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Yield Performance of Black Gram (*Vigna mungo* L.) Variety (LBG-20) at Farmers' Field of Mandla District of Madhya Pradesh

H.S. Rai[1*], Sweta Rai[2] and R.S. Marabi[1]

[1]*Department of Entomology, JNKVV, College of Agriculture,*
Tikamgarh - 472 001 (M.P.), India
[2]*Medicinal Pharmaceutical Chemistry, Kashi Institute of Pharmacy, Varanasi (U.P.), India*

*Corresponding author

A B S T R A C T

A field demonstration was conducted to know the performance of black gram variety (LBG-20) at farmers' field in Mandla district, Madhya Pradesh consecutively for three *kharif* seasons 2013, 2014 and 2015. The demonstration trials of black gram were carried out in 4.8 ha area at farmer's field adjacent the farmer's practices. The results revealed that performance of black gram yield was found to be higher than farmer's practices. The yield of black gram from demonstrated module (technological interventions) was recorded with the tune of 74.05% to 100.63% over farmer's practices. The cumulative effect of the technological intervention over three years given an average yield of 1231 kg/ha which was higher 89.21% over farmer's practices. The yield attributing character of the variety *i.e.* number of pods per plant was higher (57 pods/plant) over farmer's practice (38 pods/plant). On three years average net return Rs.32667/ha was found from the recommended practice were substantially higher than farmer's practices (Rs.12560/ha). On an average Rs. 20107/ha as additional income is attributed to the technological intervention provided in demonstration plots i.e. recommended practices. The average extension gap, technology gap and technology index was recorded 579 kg/ha, 168 kg/ha and 1.20%, respectively over farmer's practices. The average B:C ratio 2.97 was found under OFT trial while it was 1.93 in farmer's practices.

Introduction

Black gram [*Vigna mungo* (L.) Hepper] is one of the most important legume crops of India. Being a pulse it has vital role in nutritional security and major sources of vegetable proteins in Indian diet. India is the world's largest producer of pulses imports a large quantity of pulses to meet out the growing domestic needs. It contains about 20% protein, which is almost three times higher than cereals, other minerals and vitamins. The demand of pulses particularly black gram is supplied across the world due to its higher consumption where animal proteins are insufficient and comparatively expensive (Ofuya and Akhidue, 2005). It is resistant to adverse climatic conditions and improves the

soil fertility by fixing atmospheric nitrogen in soil and contribute in crop produce equivalent to 22.10 kg of N/ha. In Madhya Pradesh, the black gram is cultivated in 1788.80 thousand ha area and production of 1744.35 thousand MT with the productivity of 975 kg/ha whereas, in Mandla district, it is cultivated in 2 thousand ha area and production of 1.44 thousand MT with the productivity of 718 kg/ha (Anonymous, 2019). Since last few years the average production and productivity has declined due to attack of insect pests, diseases and drastically changes of climatic conditions. Soil and climatic conditions play an important role in crop rotation, mixed and inter-cropping, leading soil fertility via nitrogen fixation, release of soil-bound phosphorus ultimately contribute significantly to sustainability of the farming systems. It is therefore, necessary to assess the technological intervention gaps in production and also to know the problems and constraints in adopting improved variety of black gram production technologies (Islam *et al.,* 2011 and Kumar *et al.,* 2014). Availability of quality seed of improved varieties and other inputs is one of the major constraints in increasing the production of legume crops. In this context, Krishi Vigyan Kendra is a grass root level organization meant for catering application of technology through demonstrations (cluster front line demonstration and on farm testing), training schools, yield assessment, refinements and dissemination of proven technologies under different micro farming situation in the district levels (Dubey *et al.,* 2010).

Though, huge numbers of resistant / tolerant varieties of black gram have been developed by researchers but dissemination of such varieties at farmers' field level is experienced very scanty. This is due to the lack of knowledge and awareness in the farmers and gap of new transfer technology, motivational trainings through field demonstrations to build up reliance towards the changing their

cropping system. The technology adoption and awareness regarding black gram cultivation, adoption of new practices must be improved to lessen the gaps in the farmer's practices. Certainly, field level demonstrations of new crop varieties is planned to demonstrate their high yield potential at farmers field. Eventually, it will enhance requirement for quality seed of new seed varieties ultimately towards the adaptation and maximization of black gram production. Thus, keeping the above facts in mind the present study was conducted to study the performance of black gram variety at farmer's field level and gap analysis of variety production through on farm testing (OFT) to establish potential production for getting good economic returns.

