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Growth, development and yield attributes of black gram (*Vigna mungo* L.) varieties at Patuakhali region

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Abstract: A field experiment was conducted at the research farm of Regional Horticulture Research Institute, Lebukhali, Patuakhali in the year 2012 to find out the suitable black gram variety for coastal area on the growth, yield and yield attributes of black gram grown under semi-arid climate. Results revealed that all the parameters including growth, yield and yield components were significantly influenced by varieties. BARI mush–3 produced highest branches plant^{-1} (4.83), higher LAI (9.99), higher CGR (3.216 g m^{-2} day^{-1}), maximum number of pods plant^{-1} (19.42), maximum seeds pod^{-1} (9.28), and grain yield (1.69 t ha^{-1}). Poor performance was observed in local variety. BARI mush–3 was the most productive variety under the coastal area.
Key words: Variety, Coastal, Attributes, Productive.

Introduction

Pulses are important crops in Bangladesh. They occupy an area of about 317.80 thousand hectares with an annual production of 237 thousand metric tons (BBS, 2005). Pulses mainly being the Rabi season crops which are losing area under cultivation each year due to increase in cultivation of wheat, vegetables and high yielding boro rice with increasing facilities of irrigation. Black gram (*Vigna mungo* L.) is an important pulse ranking the fourth both in acreage and production among the pulses (BBS, 2005). The crop not only fixing free atmospheric N_2, but also enrich the soil with N for the growth of succeeding crops (Sen, 1996). It grows well in north or north-west part of Bangladesh, especially in Rajshahi and Chapai Nawabganj districts. But in case of southern districts it is less cultivated due to ignorance and different types of soil and environmental factors. Most of the farmers of Bangladesh were cultivating traditional, local varieties with low yield potential. However, expansion of Black gram cultivation in such non–traditional areas depends largely on its competitive ability with other crops as well as its adaptability over a wide range of environmental conditions (Popalghat *et al*., 2001). Moreover, farmers are losing interest in producing Black gram due to low income per unit of resources invested. Therefore, attention should be given to increasing yield through the proper selection of high yielding varieties (Singh *et al*., 2009). The yield components depend on some physiological traits. To understand the physiological basis of yield difference among the genotypes of Black gram, it is essential to quantify the components of growth, and the variation, if any, may be utilized in crop improvement. However, the present study was performed under the Southern part of Patuakhali (Agro Ecological Zone-13) region of Bangladesh which was slightly affected by salinity, which was also some of the major causes of its low yield. Therefore, this study was carried out to investigate the varietal performances on the growth, development and yield attributes of Black gram under the Southern part of Patuakhali district.

Materials and Methods

The experiment was conducted at the research farm of Regional Horticulture Research Institute, Lebukhali, Patuakhali and covered by the Ganges Tidal Flood Plains under AEZ-13. The soil of the experimental field was silty clay loam having pH value of 7.00. The seeds of Five (05) Black gram varieties viz. BARI mash-1 (Pantho), BARI mash-2 (Soroth), BARI mash-3 (Hemonto), BINA mash-1, Local cultivar were used as planting material for this experiment. The experiment was laid out in Randomized Complete Block Design (RCBD) with four replications. The fertilizer was applied such as urea, TSP and MoP at the rate of 20, 150 and 50 kg per ha, respectively during the final land preparation. Seeds were sown in rows by hand plough on November 06, 2011. The distances between row to row and seed to seeds were 30 and 10 cm, respectively. Randomly selected five plants in each plot for measures plant height and number of leaves. Leaf area index was measured by dividing leaf area per plant with surface area (cm^2) covered by the plant. Data were analyzed statistically by ANOVA to examine whether treatment effects were significant (Gomez and Gomez, 1984). Mean values were compared by DMRT (Duncan's Multiple Range Test). The software package, WASP was followed for statistical analysis.

