Influence of various plant spacing configurations on Blackgram cultivars' productivity and profitability (*Vigna mungo* (L.) Hepper]

Abstract

A field investigation entitled as Evaluation of blackgram varieties (*Vigna mungo* (L.) Hepper) under different plant Spacings.was conducted at Department of Agronomy, College of Agriculture, Badnapur. The experimental field was levelled and well drained. The soil was clay loam in texture, low in available nitrogen, medium in available phosphorus, very high in available potassium and alkaline in reaction. The environmental conditions were moderately congenial for normal growth and maturity of blackgram crop. The experiment was laid out in a Factorial Split plot Design with and four different spacings, three different varieties which comprised twelve treatment combinations. Each experimental unit was repeated three times 5.4 m x 5.0 m size in gross plot and it was of 4.5 m x 4.6 m size in net plot. Sowing was done on 14th July, 2015 with three varieties BDU-1, TAU-1 and AKU-15. Sowing was done by dibbling method with different spacings of 30 cm x 10 cm, 30 cm x 20 cm, 45 cm x 10 cm and 45 cm x 20 cm. The RDF was applied before sowing. The recommended cultural practices and plant protection measures were under taken as per recommendation. Among différent varities of blackgram, BDU-1 (V_1) produced significantly higher yield attributting characters and economics such as number of pods per plant, number of seeds per pod, pod length, pod weight per plant, seed yield per plant, test weight (1000 seed weight g), harvest index and Gross Monetary Returns (Rsha^{-1}), Net Monetary Returns (Rsha^{-1}), and Benefit: Cost (B : C) ratio. The interaction effects of varieties x spacings were foundto be non-significant.

***Keywords*:** Plant Spacing, Blackgram, Varieties, Growth, Yield and Economics.

Introduction

Pulses are important component of food grain crops because of their high nutritive value (Protein content ranging from 17 to 27 %) and adaptability to wide range of agro ecological and management variable. Being a leguminous crop, they fix utilize and atmospheric nitrogen and improve the fertility of soil and therefore fit well in crop rotation and cropping systems. The production of pulses is far below the requirement to meet even the minimum level of per capita consumption. The per capita availability of pulses is 45 g/day as

against FAO/ WHO recommended level of 104 g /capita/ day. Thus, it is a big challenge for the agricultural scientists to meet the pulse requirement of teeming population of the country. Among pulses, black gram (*Vigna mungo* (L.) *Hepper*) is one of the most important crops grown in India. It is consumed in the form of 'dal' (whole or split or unhusked) or parched. It is chief constituent of 'papad'. It is used as nutritive fodder specially for milch cattle and also used as green manuring crop. It adds 42 kg N/ha in soil. It posses deep root system which binds soil particles and thus, prevent erosion. Black gram contain about 24 per cent protein, 60 per cent carbohydrate, 10.9 per cent moisture, 1.4 per cent fat, 0.9 per cent fiber, 3.2 per cent minerals and vitamin viz. calcium -154 mg, phosphorus -385mg, iron-9.1mg and small amount of vitamin B complex. The delay in planting of black gram results conspious reduction in seed yield parameters that is grain yield per ha^{-1}, number of pods per plant and seed quality parameters i.e 1000 grain weight.

The productivity of black gram in Maharashtra is very low (299 kg ha^{-1}). The low productivity is due to day by day decreasing in yielding ability and non use of improved varieties and proper spacing. To realize the maximum yield potential of black gram grown during summer and rainy season, maintenance of optimum space made available to individual plant is of prime importance. A compromising balance between the variables of row and plant spacing has to be worked out to get desired spacing. The spacing requirement depends upon the growth behaviour of genotype. So it is required to maintain spacing and variety for higher yield.

Keeping all these factors in mind, the present experiment was conducted during 2015 to study the adequate plant spacing and to find out an appropriate variety of blackgram under rainfed condition.

Material and Methods

The aim of present experiment was to find out suitable plant spacing for blackgram varieties, to study the performance of blackgram varieties under different plant spacing and to study the interaction effect of plant spacing and varieties of blackgram.

The gross and net plot size of the experiment was 5.4 m x 5.0 m and 4.5 m x 4.6 m, respectively. Sowing was done by adopting dibbling method on 14th July 2015 respectively at a spacing S_1-30 cm x 10 cm, S_2-30 cm x 20 cm, S_3- 45 cm x 10 cm and S_4- 45 cm x 20 cm and the varieties used were, V_1 - BDU-1, V_2 - TAU-1 and V_3 - AKU-15. The recommended dose of fertilizer (RDF) 25:50:00 NPK kg ha^{-1} were applied at the time of sowing.

