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The Effects of Variety and Foliar Application of Urea and Boron on Growth and Yield of Blackgram (*Vigna mungo* L.)

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ABSTRACT

An experiment was conducted at the research field of Sher–e-Bangla Agricultural University, Dhaka, during the period from March to July 2016 to study the effects of variety and foliar application of urea and boron on growth and yield of Blackgram. The experiment comprised of two varieties *viz*. V_1 = BARI mash-2 and V_2 = BARI mash-3 and eight levels of fertilizer management *viz*. T_1 = Recomme-nded fertilizer (RF), T_2 = RF + Foliar spray (FS) of water at flower initiation (FI), T_3 = RF + Urea (2%) FS at FI, T_4 = RF + Boron (1%) FS at FI, T_5 = RF + Urea (2%) + Boron (1%) FS at FI, T_6 = Urea (2%) FS at FI, T_7 = Boron (1%) FS at FI and T_8 = Urea (2%) + Boron (1%) FS at FI. It was laid out in split-plot design with three replications. The results indicated that effects of variety and foliar application BARI mash-2 gave the highest plant (54.27cm), number of nodules plant^{-1}(170.7), number of pods plant^{-1}(31.70), pod length (4.58cm), 1000 seed weight (39.67 g), seed yield t ha^{-1} (1.29), stover yield t ha^{-1}(1.64) and biological yield (2.93 t ha^{-1}). So, the effects of variety BARI mash-2 with T_5 (RF + Urea 2% + Boron 1% FS at FI) were suggested for better result on Blackgram cultivation.

INTRODUCTION

Blackgram [*Vigna mungo* (L.) Hepper] most important legume protein rich pulses crop of rainfed areas grown through the country which belongs to family Fabaceace. It is native to India, and known by the names of Mashkalai, and urid. It has great value as food, fodder and green manure. It is an inexpensive source of protein that may be consumed directly by humans and increases soil fertility. In addition to fixing free atmospheric N_2, Blackgram enriches the soil with NPK to support the growth of subsequent crops [19]. In Bangladesh, Blackgram ranks fourth in acreage and production but ranks second in market price. Blackgram is cultivated in the area of 102000 acre contributing 9.5% of total pulse production (41000 metric tons) [4]. The average yield of Blackgram is very low (756 kg ha^{-1}) compare to other growing areas around the globe. In Bangladesh, it grows well in north or northwest part especially in Rajshahi and Chapai Nawabganj districts. Blackgram is a photo-insensitive legume crop, can be grown in year-round. Its need least care for cultivation with minimum tillage, fertilizers, pesticides and very early or very late sowing, no irrigation and drainage facilities etc. In Bangladesh, nutrient deficiency in the soil is a major factor for the low productivity of pulse crops. Soil of Bangladesh is mostly deficient in nitrogen. when nitrogen given as basal is very limiting when plant requires adequate at different stage of its growth. All these factors are combined responsible for low yield of Blackgram [8]. On the other hand, relatively low Boron (B) contents in most of the soils in Bangladesh is another serious problem; only soluble Boron in soils is available for plants. The occurrence of B deficiency in most of the soil depends on various factors mainly caused by the reduction of the availability of soluble B in the soil, such as weather conditions (drought, high precipitation), soil conditions (low pH soils: B leaching, calcareous soils: B fixation) and the cultivated crop species [20]. Among these factors, foliar application of fertilizer like nitrogen and boron is new concept. Foliar fertilization is one of the most important methods of fertilizer application practices in agriculture because

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foliar nutrients facilitate easy and quick consumption of nutrients by penetrating the stomata or leaf cuticle and enters the cells and efficient utilization of nutrients, elimination of losses through leaching, fixation and regulating the uptake of nutrients by plant [13]. Foliar application of N at flowering stage may solve the slow growth, nodule senescence and low seed yield of pulse without involving root absorption at critical stage [12]. [2] reported positive effect of foliar application towards improving yield and yield components of Blackgram.The above observation defined the parameters of the current investigation, which aims to assess the impact of fertilizer management and variety on the growth and yield of Blackgram.

