram; CFLDs; technology gap; extension gap; technology index; constraints

INTRODUCTION

Black gram (*Vigna mungo* L) is a popular legume that belongs to the family Fabaceae. It is one of the important pulse crops of India after chickpea and pigeon pea. It can be grown in different agro-ecological conditions under diverse cropping systems. Black gram is a well known leguminous crop and popular because of its nutritional quality (protein). Major portion of black gram is utilized in making Dal, curry, soup, sweet and snack. In south India, the most popular Idli and Dosa are prepared using mixed proportions of rice and black gram (Chandravanshi et al 2022). Black gram is also used as a green manure and cover crop or fodder crop and as short-lived forage (Prioty et al 2023). The crop is a potential component of various cropping systems, especially in rice and wheat fallows owing to its short life cycle (70-90 days), capacity to fix atmospheric nitrogen and relative drought tolerance. Black gram is generally intercropped with maize, sorghum, cotton, millets and pigeon pea or rotated with cereal crops such as rice to increase soil fertility, minimize pest and disease incidence and enhance dry matter yield of main crops (Yadav et al 2006). The black gram production of India was 2.78 million tonnes from acreage of 4.63 million ha with a productivity of 600 kg per ha. India is its largest producer and consumer. Black gram production contributes to 11 per cent of India's total pulses production (Anon 2023).

India's domestic pulse production is currently inadequate, necessitating imports to meet the growing demand. This shortfall has prompted the government to prioritize pulse cultivation as part of its strategy to double farmers' income, encouraging diversification away from traditional cereal crops like wheat and rice. Despite these efforts, a significant demand-supply gap persists, with projections indicating a need for 35 million tonnes of pulses by 2030. To achieve self-sufficiency by 2050, the sector requires a consistent annual growth rate of 2.2 per cent. However, unpredictable yields and insufficient overall production are expected to widen this gap further. The resulting decline in per capita pulse availability conflicts with government policy, as pulse production often competes with the established dominance of wheat and rice cultivation (Anon 2023).

The yield of pulses can be enhanced by training farmers in scientific cultivation which can be done through cluster frontline demonstrations (CFLDs). CFLDs are conducted under the close supervision and guidance of scientists.

In the present study, CFLDs on black gram were laid by the Krishi Vigyan Kendra, Samba, Jammu and Kashmir using improved production technologies under real farm situations over locally cultivated black gram crop during kharif season of 2020, 2021 and 2022.

METHODOLOGY

The present study was carried out by Krishi Vigyan Kendra, Samba, Jammu and Kashmir in the farmers' fields under different agro-ecological conditions of district Samba. Samba is situated at an elevation of 384 m amsl at a longitude of 75.12^{o} E and latitude of 32.57^{o} N. The soil of this region is alluvial sandy loam with pH of 6.7. The soil of the region is low in organic carbon, medium in phosphorus and low in potash and is suitable for the cultivation of millets, pulses and mustard. The temperature of the district ranges from 5.2 to 44.5^{o}C. A total of 200 farmers were included in CFLDs on black gram production technology. For this purpose five Tehsils were selected purposively. For the selection of respondents, a list of farmers was prepared who laid out the CFLDs. Under the CFLDs, an area of 10, 10 and 20 ha was covered in 2020, 2021 and 2022 respectively.

Full package of practices was adopted which included improved variety, seed treatment, use of bio-fertilizers, recommended dose of fertilizers and timely irrigation and plant protection (Table 1). The crop was sown after the onset of monsoon in the month of July. The inputs for the demonstrations were provided to the farmers. The farmers were instructed to use right amount of seed and follow the recommended package of practices.

Data were collected on increase in yield, net and gross returns obtained and benefit-cost ratio in comparison to local practice of the farmers. The satisfaction level of beneficiaries was taken as to react positively or negatively towards the services rendered during CFLDs on various dimensions like technology demonstrated, training of participants, timeliness of services, provision of inputs, field visits, diagnosis and advisory services to field problems, organization of extension activities, performance of variety demonstrated and overall impact of CFLDs. The selected respondents were interviewed personally with the help of structured interview schedule. The yield data were collected from both the demonstrations and farmers' practice using random crop cutting method and analyzed. The technology gap, extension gap and technologiy index were calculated as per Samui et al (2000):

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Extension gap} = \text{Demonstration yield} - \text{Farmers' yield}$$

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

The client satisfaction index was calculated as suggested by Kumaran and Vijayaragavan (2005):

$$\text{Client satisfaction index} = \frac{\text{Individual obtained score}}{\text{Maximum possible score}}$$

RESULTS and DICUSSION

Data on yield, technology gap, extension gap and technology index of black gram cultivation are given in Table 2.

Yield

Yield was recorded 8.1, 8.9 and 9.2 q per ha in CFLDs in comparison to 5.0, 5.6 and 5.8 q per ha in farmers' practice in 2020, 2021 and 2022 respectively. Thus there was an increase of 62.0, 58.9 and 61.4 per cent in 2020, 2021 and 2022 respectively in CFLDs over farmers' practice. It shows that the performance of black gram was better when the crop was grown under integrated crop management practices including good quality seed of improved variety, recommended fertilizer doses and proper disease and pest management practices than the prevailing farmers' practice.

