I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Yield,Yield Attributes and Economics of Black Gram (*Vigna mungo* (L.) *Hepper*) Varieties as Influenced by Different Spacings

S. K. Nayak*, D. A. Chavan*, S. G. Jadhav*, K. T. Jadhav*

ABSTRACT: *The field investigation experiment was conducted during kharif season of 2012 on PG research farm, department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Agriculture University Parbhani, it was observed from present investigation that the plant spacing 30 x 10 cm with variety BDU-1 was found be significantly superior over rest of the plant spacings and varieties in respect to pods/plant, seeds/pod, pod weight/plant,yield/plant,test weight, harvest index, seed yield (kg/ha),gross monetary return , net monetary return Benefit:Cost ratio.*

key words: *spacing, black gram, varieties, yield)*

INTRODUCTION

Pulses are important component of food grains 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 and utilize 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 crop grown in india. It is consumed in the form of 'dal' (whole or split, husked and unhusked) or parched. It is chief constituent of 'papad'. It is used as nutritive fodder specially 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 particle 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.

India is the largest producer of pulses, accounting 22 per cent of world's pulse production. The pulses are grown on 304 lakh ha area in India with production of 14.77 million tones with a productivity of 617 kg ha^{-1}. The total area under pulses in Maharashtra is 32.69 lakh ha with total production of 21.44 lakh tones and productivity of 217 kg ha^{-1} (Indian Economy -2010-11), Anonymous (2010). In India black gram is grown on 2.5 million ha area with total production of 1.5 million tones and productivity of 166 kg ha^{-1}. In Maharashtra it occupies an area of 3.65 lakh ha with total production of 1.22 lakh tones and the productivity of 299 kg ha^{-1} (Economic Survey of Maharashtra 2009-10), Anonymous (2010).

The low productivity is due to decreasing day by day 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 behavior of genotype. So it is required to maintain spacing and variety for higher yield.

MATERIAL AND METHODS

The experiment was laid out in field plot number A-4 at PG Research Farm of Agronomy Department,

* Vasantrao Naik Marathwada Agriculture University Parbhani 431 402

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* season of 2012. the soil of experimental plot was clayey in texture, moderate in organic carbon, poor in nitrogen, medium in available phosphorus and high in potash and slightly alkaline in reaction. Geographically, Parbhani is situated at 409 m mean sea level altitude 19^0 16' North latitude and 76^0 47' east longitude and has a subtropical climate. The mean average annual precipitation is 954.9mm and distributed in 46 rainy days mostly during June to September In the present investigation, three spacings and four varieties of black gram comprising of twelve treatment combinations were tried on *kharif* black gram.

The experiment was laid out in split plot design where in the main plot were assigned to three spacings and subplots to four varieties of black gram and these treatment combinations were randomly replicated thrice. The treatments were allotted randomly to each replication. The gross plot size was 5.4 m x 5.4 m and net plot size S_1- 4.8 m x 5.2 m, S_2- 4.5 m x 5.1 m, S_3-4.2 m x5.2 m. Details of the treatment along with symbols summarized as Main Plots (Spacings**)** S_1 : 30 cm x 10 cm ,S_2 : 45 cm x 7.5 cm ,S_3 : 60 cm x 5 cm. Sub plots (Varieties) V_1 : BDU-1, V_2 : TAU-1,V_3 :TPU-4 ,V_4 : T-9. Recommended dose of fertilizer for black gram is 25 kg N ha^{-1} and 50 kg P_2O_5 ha^{-1}. Accordingly, the fertilizer requirement was calculated for each plot. Being short duration and leguminous crop, the complete dose of nitrogen and phosphorous was applied at the time of sowing to each plot as a starter dose. Before sowing, the seed was treated with *Rhizobium* and PSB @ 2.5 g each per kg of seed followed by thirum @ 4 g per kg of seed. The sowing was done by dibbling, keeping distance as per treatments. Two seeds were dibbed at each hill.