MATERIALS AND METHODS

Plant Materials

Seeds of BARI Mash-2 and BARI Mash-3 were used as planting material were collected from Bangladesh Agricultural Research Institute, Joydebpur and Gazipur. In case of BARI Mash-2 plant height ranges from 33 to 35 cm and average yield of this cultivar is about 1.4-1.5 t ha^{-1}. And in case of BARI Mash-3 plant attains a height of 35 -38 cm long and average yield is about 1.5-1.6 t ha^{-1}.

Treatments of the Experiment

The experiment consisted of eight applications viz. T_1= Recommended Fertilizer (RF), T_2= RF+ Foliar Spray (FS) of water at flower initiation (FI), T_3= RF+ Urea (2%) FS at FI, T_4= RF+ Boron (1%) FS at FI, T_5= RF+ Urea (2%) + Boron (1%) FS at FI, T_6= Urea (2%) FS at FI, T_7= Boron (1%) FS at FI, T_8= Urea (2%) + Boron (1%) FS at FI. The experiment was laid out in split-plot design with three replications.

Experimental Design and Layout

The experiment was laid out in a Split-plot Design with three replications. Variety was in main plot and foliar spray in sub plot. The experiment was divided into three blocks and consisted of 16 plots in each plot. Each unit plot in from of raised bed was 5.04 m^2 (2.1m ×2.4 m) in size. Altogether there were 48-unit plots in experiment and required 448.26 m^2 lands. Row to row and plant to plant distance were 30 x 10 cm respectively.

Manures and Fertilizer Application

As per recommendation, followed by the doses per hectare of manures and fertilizer were applied:

Recommended Fertilizers and Treatment Doses are-

Treatments	Doses/plot
T_1=Recommended Fertilizer (RF)	RF
T_2 =RF+ Foliar Spray (FS) of water at flower ignition (FI)	RF
T_3 =RF+ Urea2% FS at FI	RF+2g
T_4 =RF+ Boron 1% FS at FI	RF+1g
T_4 =RF+ Urea2% + Boron1% FS at FI	RF+2g+1g
T_6=Urea2% FS at FI	2g
T_7=Boron 1% FS at FI	1 g
T_8=Urea2% + Boron1% FS at FI	2g+1g

Fertilizer	Dose (per ha.)
Cowdung	15 ton
Urea	20 kg
TSP	40 kg
MP	20 kg
Boric Acid	As per treatment

Seed Sowing

The Blackgram seeds ware treated by Forastin 50 wp 15 g per 1.5 kg. Seeds were sown in the field using the line-by-line method. Water was supplied every line before sowing of Blackgram seed. The seed sowing time was 4th March 2016. On the 3rd day after sowing 80% of seeds were germinated.

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Intercultural Operations

1st weeding, thinning and drainage were completed on 20 days after sowing on 19th March 2016. 2nd weeding was completed after 15 days interval of first weeding and 3rd weeding was completed at 60 days after sowing. Two times of irrigation was done at each plot, 1st irrigation was done 15 days after sowing and 2nd irrigation was done at 40 days after sowing. To control destruction from birds, trap was used which was made from tin and Bamboo.

Harvesting

The crop was harvested plot wise when about 80 percent pod became mature at 75 days after sowing. The harvested pods were sorted into individual bags for each plot. They were taken to the threshing floor and sun dried for three days. Afterwards the seeds and stover were separately weighed. The crop bundles were sun dried by spreading those on the threshing floor. Seeds were separated from the plants by beating the bundles with bamboo sticks. The seeds thus collected were dried in the sun for reducing the moisture in the seeds to a constant level. The dried seeds and straw were cleaned and weighed.