Results and Discussion

Plant height: Significant difference was found among the genotypes for all the data recorded for different characteristics. BARI mash–3 had the maximum plant height (51.74 cm) at 70 DAS while Local variety produced the shortest plant (1742.98 cm) (Table 1). Plant height is one of the most important growth contributing characters for any corps which would be related to several factors like genetic makeup, nutrient availability, environmental or climatic condition, soil characteristics, regional adaptability etc.

Number of branches plant^{-1}: Statistical analysis of the data on number of branches plant^{-1} differed significantly among the genotypes. Among the genotypes, the production of branches plant^{-1} had higher (4.83) in BARI mush–3 at, 70 DAS which was statistically differed among other genotypes. On the other hand, the Local variety of Black gram had lower (3.40) (Table 1).

Total dry matter (TDM): Total dry matter (TDM) also showed significant different among the genotypes. From the Table 1, it was found that the variety BARI mush–3 had also higher (64.17 g plant^{-1}) at 70 DAS. In contrast, the lower TDM (55.39 g plant^{-1}) was observed in BARI

mush–3 which was statistically same with BINA mush–1 (55.70 g plant^{-1}) at 70 DAS respectively (Table 1). These results indicated that the varietals performance on TDM due to occur their genetic variations.

Leaf area index (LAI): Statistical analysis of the data showed significant difference among the genotypes of Black gram regarding to LAI. The variety BARI mush–3 was recorded the higher LAI (9.99) at 70 DAS. On the other hand, the lowest LAI (8.98) was found in Local variety which was also closely followed by BINA mush–1 DAS (9.22) and BARI mush–1 (9.26) at 70 (Table 1). This variation was also indicated that the different variety were different effect on LAI in case of the variation in genetic makeup and their regional adaptability.

Table 1. Varietal performance on growth parameters.

Varieties	Plant height	No. of branches plant^{-1}	TDM (g plant^{-1})	LAI	CGR (g m^{-2} day^{-1})
BARI mush–1	48.72 b	3.78 c	60.40 b	9.26 bc	2.507 cd
BARI mush–2	46.91 c	4.18 b	60.81 b	9.49 b	2.830 b
BARI mush–3	51.74 a	4.83 a	64.17 a	9.99 a	3.216 a
BINA mush–1	44.03 d	3.53 d	55.70 c	9.22 bc	2.608 c
Local variety	42.98 e	3.40 d	55.39 c	8.98 c	2.342 d
CV (%)	3.12	2.25	1.65	2.49	5.01

TDM = Total Dry Matter, LAI = Leaf Area Index, CGR = Crop Growth Rate

Crop growth rate (CGR): Crop growth rate (CGR) was significantly influenced by the effect of varieties. Among the varieties, the higher CGR (3.216 g m^{-2} day^{-1}) was obtained from the variety BARI mush–3 at 70 DAS harvest. The lower CGR (2.342 g cm^{-2} day^{-1}) was found with the local variety (Table 1).

Number of pods plant^{-1}: Analysis of variance data on number of pods plant^{-1} showed significant differences among the varieties at harvest where significantly the maximum number of pods plant^{-1} (19.42) was obtained from the variety BARI mush–3 while the minimum number of pods plant^{-1} (14.55) was noticed from the variety (local variety) (Table 2). The variation in number of pods plant^{-1} was found due to the variation of branch production and also the genetic variations of genotypes.

Number of seeds pod^{-1}: Seeds pod^{-1} data obtained the significant variation due to the effect of Black gram genotypes at harvest. The data on seeds pod^{-1} indicated that the genotype BARI mush–3 recorded the maximum (9.28) than other varieties while local variety had lower production of seeds pod^{-1} (5.88) (Table 2).

Pod length: Pod length was significantly influenced by the effect of Black gram varieties at harvest. Among the Black gram varieties, the longest pod (5.93 cm) was recorded from the variety BARI mush-3 while the shortest pod (3.87 cm) was observed with the local variety (Table 2). These results indicated that the pod length differ significantly among the varieties.

Table 2. Varietal effect on yield and yield contributing characters.

