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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 3806-3809

www.thepharmajournal.com
Received: 09-12-2022
Accepted: 13-01-2023

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Study on productivity and profitability of blackgram var. TBG-104 through cluster front line demonstration under rainfed conditions of Prakasam district, Andhra Pradesh

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Abstract

To establish the production potential of Blackgram crops, Cluster Front Line Demonstrations (CFLDs) is an appropriate tool. The Participatory Seed Production of Blackgram var. TBG-104 was carried out by the Krishi Vigyan Kensra, Darsi, Prakasam district Andhra Pradesh in *rabi* seasons at farmer's field in *Prakasam* district during 2018-19 to 2020-21. The basic strategy of the project was to promote and extend improved technologies. The improved technologies consisting use of modern variety, seed treatment with Imidacloprid 600 FS @ 5 ml/kg seed, *Rhizobium leguminosarum* @ 5 ml/kg seed, balanced fertilizer application (NPKS @ 20:40:0:20 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 17.50 q/ha in an average with 27.27 % increase in average yield over farmer's local practices. The study also registered improved technology gives higher gross return (Rs. 1,01,125/ha.), net return (Rs. 61358/ha.) with higher benefit cost ratio (2.54:1) as compared to farmer's local practices (2.05:1).

Keywords: Productivity, economics, blackgram var. TBG-104, front line demonstration

Introduction

Pulses on account of their vital role in nutritional security and major sources of vegetable proteins. India is the world's largest producer of pulses, it imports a large amount of pulses to meet the growing domestic needs. Thus, India is the largest importer, producer and consumer of pulses. India has to produce not only enough pulses but also remain competitive to protect the indigenous pulse production. Blackgram (Vigna mungo) contain 22-24% protein, which is almost twice the protein in wheat and thrice that of rice. Pulses provide significant nutritional and health benefits, and are known to reduce several non communicable diseases such as colon cancer and cardiovascular diseases (Jukanti *et al*., 2012) [7]. Protein-energy malnutrition as well as micronutrient deficiencies can be addressed by increasing the consumption of pulses which are a rich source of proteins, minerals, iron and fibre. Net daily pulses availability for Indians has increased slightly from 32g per capita in 2000 to 37g per capita in 2009. In order for India to meet the 40 grams per day per capita requirement of pulses, attention has to be paid to both production and consumption. Thus, a large part of their protein requirement could be met by pulses. Food security stands on the three pillars of availability, access and absorption (nutrition). Pulses availability has also increased 7-8.33 per cent slowly in account of food grain. Availability of pulses has increased in the past decade with the increasing emphasis on development of improved varieties and supportive policies (Source: Directorate of Economics and Statistics, 2016). It produces about 1.5–1.9 mt of black gram annually from about 3.5 m ha of area, with an average productivity of 600 kg ha^{-1}. Black gram output accounts for about 10 per cent of India's total pulse production. However, productivity is low due to lack of awareness in farming community regarding improved package and practices of pulse crops. Frontline demonstrations are important dissemination process for transfer of technology and to establish its production potentials on the farmer's field. Pulses can be grown on range of soil and climatic conditions and play important role in crop rotation, mixed and inter-cropping, maintaining soil fertility through nitrogen fixation, release of soil bound phosphorus, and thus contribute significantly to sustainability of the farming systems. It is therefore, necessary to assess the technological gap in production and also to know the problems and constraints in adopting modern blackgram production technologies Islam *et al*.,

(2011) [6] and Kumar *et al.*, (2014) [8]. Production of major pulses is constrained by both biotic and abiotic stresses. For example, pod borers (Helicoverpa armigera), fusarium wilt, root rots, ascochyta blight and botrytis gray mold are some of the major biotic constraints to increasing the productivity of chickpea. The major constraints to productivity in pigeonpea are biotic stresses such as pod borer, pod fly, Fusarium wilt, and sterility mosaic disease. The richness of legumes in N and P, makes them attractive for insect pests and diseases (Sinclair and Vadez, 2012) [9]. Availability of quality seed of improved varieties and other inputs is one of the major constraints in increasing the production of grain legumes (David *et al.*, 2002) [2]. Black gram is an important pulse crop grown during the month of October in almost area of Prakasam district. The productivity is very poor (500-600 kg/ha). The poor yield of black gram is mainly attributed to the use of poor quality seeds, poor germination of seeds, water stress at flowering stage, no fertilizer application, no YMV management and no weed management. The black gram crop has more importance in adverse soil and topographic area in rainfed conditions. The reason of low productivity may be attributed to non-adoption of improved production technology which includes the agronomic practices and socioeconomic conditions of the peoples. The productivity of black gram in the district can be increase by fallowing the appropriate agronomic practices along with high yielding black gram varieties. Farmers are growing local seeds; no seed treatment, no weed management practices adopted, severe incidence of YMV, no nutrient management etc are the basic reasons of low productivity of black gram in the district. Keeping this in view, an effort made by the DAATTC to study the awareness level of farmer's regarding blackgram cultivation, extent of adoption of improved practices, to find out the yield gap in black gram production through front line demonstration on farmers field during three consecutive years of *rabi* seasons from 2018-19 to 2020-21.