Data Analysis

The collected data were compiled and analyzed statistically using two-way ANOVA technique with the help of a computer package program MSTAT-C and the mean differences were adjusted by Least Significant Difference (LSD) test at 5% level of significance (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Growth Parameters:

Plant height, number of leaves per plant, number of branches per plant and number of nodules per plant of Blackgram showed significant variation due to interaction effects of variety and foliar application (Table 1). Interaction effect of V_1T_5 scored the highest plant height (37.40 cm) at 30 DAS which was statistically similar with V_1T_2, V_1T_3, V_1T_4, V_1T_5, V_1T_6, V_2T_1, V_2T_3, V_2T_4 and V_2T_5, At 60 DAS highest plant height (52.48cm) was recorded in V_1T_5 treatment which was statistically dissimilar with all other treatment except V_1T_3 and V_2T_5 and At harvest, highest plant height (54.27cm) was recorded in V_1T_5 treatment which was statistically similar with all other combination except V_1T_6, V_1T_7, V_2T_2, V_2T_6, V_2T_7 and V_2T_8. On the other hand, at 30 DAS the lowest plant height (30.07 cm) was obtained from the combination of V_2T_7 which was statistically similar with V_1T_6, V_1T_7, V_1T_8, V_2T_2, V_2T_4, V_2T_6 and V_2T_8, at 60 DAS (37.01 cm) lowest plant height was at V_2T_7 which is similar only with V_1T_6, V_1T_7 and V_2T_6 and at harvest, (41.09 cm) which was statistically similar with V_1T_6, V_1T_7, V_2T_6 and V_2T_8 treatment combinations. According to [22], foliar spraying of 2 percent urea during three stages of crop growth; vegetative, blooming, and pod filling stage for Black gram -led to a considerable improvement in growth features including plant height and leaf area. According to [11], a field experiment was carried out in the summer of 2002 to investigate the impact of both organic and inorganic foliar nutrients on the performance of Black gram. 1% urea sprayed foliarly at floral initiation and 15 days post-flowering considerably improved the growth parameters and yield contributing characteristics. Leaves plant^{-1} gradually increase with the increase of DAS (Table 1). Leaves plant^{-1} in V_1T_5 showed the maximum (15.53**)** which is statistically similar with V_1T_3, $_2T_5$ treatment combination and the lowest leaves plant^{-1} (9.80) was observed at V_2T_7 that is statistically similar with V_1T_7 and V_2T_6 at 30 DAS. At 60 DAS leaves plant^{-1} in V_2T_5 showed the maximum (20.07) that is statistically similar with V_1T, V_1T_4, V_1T_5, V_2T_1 and V_2T_3 and minimum leaves plant^{-1} (15.01) gave in V_1T_6 which is statistically similar with V_1T_2, V_1T_7, V_1T_8, V_2T_4, V_2T_6, V_2T_7 and V_2T_8. The maximum leaves plant^{-1} (37.40) gave in V_2T_5 which is statistically not similar with all the treatment except V_1T_3 and V_1T_5 whereas minimum number of leaves plant^{-1} (22.00) gave in V_1T_7 which is statistically not similar with all the treatment except V_1T_6, V_1T_8 and V_2T_7 at harvest stage. An experiment on how foliar application of urea and bio-organic fertilizers affects the growth parameters of mungbean was conducted by [10]. They discovered that applying urea and organic manure topically significantly enhanced plant-1's leaves. Effects of variety and fertilizer management through foliar application showed significant differences on branches plant^{-1} at 30, 60 and at