The gross monetary returns (Rs ha^{-1}) occurred due to different treatments in the present study, were worked out by considering market prices of economic product, by product and crop residues during the experimental year. The cost of cultivation (Rs ha^{-1}) of each treatment was worked out by considering the price of inputs, charges for cultivation, labour, land and other charges. The net monetary returns (Rs ha^{-1}) of each treatment were worked out by deducting the mean cost of cultivation (Rs ha^{-1}) of each treatment from the gross monetary returns (Rs ha^{-1}) gained from the respective treatments. The benefit: cost ratio of each treatment was calculated by dividing the gross monetary returns by the mean cost of cultivation.

RESULT AND DISCUSSION

Effect of spacings

Data presented in Table 1 indicate that the number of pods per plant were influenced significantly by different treatments. The mean number of pods per plant were 16.46. Spacing 30 cm x 10 cm was found to be significantly superior over other treatments of spacing in recording more number of pods per plant. However, spacing 45 cm x 7.5 cm was found to be significantly superior over 60 cm x 5 cm in influencing this plant character. These results fall in line with those obtained by Pookpakdi and Paradilok (1993) and Singh and singh (1990)

Data presented in Table 1 revealed that the mean number of seeds per pod were significantly influenced by different spacings. The spacing of 30 cm x10 cm recorded higher number of Seed pod^{-1}. These results fall in line with those obtained by Pookpakdi and Paradilok (1993) and Singh and singh (1990). The data furnished in Table 1 reveled that pod weight per plant was significantly influenced by different spacings . Pod weight per plant was significantly influenced due to different spacings. The highest pod weight per plant was found in spacing 30 cm x 10 cm (S_1) which was significantly superior over other spacings. Difference were found to be at par between the spacings 45 cm x 7.5 cm and 60 cm x 5 cm. The spacing 30 cm x 10 cm (S_1) recorded higher number of seeds per pod (6.47) and was significantly superior over other spacings. Other two spacing were at par with each other.

Seed yield per plant was significantly influenced due to various spacings of black gram. The maximum seed yield per plant was found in spacing 30 cm x 10 cm (S_1) which was significantly superior over other spacings. Spacings 45 cm x 7.5 cm was found to be significantly superior over 60 cm x 5 cm. Data presented in Table1 revealed that test weight (1000 seed weight) was not influenced by different spacings, varieties and their interactions. The mean test weight (1000 seed weight) was recorded 41.55 g.

The straw yield was significantly influenced by different spacings. The spacing 30 cm x 10 cm (S_1) produced maximum straw yield (1341 kg ha^{-1}) which was significantly superior over 60 cm x 5 cm (S_3) and found at par with 45 cm x 7.5 cm (S_2). Spacing 45 cm x 7.5 cm was found to be significantly superior over spacing 60 cm x 5 cm. The biological yield of black gram was significantly influenced by spacings. The spacing of 30 cm x 10 cm recorded higher biological yield and it was significantly superior over spacing

Table 1
yield, yield attributes of blackgram varieties as influenced by different spacings

Treatment	*No. of pods plant^{-1}*	*No. of seed pod-*	*Pod weight (g)*	*Seed yield plant^{-1} (g)*	*Test weight (g)*	*Straw yield (kg ha^{-1})*	*Biological yield (kg ha^{-1})*	*Harvest index (%)*	*Seed yield (kg ha^{-1})*
Spacings									
S_1 – 30 cm x 10 cm	18.02	6.47	8.08	4.38	41.54	1341	1986	32.37	645
S_2– 45 cm x 7.5 cm	17.19	6.21	7.42	4.24	41.16	1333	1947	31.44	614
S_3 – 60 cm x 5 cm	14.17	6.16	7.06	3.96	41.94	1260	1817	30.53	558
SE±	0.22	0.04	0.13	0.03	0.7	13.97	29.04	0.33	8.24
CD at 5%	0.66	0.13	0.41	0.08	NS	41.45	86.16	0.98	24.6
Varieties									
V_1-BDU-1	18.3	6.52	8.48	4.57	43.4	1506	2230	32.39	723
V_2-TAU-1	17.3	6.38	7.89	4.31	42.61	1345	1967	31.58	622
V_3-TPU-4	16.0	6.28	7.43	4.11	41.84	1249	1823	31.44	574
V_4 – T-9	14.2	5.94	6.28	3.78	38.35	1145	1646	3038	501
SE±	0.33	0.07	0.15	0.1	1.39	20.79	34.45	0.41	11.9
CD at 5%	1	0.23	0.47	0.32	NS	61.69	102.22	1.24	35.5
Interaction (S xV)									
SE±	0.58	0.13	0.27	0.18	2.4	36.02	59.67	0.72	20.7
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
General Mean	16.4	6.28	7.52	4.19	41.55	1311	1917	31.45	605