Materials and Methods

The present study was carried out the Cluster Front Line Demonstration (CFLD) of blackgram var. TBG-104 by the Krishi Vigyan Kendra, Darsi, Prakasam district Andhra Pradesh at farmers' field to assess the performance of blackgram variety TBG-104 during *rabi* seasons of the year 2018-19 to 2020-21 in different villages viz., Obannapalem, Thimithapadu, Bollapalli, Ammanabrolu and Dronadula of Prakasam districtvillage under rainfed conditions. The area under each demonstration was 0.4 ha. The soil was black loam in texture with high water holding capacity, low to medium in organic carbon (0.04-0.052%), low in available nitrogen (150.7 kg/ha), medium in available phosphorus (15.6 kg/ha), low to medium in available potassium (220 kg/ha) and soil pH was slightly alkaline in reaction (8.1). The study was carried out to demonstrate the production and economic benefit of adopting improved technologies through line transplanting with 22.5 cm x 10cm spacing in each of the 5 adopted farmer's field covering an area of 8 ha. The treatment comprised of improved technologies *vs* farmers practice. The improved technologies consisting use of modern variety, seed treatment with imidacloprid 600 FS @ 5 ml/kg seed, *Rhizobium leguminosarum* @ 5 ml/kg seed, balanced fertilizer application (N P K @ 20:50:0 kg/ha) and integrated pest management. An entire dose of N and P_2O_5 were given as basal through Urea, Single Super Phosphate (SSP) respectively. Farmer's practice constituted growing with LBG-752, which is local cultivated variety with higher seed rate (25-30 kg/ha), line sowing, no seed treatment, no biofertilizer inoculation, no proper weed management practices adopted etc. Before conduct the demonstration training to farmers of respective villages was imparted with respect to envisaged technological interventions. Yield data was collected from farmers practice and demonstration plots; cost of cultivation, net income and benefit cost ratio were analyzed. For the study, technology gap, extension gap and technology index were calculated as suggested by Samui *et al.*, (2000) [10].

$$\text{Percent increase yield} = \frac{\text{Demonstration yield} - \text{Farmers yield}}{\text{Farmers yield}} \times 100$$

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield-farmer's practice yield

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \times 100$$

Grain yield

The yield performance and economic indicators are presented in Table 2. The data revealed that under demonstration plot, the performance of black gram yield was found to be higher than that under FP during three consecutive years of demonstrations (2018-19 to 2020-21). The yield of black gram under demonstration recorded was 18.75, 16.25 and 17.50 q/ha during 2018-19 to 2020-21, respectively. The yield enhancement due to technological intervention was to the tune of 16.5 % to 44 % over FP. The cumulative effect of the technological intervention over three years, revealed on average yield of 17.50 q/ha, 27.27 % higher over FP. The year to year fluctuations in yield and cost of cultivation can be explained on the basis of variations in prevailing social, economical and prevailing microclimatic condition. The above findings were accordance with Dubey *et al.*, (2010) [4]. Gurumukhi and Mishra (2003) [5] have also reported that depending on identification and use of farming situation, specific intervention may have greater implications in enhancing systems productivity. Yield enhancement in different crops in front line demonstration has amply been documented by Tiwari *et al.*, (2003) [11] and Tomar *et al.*, (2003) [12].

Technology Gap

The technology gap means the differences between potential yield and yield of demonstration plot. The technology gap of demonstration plots were 6.25,8.75 and 7.50 q/ha during 2018-19 to 2020-21 (Table-2), respectively. On an average technology gap under three year FLD programme was 7.52 q/ha. The technology gap observed may be attributed to dissimilarity in the soil fertility status, crop production, protection practices and local climatic situation. Hence, variety wise location specific recommendation appears to be necessary to minimize the technology gap for yield level in different situations.

Extension Gap

Extension gap means the differences between demonstration plot yield and farmers yield. Extension gap of 5.75, 2.50 and 3.00 q/ha was noticed during 2018-19 to 2020-21 (Table-2), respectively. On an average extension gap under three year CFLD programme was 3.75 q/ha which emphasized the need to educate the farmers through various extension programs i.e. front line demonstration for adoption of improved production and protection technologies, to revert the trend of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap.