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harvest. At 30,60 and at harvest the highest branches plant^{-1} (3.93,4.27 and 4.87 respectively) was recorded in V_1T_5 which is not statistically similar with all other treatment except V_1T_1, V_1T_3, $V_1T_4$and V_2T_5 at 60 DAS and V_1T_1, V_1T_2, V_1T_3, V_1T_4, V_1T_8 and V_2T_5 at harvest. The lowest branches plant^{-1}(1.93) was observed in V_2T_7 that is not statistically similar with any other treatment at 30 DAS. The minimum branches plant^{-1}(2.87) was observed in V_2T_7 that is statistically similar with V_1T_6, V_1T_7 and V_2T_6. Finally, at harvest the lowest branches plant^{-1}(3.13) was recorded in V_2T_7 that is statistically similar with V_1T_7 and V_2T_6 (Table 1). According to [24], foliar spraying urea and DAP greatly increased chickpea branching. According to [14], foliar treatment of a mixture of micronutrients, including Zn, B, Fe, and Mn combined with NPK (19-19-19), resulted in the greatest number of branches (13.65) in potatoes compared to the control (10). The Black gram varieties responded differently to foliar spraying in terms of nodule number plant^{-1}. At 30 DAS, the combined effect V_1T_3 was achieved the highest number of nodule plant^{-1} (82.87) and the lowest (28.43) was obtained from the V_1T_7 which was statistically similar with V_2T_7 combination. At 45 DAS, the highest number of nodule (136.0) plant^{-1}was recorded from V_1T_5 combination. On the other hand, the lowest number of nodule (52.67) plant^{-1}was recorded from V_2T_7 combination which was statistically similar with V_1T_7, V_2T_1 and V_2T_6 combinations. At 60 DAS, V_2T_5 showed the highest number of nodule (170.7) plant^{-1} and the lowest number of nodule (62.67) plant^{-1} obtained from V_2T_7combination which was statistically similar with V_1T_1, V_1T_6 and V_2T_6 combinations (Table 1). In an experiment, [11] investigated the impact of foliar nutrient application on the growth and development of black gram (Vigna mungo (L.) Hepper) grown in rainfed conditions. The results showed that a 2% urea spray applied during flowering produced the highest number of root nodules/plant (14.33) at 30 DAS. The maximum number of root nodules per plant (15.60) was recorded at 45 DAS after applying a 2% DAP spray during flowering; the minimum number of root nodules per plant (11.67) was recorded in the control treatment 15 days later. According to [1], in chickpea, the application of 50 kg urea/ha resulted in the greatest number of nodules per plant (17.33) and the lowest values (9.67) at control conditions.

Table 1. The effects of variety and added foliar application on the growth parameters of Blackgram

Treatment	**Plant height (cm)**			**Leaves plant 1(no.)**			**Branches plant-1(no.)**			**Nodules plant 1(no.)**		
	45	**75**	**At harvest**	**45**	**75**	**At harvest**	**45**	**75**	**At harvest**	**30**	**45**	**60**
V_1T_1	34.72 a-c	46.07 b-d	50.00 a-d	13.09 c-e	17.67 b-e	28.73 e-g	2.73 de	3.87 a-d	4.67 ab	52.77 de	90.00 e-g	74.00 e-g
V_1T_2	35.57 a-c	43.27 b-e	49.27 a-e	14.07 bc	17.40 b-f	32.27 c-e	2.60 ef	3.73 c-e	4.53 a-c	71.53 b	105.0 cd	105.7 c
V_1T_3	36.47 ab	47.25 ab	52.92 ab	14.60 ab	18.93 a-c	33.83 a-c	3.40 b	4.07 a-c	4.80 a	82.87 a	104.2 cd	96.33 cd
V_1T_4	35.44 a-c	43.35 b-e	49.59 a-e	12.53 d-f	17.87 a-d	27.27 gh	3.27 bc	3.97 a-d	4.73 ab	51.77 d-f	119.3 b	102.7 c
V_1T_5	37.40 a	52.48 a	54.27 a	15.53 a	19.13 ab	36.73 ab	3.93 a	4.27 a	4.87 a	47.20 e-g	136.0 a	170.7 a
V_1T_6	33.89 a-d	41.53 c-f	44.92 c-f	11.60 fg	15.01 f	24.40 h-j	2.47 ef	3.27 f-h	3.87 de	34.87 jk	74.67 h	62.33 g
V_1T_7	32.3	40.4	43.98	10.15	15.6	22.00 j	2.3	3.07	3.40 ef	28.4	57.00	78.33