of 45 cm x 7.5 cm (S_2), and 60 cm x 5 cm (S_3). (Table 1). The increased biological yield in 30 cm x 10 cm was reported by Saibabu and Garg (1988) and Dewangan *et al.* (1993). The harvest index (Table 1) 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 7.5 cm (S_2), and 60 cm x 5 cm (S_3). The result is similar with Chauhan *et al.* (1991).

Perusal of data presented in Table 1 revealed that the seed yield of black gram was significantly influenced by different spacings. The spacing 30 cm x 10 cm produced maximum seed yield (645 kg ha^{-1}) which was significantly superior over rest of spacings. Spacing 45 cm x 7.5 cm was found to be significantly superior over 60 cm x 5 cm.

Perusal of data in Table 2 indicated that the gross monetary returns and net monetary return of blackgram was significantly influenced due to spacing. The spacing 30 cm x 10 cm (S_1) recorded higher (23232 Rs. ha^{-1}) gross monetary return,net monetary return (10044 Rs. ha^{-1}) which was significantly superior over 45 cm x 7.5 cm (S_2) and 60 cm x 5 cm (S_3) .Perusal of data in Table 1 indicated that the benefit: cost ratio of blackgram was influenced due to spacings. The spacing 30 cm x 10 cm (S_1) recorded higher (1.76) benefit: cost ratio which was superior over 45 cm x 10 cm (S_2) and 60 cm x 5cm (S_3).

Effect of varieties

Data presented in Table 1 indicate that the number of pods per plant were influenced significantly by different treatments. The mean number of pods per plant were 16.46. Variety BDU-1 recorded significantly more number of pods per plant than other varieties. Performance of TAU-1 was found to be significantly better than TPU-4 and T-9 in influencing this character. Variety TAU-4 was found significantly better than T-9. Similar trend was reported by Patel and Patel (1991) and Mitra *et al.* (1999). Data presented in Table 1 revealed that the mean number of seeds per pods were significantly influenced by different varieties.The variety BDU-1 was found to be significantly superior over other varieties (Table 1). Differences were at par between varieties TAU-1 and TPU-4 . However, these two varieties were found to be significantly superior over variety T-9. Pod weight per plant was significantly influenced by different varieties. The variety BDU-1(V_1) Produced maximum pod weight per plant (8.48 g) and found significantly superior over other varieties. Differences were at par between the varieties TAU-1 and TPU-4. However, these two varieties were found to be significantly superior over T-9. Seed yield per plant was significantly influenced due to varieties of black gram. The variety BDU-1(V_1) produced maximum seed weight per plant which was significantly superior over other varieties. Differences were at par between the varieties TAU-1 and TPU-4. However, these two varieties were found to be significantly superior over T-9.

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 16) was superior as compared to TAU-1,TPU-4 and T-9. 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 photosynthates to the sink (Seed). Similarly Yadahalli *et al*. (2006) and Massey (2006) also observed improvement in black gram varieties having different genetic makeup.

Table 2
Mean gross monetary returns (Rs.ha^{-1}), net monetary returns (Rs.ha^{1}), and Benefit Cost (B:C) ratio as influenced by different treatments.