To evaluate the treatment effect, the various growth observations were recorded in the experiment from 15 DAS up to the harvest at an interval of 15 days, while the observations on yield attributing characters and post-harvest studies were recorded at respective stages. The crop was harvested at the maturity stage on 04th October 2015.

Result and Discussion

The beneficial effect due to different plant spacing on number of pods per plant, number of seeds per pod, pod length, pod weight per plant, seed yield per plant, test weight (1000 seed weight g), harvest index and Gross Monetary Returns (Rs ha^{-1}), Net Monetary Returns (Rs ha^{-1}), and Benefit: Cost (B:C) ratiowere evident during active growth and maturity. The spacing of 30 cm x10 cm proved superior in increasing the number of pods plant$^{-1,}$ seed yield plant^{-1} than other spacings (Table 1) Considerable variation in number of pods per plant was recorded due to different spacings. The spacing of 30 cm x 10 cm recorded higher number of pods plant^{-1} and seed yield plant^{-1}. These results fall in line with those obtained by Singh A. *et al.,* (1990), Sudhansu Singh and D.S. Yadav (1994), Singh *et al.* (2006) and Veeramani P. (2019). The test weight was found to be not influenced by different spacings. This might be due to test weight being a genetically controlled factor and it is least influenced by agronomic practices of spacing. Pod formation started at 45 DAS (Table 1), continued up to 60 DAS, and development of pod was continued up to maturity. The variety BDU-1 (V_1) produced significantly more number of pods plant^{-1} over variety TAU-1(V_2). The varieties TAU-1 (V_2) and AKU-15 (V_3) was found non-significant in production of number of pods plant^{-1}. Similar trends were reported by Aher *et al. (*2006) and Veeramani P. (2019).

The seed and straw yield ha^{-1} was influenced significantly due to spacing (Table 2). The spacing of 30 cm x 10 cm produced higher seed yield of 688 kg ha^{-1} and it was superior over 45 cm x 10 cm, 30 cm x 20 cm and 45 cm x 20 cm. The grain yield plant^{-1} and other yield attributes were higher at closer row spacing and wide plant spacing. The reduction in grain yield ha^{-1} at wider spacing was probably due to the fact that grain yield plant^{-1} did not increase proportionately to the available area plant^{-1}. The plant spacing 30 cm x 10 cm recorded improvement in different growth and yield contributing characters. The optimum number of plant per unit area in spacing of 30 cm x 10 cm might have contributed towards higher seed yield ha^{-1}. This might be due to the various plant spacing. There was less crowding and less competition among the plant or vice versa. Similar results were reported by Subbaiah (1978), Reddy and Singh (1981), Rasker (1984) and Singh and Singh

(1990),Guriqbal (2014) and Ganvit *et al* (2022).The performance of variety BDU-1 as regard to yield attributing characters viz. number of pods per plant, number of seeds per pod, pod weight per plant, seed yield per plant and test weight (Table 1) was superior as compared to TAU-1 and AKU-15. The probable reason for this may be the genetic makeup of the variety that has helped in improving the photosynthetic activity due to increased source capacity and efficient translocation of photosynthesis to the sink (Seed). Similarly Yadahalli *et al.* (2006), Massey (2006), Guriqbal (2014) and Ganvit *et al* (2022) also observed improvement in black gram varieties having different genetic makeup.

The spacing of 30 cm x 10 cm recorded higher biological yield and it was significantly superior over spacing of 45 cm x 10 cm (S_3), 30 cm x 20 cm (S_2) and 45 cm x 20 cm (S_4) (Table 2). The increased biological yield in 30 cm x 10 cm was reported by Saibabu and Garg (1988) and Dewangan *et al.* (1993). Black gram variety BDU-1 produced biological yield of 1962 kg ha^{-1} which was higher over TAU-1 (1731 kg ha^{-1}) and AKU-15 (1391 kg ha^{-1}). The higher biological yield of BDU-1 as compared to TAU-1and AKU-15 might be due to accumulation of more dry matter and higher biomass potential. These findings are in conformity with the finding of Ganvit *et al* (2022) and Pandey, A. and Singh, R. (2022).

The harvest index (Table 2) was influenced due to spacing. The spacing of 30 cm x 10 cm recorded higher value of harvest index than spacing of 45 cm x 10 cm (S_3) 30 cm x 20 cm (S_2) and 45 cm x 20 cm (S_4) .The result is similar with Chauhan *et al.* (1991). And Rasul *et al.* (2012). Blackgram varieties differed significantly in harvest index (Table-2). The variety BDU-1 (V_1) recorded higher harvest index as compared to rest of the varieties, which might be due to its higher production efficiency. Similar trend was observed by Rasul *et al.*, (2012) and Ganvit *et al* (2022).