Materials and Methods

A field demonstration was conducted to know the performance of black gram variety (LBG-20) at farmers' field in Mandla district, Madhya Pradesh consecutively during three *kharif* seasons 2013, 2014 and 2015. The demonstration trials of black gram were carried out in 4.8 ha area at farmer's field adjacent the farmer's practices. The soil condition of demonstration area was light soil having medium to high fertility status. The demonstration module technology includes improved variety of black gram (LBG-20), seed treatment with Thirum + Bavistin @ 2.5g/kg seed and *Trichoderma virdae* @ 10g/kg of seed, inoculation of microbial organism *Rhizobium* + phosphorus solubilizing bacteria (PSB) @ 20 gm/kg seed, weed management (one hand weeding at 25-30 DAS), seed rate (20 kg/ha) and line sowing method. The spacing between rows and plants was maintained with 30 x 10 cm in OFT's (Table 1). In plant protection measures, one spray of Quinalphos 25 EC @1.5 liter/ha with 500 liter of water was applied against the incidence of leaf defoliator insect pests and proper agronomical practices were maintain

under demonstrated plots. The treatments comprised of recommended package of practices *viz;* integrated nutrient management 20:40:20 NPK kg/ha was given based on soil testing reports. Other hand, the farmer's practices were included with local seed having higher seed rate (25 kg/ha), broad casting and one hand weeding at 35-40 DAS. The formers neither adopted any seed treatment method with fungicides and biofertilizers nor applied any fertilizer and plant protection measures. The black gram seed was sown between the periods of 15th July to 20th July. The harvesting of crops was done manually at maturity stage and yield data was obtained from demonstrations and farmer's practices for statistical analysis. The production parameters *viz;* extension gap, technology gap, technology index, yield index, increase yield (%), benefit cost ratio between demonstrated and existing farmer's practices was computed as described by Samui *et al.,* (2000).

Extension gap = Demonstrated yield – Yield under existing practice

Technology gap = Potential yield– Demonstrated yield

Increase yield (%) =

$$\frac{\text{Demonstration yield} - \text{Farmers yield}}{\text{Potential yield}} \times 100$$

Technology index =

$$\frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

Yield index =

$$\frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}}$$

$$\text{Benefit cost Ratio} = \frac{\text{Grass return}}{\text{Grass cost}}$$

Results and Discussion

Performance of black gram yield

The yield performances of economic indicators are presented in Table 2. The data revealed that yield of all demonstrated plots of black gram was found to be higher due to high yielding variety (LBG-20) and recommended practices than that of farmer's practices during three consecutive years in *kharif* seasons 2013, 2014 and 2015. The average yield of black gram under demonstration was recorded 1187, 1239 and 1268 kg/ha during 2013, 2014 and 2015, respectively. Other hand, in farmer's practice plots, the average yield was 682, 643 and 632 kg/ha during 2013, 2014 and 2015, respectively which was comparatively very less than demonstrated module. However, the obtained seed yield of demonstration trials was quite low as compared to potential yield of black gram variety (LBG-20) which may be caused due to some unavoidable losses. The present finding is corroborated with the findings of Mahalingam *et al.,* (2018), Dubey *et al.,* (2010) and Poonia and Pithia (2011).

The yield enhancement due to technological intervention was higher which ranged from 74.05% to 100.63% over farmer's practices. The cumulative effect of the technological intervention over three years revealed on an average yield of 1231 kg/ha which was 89.21% higher over farmer's practices. The yield attributing characters of the variety like number of pods per plant was higher (57 pods /plant) over FP (38 pods /plant). The similar findings were accordance with the findings of Dubey *et al.,* (2010), as they also reported that depending on demonstration, use of farming situation and specific intervention may have

greater impact in enhancing productivity. Yield enhancement in different crops in OFT's has also been documented by Tomar *et al.,* (2003).

Extension gap

The results revealed that extension gap was 505, 596 and 636 kg/ha recorded during the year 2013, 2014 and 2015, respectively between demonstrations of on farm testing (OFT) and existing farmer's practices (Table 2). The average extension gap was recorded

579 kg/ha between demonstrations of on farm testing (OFT) and farmer's practices. Present findings are the conformity with the findings of Dhaka *et al.,* (2010), Bairwa *et al.,* (2013) Kothyari *et al.,* (2018) and Mahalingam *et al.,* (2018). Apparently, the extension gap is considered as main constraint which should be minimized by adopting some new technological interventions through demonstrations at farmer's field to change their mind set towards the acceptance of high yielding crop varieties and innovative agricultural technologies.