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	7 b-d	0 ef	d-f	h	0 d-f		3 f	gh		3 l	i	ef
V_1T_8	33.27 b-d	45.91 b-e	50.83 a-c	13.10 cd	17.10 b-f	26.80 g-i	2.67 def	3.80 b-e	4.73 ab	57.53 cd	97.67 c-e	79.00 ef
V_2T_1	34.51 a-c	46.51 bc	51.45 ab	12.20 d-f	18.53 a-c	31.20 c-f	2.60 ef	3.60 d-f	4.20 b-d	43.20 gh	61.33 i	84.33 de
V_2T_2	33.22 b-d	44.01 b-e	47.86 b-e	11.93 d-g	17.60 b-e	29.53 d-g	2.40 ef	3.53 d-f	4.00 cd	46.67 fg	93.67 c-f	104.7 c
V_2T_3	35.60 a-c	46.05 b-e	50.77 a-c	14.13 bc	18.87 a-c	33.20 b-d	3.00 cd	3.60 d-f	4.20 b-d	49.33 ef	85.00 f-h	83.67 de
V_2T_4	33.37 a-d	45.56 b-e	48.45 a-e	11.87 e-g	17.07 b-f	27.40 f-h	2.40 ef	3.40 e-g	4.07 cd	37.43 h-j	80.33 gh	108.3 c
V_2T_5	36.37 ab	47.19 ab	52.11 ab	14.87 ab	20.07 a	37.40 a	3.40 b	4.20 ab	4.87 a	60.77 c	106.0 c	153.0 b
V_2T_6	31.63 cd	40.84 d-f	43.52 ef	10.93 gh	15.03 f	26.00 g-i	2.33 f	3.17 f-h	3.40 ef	37.00 ij	61.00 i	69.00 fg
V_2T_7	30.07 d	37.01 f	41.09 f	9.80 h	15.47 ef	23.00 ij	1.93 g	2.87 h	3.13 f	30.87 kl	52.67 i	62.67 g
V_2T_8	33.05 b-d	43.59 b-e	47.09 b-f	12.33 d-f	16.60 c-f	28.00 f-h	2.60 ef	3.40 e-g	3.93 de	42.33 g-i	93.33 d-f	86.67 de
LSD (0.05)	**4.13**	**5.65**	**6.23**	**1.23**	**2.39**	**3.82**	**0.35**	**0.46**	**0.54**	**5.98**	**12.66**	**13.31**
CV (%)	**7.23**	**7.60**	**7.66**	**5.78**	**8.23**	**7.81**	**7.57**	**7.58**	**7.71**	**7.39**	**8.55**	**8.37**

In a column, means with similar letter (s) are not significantly different by LSD at 5% level of significance.

V_1: BARI mash-2, **V_2**: BARI mash-3; **T_1**: Recommended Fertilizer (RF), **T_2**: RF+ Foliar Spray (FS) of water at flower initiation (FI), **T_3**: RF+ Urea (2%) FS at FI, **T_4**: RF+ Boron (1%) FS at FI, **T_5**: RF+ Urea (2%) + Boron (1%) FS at FI, **T_6**: Urea (2%) FS at FI, **T_7**: Boron (1%) FS at FI, **T_8**: Urea (2%) + Boron (1%) FS at FI

Table 2. The effects of variety and added foliar application on the yield and yield parameters of Blackgram

Treatment	**Pods plant^{-1}**	**Pod length (cm)**	**Seeds pod^{-1}**	**1000 seed weight (g)**	**Seed yield (t ha^{-1})**	**Stover yield (t ha^{-1})**	**Biological yield (t ha^{-1})**	**Harvest index (%)**
V_1T_1	20.93 cd	4.04 d-f	6.07 ab	33.67 b-e	1.04 c-e	1.36 c-e	2.40 de	43.46 b
V_1T_2	20.73 cd	4.17 b-f	5.72 a-e	35.33 bc	1.05 c-e	1.40 cd	2.45 c-e	42.90 b