Table 1. Package of practices used in black gram cultivation under CFLDs and practices used by farmers

Component	Technological intervention	Farmers' practice	Gap
Land preparation	Three ploughings	Three ploughings	Nil
Variety	PU-31	Local	Full
Seed rate	20 kg/ha	40 kg/ha	Full
Seed treatment	*Trichoderma viride* 5 g/kg seed	No seed treatment	Full
Seed inoculation	*Rhizobium* culture with 20 g/kg seed	No seed inoculation	Full
Sowing method	Line sowing	Broadcasting	Full
Fertilizers used	N:P:K @ 16:90:40 kg/ha	Only FYM and small amount of DAP	Full
Weed management	Pre-emergence herbicides application of pendimethlin @ 3.3 l/ha + two mechanical weedings	No weeding	Full
Irrigation	Two irrigations at pre-flowering and one irrigation at partial pod development stage	Rainfed	Full
Plant protection	Pheromone trap @ 4/plot + bird percher (T-shaped pegs) @ 10/plot + spray of 250 l HaNPV after 10 days of second spray; spraying of neem seed kernel extract (NSKE) @ 5% at 15-days interval from pod formation stage	Application of partial dose of insecticide without knowing the name and correct dose	Partial

Table 2. Yield, technology gap, extension gap and technology index of black gram cultivation

Year	Area	Number of FLDs	Yield (q/ha)		% increase over farmers' practice	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
			CFLDs	Farmers' practice				
2020	10	50	8.1	5.0	62.0	3.4	3.1	29.5
2021	10	50	8.9	5.6	58.9	2.6	3.3	22.6
2022	20	100	9.2	5.8	61.4	2.3	3.4	20.0

Technology gap

A technology gap in agriculture refers to the discrepancy between available agricultural technologies and their actual adoption and utilization by farmers, often leading to lower yields and productivity. The data reveal that the technology gap was 3.4, 2.6 and 2.3 q per ha in 2020, 2021 and 2022 respectively over the potential yield 11.5 q per ha of black gram. The technology gap may be attributed to the dissimilarity in the soil fertility status and weather conditions in the area as well as the management by the farmers.

Extension gap

The highest extension gap of 3.1, 3.3 and 3.4 q per ha was observed in 2020, 2021 and 2022 respectively. This emphasized the need to educate the farmers through various means of improved agricultural production technologies to reverse this wide extension gap. More and more use of latest production technologies with high yielding varieties would subsequently change this alarming trend of galloping extension gap. The new technologies would eventually lead the farmers to discontinue the old technologies and to adopt new technology.

Technology index

The technology index shows the feasibility of the evolved technology at the farmers' fields. The lower the value of technology index more is the feasibility of the technology adoption (Jeengar et al 2006). The technology index of 29.5, 22.6 and 20.0 per cent was recorded in the year 2020, 2021 and 2022 respectively. It could be due to uneven and erratic rainfall and caprice of weather conditions.

Economic returns

The economics of CFLDs is presented in Table 3. The input and output prices of the commodities prevailed during the demonstrations were taken for calculating cost of cultivation, gross and net returns and benefit-cost ratio. With the adoption of improved technology under CFLDs, higher gross return (Rs 72,900, 80,100 and 87,400/ha), net return (Rs 54,900, 61,100 and 67,400/ha) and B-C ratio (1:3.0, 1:3.2 and 1:3.3) were recorded as compared to farmers' practice having the gross return of (Rs 44,000, 49,280 and 51,040/ha), net return (Rs 27,000, 31,280 and 32,540/ha) and B-C ratio of (1:1.5, 1:1.7 and 1:1.6) in 2020, 2021 and 2022 respectively. This may be attributed to higher yield obtained by adopting improved technologies.

Farmers' satisfaction level

The satisfaction level of farmers on the introduced technology was high among 62.0, medium among 49.5 and low among 28.0 per cent respondents (Table 4). The high to medium level of satisfaction indicates stronger conviction and full involvement of the beneficiaries leading to higher adoption of technology.

Reasons for low yield and constraints of black gram farmers

It was observed that optimum sowing time was not followed by the farmers due to non- availability of quality seed. Moreover, farmers raised the crop in traditional way by broadcasting without any seed treatment and inoculation. Use of inadequate and imbalanced dose of fertilizers could not result in potential yield. Lack of knowledge regarding weedicides, plant protection measures, other cultural operations and post-harvest management techniques were also factors responsible for lower yield. The constraints enumerated by the black gram growers were traditional implements and tools having poor working efficiency, lack of simple modern tools, less capability to take risk and fear to invest in costly inputs due to their poor purchase capacity.

