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Study on production potential of Blackgram var. PU-31 through front line demonstration in Bishnupur district, Manipur, India

A Tarajit Singh, Sakhen Sorokhaibam, RK Imotomba Singh, Senjam Jinus S and Thiyam Jefferson Singh

A Tarajit Singh
Krishi Vigyan Kendra, Bishnupur District, Utlou, Manipur, India

Sakhen Sorokhaibam
Krishi Vigyan Kendra, Bishnupur District, Utlou, Manipur, India

RK Imotomba Singh
Krishi Vigyan Kendra, Bishnupur District, Utlou, Manipur, India

Senjam Jinus S
School of Horticulture, Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur, Utlou, Manipur, India

Thiyam Jefferson Singh
ICAR, Research Complex for NEH Region, Manipur Centre Lamphelpat, Imphal, Manipur, India

Correspondence
A Tarajit Singh
Krishi Vigyan Kendra, Bishnupur District, Utlou, Manipur, India

Abstract
To establish the production potential of Blackgram crops, Front Line Demonstrations (FLDs) is an appropriate tool. The Participatory Seed Production of Blackgram var. PU-31 was carried out by the Krishi Vigyan Kendra, Bishnupur district, Manipur (India) in *kharif* seasons at adopted farmer's field in *Kumbi village*, Bishnupur district during 2017-18. The basic strategy of the project was to promote and extend improved technologies. The improved technologies consisting use of modern variety, seed treatment with Carbendazim 50% and Mancozeb 50% @ 2g/kg seed, *Rhizobium leguminosarum* @ 20g/kg seed, balanced fertilizer application (NPKS@20:40:20:20 kg/ha) and integrated pest management. Impact assessment recorded higher yield as well as higher economic return as compared to the farmer's local practices. The demonstration of technologies gave higher yield of 8.53qt/ha in an average with 32.12% increase in average yield over farmer's local practices. The study also registered improved technology gives higher gross return (Rs. 68240/ha.), net return (Rs. 39540/ha.) with higher benefit cost ratio (2.38:1) as compared to farmer's local practices (1.67:1).

Keywords: Production potential, blackgram var. PU-31, front line demonstration

Introduction
In Indian agriculture, pulses have great significance as they are high-protein foods (17 to 25%) as compared to cereal crops (6 to 10%) (Veeramani *et al.*, 2017) [30]. During the year 2013-14, India has achieved 19.25 million tonnes of pulse production from an area of about 25.2 million hectare (Roy *et al.*, 2017) [22]. India achieved a record 18.1 MT pulses production in 2010-11 with in Pigeon pea (3.27 MT), Chickpea (8.25 MT), Moong (1.82 MT) and urad (1.74 MT). The current productivity of pulses varied from 700-790 kg/ha. Recently, there is slight incline in pulse productivity, but it is far below the global average productivity (840 kg/ha) (Raj *et al.*, 2013) [19]. The per capita availability of protein is 28g/day which is much lower than the FAO recommended level of 80g/day (Nagy *et al.* 2013; Prasad *et al.* 2013; Saroj *et al.* 2013) [15, 27, 25]. In 2008, per capita consumption of pulses over the years has come down to 30g/day from 61g/day in 1951 (Reddy, 2009) [21]. In the North Eastern Hill Region of India pulses are also mainly grown in the uplands. In 2013-14, NE India produced 209.3 thousand tonnes of pulses from an area of 252.8 thousand hectare with an average productivity of 828 Kg/ ha. As per ICMR recommendation, the NE region of India is almost 82% deficit in pulse production against its requirements (Roy *et al.,* 2017) [22].

Black gram is a rich source of food protein containing about 24 per cent protein, which is almost three times that of cereals and other minerals and vitamins (Reddy, 2010, Anonymous, 2017) [20]. Black gram contributes to 10% of the national pulse production. The crop improves the soil fertility by fixing atmospheric nitrogen in the soil. It is reported that, black gram and green gram are reported to meet up to 50 per cent of their requirement from the N_2 fixed by them (Anon, 1972) and black gram produces 22.10 kg of N ha^{-1} which has been estimated to be supplement of 59 thousand tons of urea annually (Senaratne and Ratnasinghe, 1993) [27]. In addition, it is also used as nutritive fodder, especially for milch animals (Sathe, 1996). In Manipur, Blackgram is major food crops among the pulses (Saikia *et al.*, 2018) [23]. The Blackgram var. PU 31 is a bold seeded Yellow Mosaic Virus (YMV) tolerant blackgram variety with crop duration of 75-85 days depending on the environmental condition.

There are many factors responsible for declining the productivity of pulses is; more highlight on cereal crops e.g. wheat & rice, meagre investment on irrigation facilities (only 15% for pulses as against 80- 90% for wheat/ rice), technological absence to cope abiotic and biotic stress and weed infestation, that caused substantial maladies (30%) in standing crops, green revolution just by passed the pulses and hence the use of improved varieties for pulses was never encouraged, lack of quality seed of improved varieties, cultivation on less fertile soil, rain fed and marginal lands, imbalance use of nutrient, lack of integration of nutrient supply sources and adverse impact of weather aberrations on crops (Meena *et al.*, 2018, Rachhoya *et al.*, 2018) [10, 18]. In this regard, to sustain this production and consumption system, Front Line Demonstration (FLD) of Participatory Seed Production of Blackgram var. PU-31 was carried out by the Krishi Vigyan Kendra, Bishnupur district, Manipur (India) in *kharif* seasons at adopted farmer's field in *Kumbi* village Bishnupur district during 2017-18. The basic strategy of the study was to promote and extend improved technologies, i.e., seed, micro-nutrients, soil amendments, integrated pest management, farm machinery and implements, irrigation devices along with capacity building of farmers. This project was implemented by Krishi Vigyan Kendra, Bishnupur district district with main objective to boost the production and productivity of pulses through FLDs with latest and specific technologies.