Technology Index

Technology Index indicates the feasibility of the evolved technology in the farmers' fields. Lower the value of technology index, higher is the feasibility of the improved technology. The technology index varied from 25.00 to 35.00 per cent (Table-2). On an average technology index was observed 30.00 per cent during the three years of FLD programme, which shows the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of black gram.

Economics

Economic indicators i.e. cost cultivation, gross returns, net returns and B: C ratio of front line demonstration is presented in Table 3. The data clearly revealed that the net return from the recommended practice were substantially higher than FP plot during 2018-19 to 2020-21 (three consecutive years of demonstration). Average net returns from recommended practice were observed to be Rs. 61358 /ha in comparison to FP plot i.e. Rs 40658/ha. On an average Rs. 20700/ha as additional income is attributed to the technological intervention provided in demonstration plots i.e. recommended practices. Economic analysis of the yield performance revealed that benefit cost ratio of demonstration plots were observed higher than FP plots. The benefit cost ratio of demonstration and FP plots were 2.80, 2.15, 2.70 and 2.00, 1.87, 2.31 during 2018-19, 2020-21 respectively. Hence favorable benefit cost ratios proved the economic viability of the intervention made under demonstration and convinced the farmers on the utility of intervention. The data clearly revealed that the maximum increase in yield and benefit cost ratio observed was 187.5 and 2.80, respectively during 2018-19. The variation in benefit cost ratio during all the years may mainly on account of yield performance and input output cost in that particular years. The higher net returns and B: C ratio in black gram demonstration might be due to the higher grain yield and better pricing of the produce in the market. These results in accordance with the findings of Gurumukhi and Mishra (2003) [5] and Dhaka *et al.*, (2010) [3]. Recommended practice (FLD's) proved beneficial in respect of yield and economics of blackgram in Prakasam District.

Table 1: Comparison between demonstration packages and existing practice under blackgram FLDs

S. No.		Chickpea	
	Particulars	**Demonstration package**	**Farmers practice**
1.	Farming situation	Rainfed	Rainfed
2.	Variety	TBG-104	LBG-752
3.	Time of sowing	First week of October	First week of October
4.	Method of sowing	Line sowing	Line sowing
5.	Seed treatment	Imidacloprid 600 FS @ 5 ml/kg seed	Not adopting
6.	Fertilizer dose	20:50:0 kg N:P:K ha-1 + Sulphur @ 20 kg/ha (N in form Urea and P inform of SSP)	Farmers are using DAP only
7.	Biofertilizers application	Seed inoculation with Rhizobium 5 g and soil application of biofertilizer consortium @ 12.5 kg ha^{-1} at time of sowing	Not adopting
8.	Weed management	Pre-emergence application of Pendimethalin @ 1.5 lit ha^{-1} at 2 DAS	Manual weeding
9.	Plant protection	Need based application	Non judicious use of pesticides

Table 2: Seed yield, technology gap, extension gap, technology index and B: C ratio of chickpea under FLD

Year	Seed yield (q/ha)			% increase over control	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)	B:C ratio	
	Potential	Demo	Control					Demo	Check
2018-19	25.0	18.75	13.00	44.23	6.25	5.75	25.00	2.80	2.00
2019-20	25.0	16.25	13.75	18.18	8.75	2.50	35.00	2.15	1.87
2020-21	25.0	17.50	14.50	16.50	7.50	3.00	30.00	2.70	2.32
Mean	25.0	17.50	13.75	27.27	7.50	3.75	30.00	2.54	2.05

Table 3: Economic analysis of the frontline demonstrations on blackgram

Year	Cost of cultivation cost (Rs.ha-1)		Gross returns (Rs.ha-1)		Net return (Rs.ha-1)		Additional return (Rs.ha-1) FLD's	B:C ratio	
	Recommended Practice (RP)	Farmer's Practice (FP)	Recommended Practice (RP)	Farmer's Practice (FP)	Recommended Practice (RP)	Farmer's Practice (FP)		Recommended Practice (RP)	Farmer's Practice (FP)
2018-19	40200	39000	112500	78000	72300	39000	33300	2.80	2.00
2019-20	41500	40500	89375	75625	47875	35125	12750	2.15	1.87
2020-21	37600	36250	101500	84100	63900	47850	16050	2.70	2.32
Mean	39766	38583	101125	79241	61358	40658	20700	2.54	2.05

Conclusion
Black gram is a potential rabi pulse crop in Prakasam district of Andhra Pradesh 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 Prakasam district of Andhra Pradesh. 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 crops through CFLDs with latest and specific technologies.

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