Kumar et al (2023) reported that application of IPM module under demonstrated technology on black gram reduced 50.49 per cent larval infestation and 67.76 per cent yellow mosaic incidence. The FLD yield was 1,120 kg per ha which was better than farmers' practice (747 kg/ha). Thus the use of improved production technology for black gram contributed 24.09 per cent higher production than the farmers' practice. The average additional net return was Rs 6,758 per ha. The benefit-cost ratio under recommended practices was higher (2.88 to 3.36) as compared to

Table 3. Economics of black gram cultivation in CFLDs and farmers' practice

Year	Cost of cultivation		Gross return		Net return		B-C ratio	
	FLDs	Farmers' practice	FLDs	Farmers' practice	FLDs	Farmers' practice	FLDs	Farmers' practice
2020	18,000	17,000	72,900	44,000	54,900	27,000	3.0	1.5
2021	19,000	18,000	80,100	49,280	61,100	31,280	3.2	1.7
2022	20,000	18,500	87,400	51,040	67,400	32,540	3.3	1.6

Table 4. Farmers' satisfaction level over performance of demonstrated technology

Satisfaction level	Respondents (n = 200)	
	Frequency	Percentage
High	124	62.0
Medium	99	49.5
Low	56	28.0

Multiple responses

farmers' practice (2.51 to 3.11). The average technology gap and extension gap for three years under FLDs were 273.33 and 180 kg per ha respectively. The extension gap emphasized the need to educate the farmers through various extension programmes with more and more use of latest production technologies. The average technology index was 22.78 per cent which showed the efficacy of good performance of technical interventions. The CFLDs gave a good impact over the farming community as they were motivated for adoption of new agricultural technology applied in the CFLD plots. The productivity gains under CFLDs over existing practices created greater awareness and motivated the other farmers to adopt suitable production technology of black gram in the district.

Lal and Stanzen (2024) reported that in case of black gram in 2020-21, 2021-22 and 2022-23, the increase in yield was 63.04, 69.50 and 64.58 per cent respectively under CFLDs in comparison to farmers' practice. There was a wide yield gap between potential demonstration yield due to technology extension gap.

Sahu et al (2021) attributed the increase in yield of black gram crop under CFLDs to spreading of improved technologies. The yield of black gram in CFLDs ranged from 9.29 to 10.29 q per ha, whereas, in farmers' practice, it ranged between 4.32 to 4.5 q per ha. The per cent increase in yield with improved practices over farmers' practice was in the range of 52.85 to 52.79. The benefit-cost ratio was 2.46 to 2.52. They reported an extension gap between 5.06 and 5.79 q per ha over farmers' practice.

Sharma and Singh (2024) reported that average yield under FLDs on black gram, where improved technologies were demonstrated, was 8.1 q per ha, whereas, the yield under farmers' practice was 5.9 q per ha. A considerable 34.4 and 41.6 per cent increase in the yield in demonstrated plots was observed during 2022-23 and 2023-24 respectively over farmers' practice. Demonstrated black gram plots fetched average net return of Rs 42,350 per ha with B-C ratio of 2.9 higher in comparison to farmers' practice (Rs 24,600/ha and 2.0 respectively). The mean technology gap, extension gap and technology index were found to be 2.2 q per ha, 2.1 q per ha and 29.0 per cent respectively.

Jat et al (2017) reported that the major constraints perceived by black gram growers were lack of training institutions for training of the farmers about improved cultivation practices, non-availability of improved seeds and chemical fertilizers, lack of knowledge about *Rhizobium* culture, plant protection measures and technical advice for crop cultivation, absence of regulated market, lower prices at harvesting time etc. The constraints could be appropriately addressed and overcome by providing technical knowledge about improved black gram cultivation practices.

Vasanthakumar (2016) reported that constraints limiting productivity of black gram were non-availability of high yielding varieties, low seed replacement or varietal replacement, limited availability of labour, non-availability of quality seeds, susceptibility to pests and diseases, lack of assured procurement and price, drought or moisture stress, salinity/alkalinity and lack of life saving irrigation.

Ashokkumar et al (2018) reported that constraints encountered by black gram growers in adoption of recommended cultivation practices were shortage of the labour, high cost of inputs, lack of finance, non-availability of FYM, lack of knowledge about insect pest and disease management, fluctuation in market price, heavy risk due to failure of monsoon rains, high wages of labourers, lack of knowledge about different cultivation practices, lack of timely advisory service and non-availability seeds at right time.

CONCLUSION

The cluster frontline demonstrations conducted by Krishi Vigyan Kendra, Samba, Jammu and Kashmir effectively showcased the benefits of improved black gram cultivation practices, leading to a substantial increase in yield and economic returns for participating farmers. The adoption of improved varieties, seed treatment and integrated management strategies significantly outperformed traditional farming methods. The technology and extension gaps indicated the need for continued farmer education and enhanced extension services; the high to medium satisfaction levels among farmers highlighted the positive impact of these demonstrations. The study underscored the crucial role of KVK in bridging the gap between research and practice, ultimately contributing to increased pulse production and improved livelihoods in the region. Addressing constraints such as access to quality seeds and modern inputs will further enhance the adoption of these technologies and contribute to the overall growth of the pulse sector.

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