Varieties	No. of pods plant^{-1}	No. of seeds pod^{-1}	Pod length	1000–seeds wt.	Grain yield	Straw yield	Biological yield	Harvest index (HI)
BARI mush–1	16.98c	7.40c	4.73c	42.89 b	1.47 b	3.36 b	4.81 c	30.23 ab
BARI mush–2	18.73b	8.00b	5.26b	44.42 a	1.52 b	3.43 b	4.95 b	30.69 a
BARI mush–3	19.42a	9.28a	5.93a	45.45 a	1.69 a	3.79 a	5.47 a	30.80 a
BINA mush–1	16.63c	6.78d	4.19d	41.28 c	1.32 c	3.11 c	4.43 d	29.81 b
Local variety	14.55d	5.88e	3.87e	38.60 d	1.26 c	3.06 c	4.32 d	29.22 c
CV (%)	3.02	3.67	4.13	2.08	5.70	2.10	1.85	1.19

1000 seeds weight: Thousand seed weight showed significant differences among the Black gram varieties. From the Table 2, it is found that the variety BARI mush-3 had higher on 1000–seeds weight of 45.45 g over other varieties. It is also found that the variety (local) produces the lowest 1000–seeds weight (38.60 g) which was also showed significant differences among other Black gram varieties. The variation in 1000–seeds was found due to its genetic variation (Table 2).

Grain yield: Grain yield data indicated significant differences by the effect of varieties. Table 2 indicated that the grain yield had higher (1.69 t ha^{-1}) in BARI mush–3 which was statistically differed among other varieties. In contrast, the lower grain yield was recorded from the variety (1.26 t ha^{-1}) which was statistically significantly with BINA mush-1 (1.32 tha^{-1}) (Table 2). Genotypes play an significant role in influential the yield of crops and the probable of genotypes within genetic limits is set by its regional adaptability of the soil characteristics in this study area. Genotypes also differ in their yield potential depending on many factors *viz.* genetic makeup, climatic condition, soil nutrient, regional adaptability etc. which occurring in various parts of plant involved in many morphological and physiological changes. Differential response of different varieties was also observed by Miah *et al.*, 2009 and Sing *et. al*. (2010). Variation in grain yield could be attributed to variation in yield components such as panicle length, 1000–grain weight, harvest index etc. In general, it was observed in the present study that the genotypes which had a good

combination of harvest index, TDM and straw yield performed better in terms of yield.

Straw yield: Effect of Black gram varieties was found to be the significant differences in respect of straw yield (Table 2). This significant variation results indicate that the highest straw yield (3.79 t ha^{-1}) was in BARI mush–3 while BARI mush–2 (3.43 t ha^{-1}) and BARI mush–1 (3.36 t ha^{-1}) produces statistically the similar average (second) yield of straw. Another two varieties *viz.* (3.06 t ha^{-1}) and BINA mush-1 (3.11 t ha^{-1}) were also recorded the statistically similar lower straw yield.

Biological yield: Analysis of variance data on biological yield was present in Appendix XIV and indicated significant differences by the genotypic effect of Black gram (Table 2). The highest biological yield (5.47 t ha^{-1}) was found from the variety BARI mush–3 and it differed significantly among the other varieties. However, the lowest biological yield (4.32 t ha^{-1}) was obtained with the local variety which variety produces statistically similar biological yield (4.43 t ha^{-1}) with BINA mus-1. This variation results were observed due the variation of grain and straw yield in case of they are directly related to biological yield. This variation was also occurred might be the genetic differences.

Harvest index (HI): A significant variation was found on harvest index due to the effect of Black gram varieties where the variety BARI mush-3 had higher HI (30.80%) which was statistically similar with BARI mush-2 (30.69%) and closely followed by BARI mush–1 (30.23%). The lowest HI (29.22%) was found in (local variety) which was showed statistically significant difference with BINA mus-1 (29.71%) (Table 2). The maximum harvest index was obtained with the variety BARI mush-3 could be attributed mainly is due to better partitioning of dry matter into economic parts and yield of grains and straw.

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