The spacing of 30 x 10 cm (S_1) recorded higher values of Gross Monetary Return, Net Monetary Return and B : C ratio than spacing of 45 cm x 10 cm (S_3), 30 cm x 20 cm (S_2) and 45 cm x 20 cm (S_4). Black gram variety BDU-1 recorded higher values of Gross Monetary Returns, Net Monetary Returns and B: C ratio as compared to rest of the varieties. Similar result was recorded with Ganvit *et al* (2022) and Pandey, A. and Singh, R. (2022).

The interaction effects were not influenced significantly in case of growth, yield and yield attributes.

Table 1: Mean number of pods per plant, number of seeds per pod, pod length, pod weight per plant, seed yield per plant and test weight (1000 seed weight g) as influenced by various treatments.

Treatments	No. of pods plant^{-1}	No. of seed pod^{-1}	Pod length (cm)	Pod weight (g)	Seed yield plant^{-1} (g)	Test weight (g)
A. Main Plots (Spacings (S))						
S_1 - (30 cm x 10 cm)	19.37	7.0	5.86	6.35	5.38	41.57
S_2 - (30 cm x 20 cm)	13.69	5.85	5.03	3.69	2.73	40.28
S_3 - (45 cm x 10 cm)	17.59	6.42	5.37	5.30	4.42	41.05
S_4 - (45 cm x 20 cm)	12.33	5.34	4.31	3.03	2.66	39.34
SE ±	0.36	0.25	0.19	0.21	0.11	1.24
CD at 5%	1.10	0.76	0.57	0.64	0.33	3.71
B. Sub Plots (Varieties (V))						
V_1 - (BDU-1)	16.96	6.93	5.51	5.01	4.24	41.38
V_2- (TAU-1)	15.17	6.00	5.02	4.81	3.95	40.31
V_3 - (AKU-15)	15.11	5.53	4.89	3.96	3.20	39.98
SE ±	0.45	0.17	0.13	0.14	0.14	1.76
CD at 5%	1.37	0.52	0.39	0.42	0.42	5.29
Interaction (A x B)						
SE ±	0.91	0.35	0.26	0.28	0.28	3.53
CD at 5%	NS	NS	NS	NS	NS	NS
General Mean	**15.75**	**6.15**	**5.14**	**4.59**	**3.80**	**40.56**

Table 2: Mean yieldand economics as influenced by various treatments.

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)	Gross Monetary Return (Rs ha^{-1})	Net Monetary Return (Rs ha^{-1})	B.C. Ratio
Spacings (S)							
S_1 -(30 cm x 10 cm)	688	1479	2167	31.77	57174	41966	3.75
S_2 -(30 cm x 20 cm)	447	1015	1771	30.58	37155	22322	2.50
S_3 -(45 cm x 10 cm)	550	1221	1462	31.08	45756	31173	3.13
S_4 -(45 cm x 20 cm)	411	968	1379	29.81	34209	19876	2.38
SE ±	18.51	37.96	77.61	1.92	910	1431	-
CD at 5%	55.43	113.6	232.3	NS	2725	4283	-
Varieties (V)							
V_1 -(BDU-1)	618	1344	1962	31.45	51341	36602	3.47
V_2- (TAU-1)	536	1194	1731	30.96	44596	29856	3.01
V_3 -(AKU-15)	418	973	1391	30.01	34783	20044	2.35
SE ±	20.29	62.24	89.60	1.66	788	862	0.15
CD at 5%	60.76	186.3	268.2	NS	2361	2582	0.46
Interaction (S x V)							
SE ±	40.59	124.8	179.2	3.33	1577	1725	-
CD at 5%	NS	NS	NS	NS	NS	NS	-
General Mean	**524.3**	**1171**	**1695**	**30.81**	**43574**	**28834**	**2.94**

Conclusions

It is concluded that application of treatment 30 cm x 10 cm was recorded significantly higher Seed yield (688 kg ha^{-1}), higher gross returns (Rs. 57174 Rs ha^{-1}), net returns (Rs. 41966 Rs ha^{-1}) and benefit cost ratio (3.75) and the Black gram Variety BDU-1 was recorded significantly higher Seed yield (618 kg ha^{-1}), higher gross returns (Rs. 51341 Rs ha^{-1}), net returns (Rs. 36602 Rs ha^{-1}) and benefit cost ratio (3.47) found to be more productive under 30 cm x 10 cm spacing against TAU-1 and AKU-15as compared to other treatments. Since, the findings based on the research done in one season.

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