Treatment	*Gross Monetary Return (Rs./ha)*	*Net Monetary Return(Rs./ha)*	*B:C Ratio*
Spacings (S)			
S_1 – 30 cm x 10 cm	23232	10044	1.76
S_2 – 45 cm x 7.5 cm	22151	8963	1.67
S_3 – 60 cm x 5 cm	20105	6917	1.52
SE±	296	296	-
CD at 5%	880	880	-
Varieties (V)			
V_1 – BDU-1	26070	12732	1.95
V_2 – TAU-1	22447	9107	1.68
V_3 – TPU-4	20723	7685	1.58
V_4 – T-9	18078	5038	1.38
SE±	423	423	-
CD at 5%	1256	1256	-
Interaction (S xV)			
SE±	733	733	-
CD at 5%	NS	NS	-
General Mean	21829	8641	1.64

The straw yield was significantly influenced by different varieties. Maximum straw yield 1506 kg ha^{-1} was recorded by variety BDU-1(V_1) which was significantly superior over other varieties. Variety TAU-1 was found to be significantly superior over varieties TPU-4 and T-9. Straw yield (Table 17) produced by variety TPU-4 was found to be significantly more than variety T-9. Black gram variety BDU-1 produced biological yield of 2230kg ha^{-1} which was higher over TAU-1 (1967 kg ha^{-1}),TPU-4 (1823 kg ha^{-1}) and T-9 (1646 kg ha^{-1}). The higher biological yield of BDU-1 as compared to TAU-1,TPU-4 and T-9 might be due to accumulation of more dry matter and higher biomass potential. These findings are in confirmity with the finding of Mitra *et al*. (1999). All varieties differed significantly in harvest index (Table 1). Black gram variety BDU-1 recorded higher harvest index as compared to TAU-1,TPU-4 and T-9, which might be due to its higher production efficiency. Similar trend was observed by Sontakey and Patil (1990) and Singh and Singh (1991).

The seed yield was significantly influenced due to varieties. The variety BDU-1(V_1) produced maximum seed yield (723 kg ha^{-1}) which was significantly superior over other varieties. Variety TAU-1 was found to be significantly superior over varieties TPU-4 and T-9. Seed yield produced by variety TPU-4 was significantly higher than variety T-9. Similar findings were reported by Jain *et al*. (1988), Patel *et al*. (1992).

Gross monetary returns is significantly affected by varieties. The variety BDU-1 (V_1) recorded significantly higher (12732 Rs.ha$^{-1)}$ gross monetary return over rest of the varieties Net monetary returns is significantly affected by varieties. The variety BDU-1(V1) recorded significantly higher (12732 Rs ha^{-1}) net monetary return over rest of the varieties. Benefit: cost ratio of blackgram affected by varieties. The variety BDU-1 (V_1) recorded higher (1.95) benefit: cost ratio compared to TAU-1(V_2), TPU-4(V_3) and T-9(V_4).

REFERENCES

Anonymous, (2010), Area, production and productivity of pulses. *Indian Economy*.

Anonymous. (2010), Area, production and productivity of black gram. *Economic Survey of Maharashtra*.

Chauhan, Y.S., V.K. Jain., K.V.Jain., and R.S. Chauhan (1991), Growth, yield and quality of green gram as affected by varieties and inter row spacing, *Haroyand J. Agron*., **7** (1) : 29-32

Pookapakdi, A. and H. Pataradiok. (1993), Response of genotypes of mungbean and blackgram to planting dates and plant population densities. *Kasetsart J. Nat. Sci.*, **27** (4) : 395-400.

Singh, C.P. and H.P. Singh. (1990), Response of mung bean to plant population and planting pattern. *Narendra Deva J. Agric. Res*., **5** (1) : 122-124.

Mitra, S. Bhattacharaya, S.K., Datta, M. and S. Banik (1999), Effect of variety, rock phosphate and phosphate solubilizing bacteria on growth and yield of green gram in acid soils of Tripura. *Environ. Eco*., **17** (4) : 926-930.

Sontakey, P.Y. and B.N. Patil (1990), Physiological variability in green gram. *Annals of plant physiol*., **4** (1) : 124-126.

Singh, D. and M. Singh (1991), Response of mungbeans to phosphorus. *Indian J. Pulses Res* ., **4** (1): 113-114.