Table.1 Gap analysis between demonstration practices and farmer's practices

S. No.	Practices	Demonstration practice	Farmer's practice	Gap
1.	Land preparation	Two ploughing	Two ploughing	No gap
2.	Variety	LBG-20	Local seed	Full gap
3.	Seed rate (kg/ha)	20 kg/ha	25-30 kg/ha	Higher seed rate
4.	Seed treatment	Thirum+Bavistin 2:1 @ 2.5 g/kg seed and *Trichoderma virdae* @10g/kg of seed	No seed treatment	Full gap
5.	Sowing method and spacing	Line sowing (30 x 10 cm)	No line sowing (Broad casting)	Full gap
6.	Manures and Fertilizers	20 :40:20 NPK kg/ha	No use of fertilizer (Negligible)	Full gap
7.	Weed management	One hand weeding at 25-30 DAS	One hand weeding at 35-40 DAS	Partial gap
8.	Plant protection measure	Need based plant protection measures	No plant protection measures	Full gap

Table.2 Productivity, extension gap, technology gap and technology index of black gram as grown under OFT'S and existing farmer's practices

Year	Area (ha)	No. of OFT's	Variety	Average yield (kg/ha)			Increase yield over F.P. (%)	Extension gap (kg/ha)	Tech. gap (kg/ha)	Tech. Index (%)
				Potential	Demo.	Farmers				
2013-14	4.8	12	LBG-20	1400	1187	682	74.05	505	213	1.52
2014-15	4.8	12	LBG-20	1400	1239	643	92.69	596	161	1.15
2015-16	4.8	12	LBG-20	1400	1268	632	100.63	636	132	0.94
Total	14.4	36	-	-	3694	1957	267.37	1737	506	3.61
Mean	4.8	12	-	-	1231	652	89.12	579	168	1.20

Table.3 Profitability of balck gram grown under on farm testing (OFT's) and existing farmer's practices

Year	Average cost of cultivation (Rs./ha)		Average gross return (Rs./ha)		Average net return (Rs./ha)		B:C Ratio	
	OFT's	Farmers practice	OFT's	Farmers practice	OFT's	Farmers practice	OFT's	Farmers practice
2013-14	16348	13360	47480	27280	31132	13920	2.90	2.04
2014-15	16680	13480	49560	25720	32880	12240	2.97	1.90
2015-16	16730	13759	50720	25280	33990	11521	3.03	1.84
Total	49758	40599	147760	78280	98002	37681	8.90	5.78
Average	16586	13533	49253	26093	32667	12560	2.97	1.93

Yield gap and technology index

The yield gap in the demonstration of black gram (LBG-20) yield over farmer's yield was recorded maximum during the year 2015 (636 kg/ha) followed 2014 (596 kg/ha) and 2013 (505 kg/ha) (Table 2). The observed technological gap may be attributed dissimilarity in soil status, rainfall distribution, infestation of insect pests and disease as well as the change in the locations of demonstrated plots in every year. The technology gap in the black gram (LBG-20) demonstration yield over potential yield was recorded maximum (213 kg/ha) during *kharif* 2013, followed by 2014 (161 kg/ha) and 2015 (132 kg/ha). Further, it is revealed that the technology index 1.52, 1.15 and 0.94 percent was found during the year of 2013, 2014 and 2015, respectively. The lower value of technology index expressed about the more plausible feasibility of the black gram variety (LBG-20) at the farmer's field. The results revealed that the extension and technology gaps are existed between transfer technology and technology adoption at existing farmer's field. The present findings are in accordance with the findings of Thakral and Bhatnagar (2002), Dhaka *et al.,* (2010), Bairwa *et al.,* (2013), Kumar *et al.,* (2014) and Ganga Devi *et al.,* (2017).

Evaluation of economic return

The economic indicators in term of cost of cultivation, gross returns, net returns and benefit cost ratio of demonstration and existing farmer's practices is given in Table 3. The data clearly depicted that the net return from the recommended practices was substantially higher than farmer's practices. The average cost of cultivation from recommended practice was found to be Rs. 16586/ha as compared to farmers practices *i.e.* Rs.13533/ha. Although, the cost of cultivation of OFT's was higher than that of farmer's practices but the average net return

was obtained higher due to undertaken all recommended practices. On an average Rs. 20107/ha as additional income is attributed to the technological intervention provided in demonstrated module *i.e.* recommended package practices. Average net returns from recommended practices was found to be Rs. 32667/ha as compared to farmer's practices *i.e.* Rs.12560/ha. The average B:C ratio 2.97 was found under OFT's whereas, 1.93 in farmer's practices. The similar findings were also obtained by Bairwa *et al.,* (2013), Ganga Devi *et al.,* (2017) and Jain *et al.,* (2020). The present study is concluded that the yield response and economic returns of improved variety of black gram (LBG-20) was found to be higher than farmer's practices due to following the recommended package of practices.

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