Materials and Methods

The present study was carried out the Front Line Demonstration (FLD) of Participatory Seed Production of Blackgram var. PU-31 by the Krishi Vigyan Kendra, Bishnupur district, Manipur (India) in *kharif* seasons at adopted farmer's field in *Kumbi* village Bishnupur district during 2017-18. The study was carried out to demonstrate the production and economic benefit of adopting improved technologies through line transplanting with 25cm x 10cm spacing in each of the 20 (Twenty) adopted farmer's field covering an area of 10 ha. The improved technologies consisting use of modern variety, seed treatment with Carbendazim 50% and Mancozeb 50% @ 2g/kg seed, *Rhizobium leguminosarum* @ 20g/kg seed, balanced fertilizer application (NPKS@20:40:20:20 kg/ha) and integrated pest management. The fertilizers were given as per improved practices as basal dose. Pest and diseases management were done routinely. The crops were harvested at perfect maturity stage with suitable method. In demonstration plots, critical inputs in the form of quality seed and treatment, farm manure, balanced fertilizers and agro-chemicals were provided by KVK, Bishnupur. For the study, technology gap, extension gap and technology index were calculated as suggested by Samui *et al.*, (2000) [24].

Results and Discussion

The demonstration packages on high, low and average yield of Blackgram var. PU-31 were recorded 11.80 Qt/ha., 6.90 Qt/ha., and 8.53 Qt/ha., respectively. It was found higher than yield of local checked (5.79 Qt/ha.). The results indicated that the front line demonstrations have given a good impact over the farming community of *Kumbi*, Bishnupur district as they were motivated by the new agricultural technologies applied in the FLD plots (Table 1). This finding is in agreement with the findings of Kumar and Yadav (2007) [9], Poonia and Pithia (2010) [16]. The technology gap in the demonstration yield over potential yield (10Qt/ha.) was 1.47Qt/ha. The technological gap may be attributed to the non-uniformity in the soil fertility status and weather conditions (Mukharjee, 2003) (Table 1). Hence, variety wise location specific recommendation appears to be necessary to minimize the technology gap for yield level in different situations (Rachhoya *et al.*, 2018) [18]. The highest extension gap of 2.74Qt/ha was recorded. This emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and to adopt new technology (Table 1). This finding is in corroboration with the findings of Hiremath and Nagaraju, (2010) [4]. The technology index shows the feasibility of the evolved technology at the farmer's fields and the lower the value of technology index more is the feasibility of the technology (Jeengar, *et al*., 2006) [6]. The technology index was 14.7 percents (Table 1); it may be due to uneven agro-climatic conditions in the region (Rachhoya *et al.,* 2018) [18]. The inputs and outputs prices of commodities prevailed during the study of demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio (Table 1). The cultivation of Blackgram var. PU-31 under improved technologies gave higher net return of Rs. 39540/ha, as compared to farmers practices Rs. 18571/ha. The benefit cost ratio of Blackgram var. PU-31 under improved technologies was 2.38:1 as compared to 1.67:1 under farmer's practices. This may be due to higher yields obtained under improved technologies compared to local check (farmers practice). This finding is in agreement with the findings of Hiremath and Nagaraju (2010), Kiresur (2011), Mokidue *et al.*, (2011), Kumar (2015) [4, 7. 12. 8].

Table 1: Improved cultivation practices of blackgram var. PU-31

Crop Enterprise	Technology demonstrated	Demonstration Yield (Qt/Ha)			Yield of local Check	% increase/ change in avg. yield over local	Gross Cost (Rs/ha)/ (Rs./ unit)	Gross Return (Rs/ha) / (Rs./ unit)	Net Return (Rs/ha) / (Rs./ Unit)	B:C Ratio (GR/GC)
		H	L	A	Qt/ha)	%				
Blackgram var. PU-31	Improved cultivation practices of blackgram cultivation. Seed rate 20kg/ha, Spacing 45cm X 15 cm, Seed treatment with Carbendazim 50% and Mancozeb 50% @ 2g/kg seed, Rhizobium leguminosarum @ 20g/kg seed, NPKS@20:40:20:20 kg/ha.	11.80	6.90	8.53	5.79	32.12	28700	68240	39540	2.38:1
	Farmer's practice: Broadcasting method of sowing						27749	46320	18571	1.67:1

Conclusion

Black gram is a potential kharif pulse crop in Bishnupur district of Manipur 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 black gram cultivation in *Kumbi*, Bishnupur district of Manipur. 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 FLDs programme is a successful tool in improving the production and productivity of blackgram crops through FLDs with latest and specific technologies.

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