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V_1T_3	25.67 b	4.14 c-f	5.75 a-e	34.00 b-d	1.15 bc	1.58 ab	2.73 ab	42.11 b
V_1T_4	24.40 b	4.28 a-e	5.40 d-f	34.00 b-d	1.13 bc	1.38 cd	2.51 b-d	45.16 ab
V_1T_5	31.70 a	4.58 a	6.11 ab	39.67 a	1.29 a	1.64 a	2.93 a	44.07 ab
V_1T_6	16.67 fg	3.97 ef	5.35 d-f	34.67 b-d	0.97 e-g	1.31 c-e	2.28 ef	42.77 b
V_1T_7	14.07 h	3.93 f	5.10 f	33.00 c-e	0.86 hi	1.12 fg	1.98 gh	43.44 b
V_1T_8	19.40 de	4.39 a-c	5.43 d-f	35.33 bc	1.01 d-f	1.27 d-f	2.28 ef	44.51 ab
V_2T_1	20.13 cd	4.30 a-e	5.87 a-d	33.67 b-e	0.93 f-h	1.21 ef	2.14 fg	43.57 ab
V_2T_2	20.73 cd	4.24 b-f	5.85 a-d	34.00 b-d	1.06 c-e	1.33 c-e	2.38 de	44.27 ab
V_2T_3	21.87 c	4.31 a-d	6.03 a-c	35.00 b-d	1.08 b-d	1.36 c-e	2.44 c-e	44.33 ab
V_2T_4	19.53 de	4.02 d-f	5.57 b-f	34.67 b-d	1.02 d-f	1.27 d-f	2.29 d-f	44.33 ab
V_2T_5	26.00 b	4.49 ab	6.27 a	37.33 ab	1.18 b	1.46 bc	2.64 bc	44.78 ab
V_2T_6	17.67 ef	3.98 d-f	5.44 c-f	31.33 de	0.89 g-i	1.01 g	1.90 h	46.83 a
V_2T_7	15.07 gh	3.92 f	5.20 ef	30.00 e	0.82 i	1.02 g	1.84 h	44.68 ab
V_2T_8	20.80 cd	4.10 c-f	5.93 a-d	34.00 b-d	1.04 c-e	1.25 d-f	2.30 d-f	45.41 ab
LSD (0.05)	**2.19**	**0.33**	**0.59**	**3.97**	**0.11**	**0.17**	**0.22**	**3.35**
CV (%)	**6.23**	**4.76**	**6.22**	**6.90**	**6.42**	**7.47**	**5.75**	**4.54**

In a column, means with similar letter (s) are not significantly different by LSD at 5% level of significance.

V_1: BARI mash-2, **V_2**: BARI mash-3; **T_1**: Recommended Fertilizer (RF), **T_2**: RF+ Foliar Spray (FS) of water at flower initiation (FI), **T_3**: RF+ Urea (2%) FS at FI, **T_4**: RF+ Boron (1%) FS at FI, **T_5**: RF+ Urea (2%) + Boron (1%) FS at FI, **T_6**: Urea (2%) FS at FI, **T_7**: Boron (1%) FS at FI, **T_8**: Urea (2%) + Boron (1%) FS at FI

Yield and Yield Contributing Parameters:

Significant difference was observed due to interaction effect of variety and foliar spray on number of pods per plant, pod length, seeds per pod, 1000-seed weight, seed yield, stover yield, biological yield and harvest index (Table 2). The highest pods plant^{-1} (31.70) was found from V_1T_5 and the lowest pods plant^{-1} (14.07) was recorded from the V_1T_7 which was statistically significant with V_2T_7 (Table 3). According to [7], applying liquid fertilizers to legume crops at a greater dose resulted in an increase in the number of pods per plant. According to [15], mungbean produced more pods per plant (15.2) than other treatments when 1.5% urea was applied alone or in combination with different micronutrients like boron, molybdenum, zinc, calcium, and iron at 0.1 percent with four sprays at 4-day intervals from flowering to pod development stage. The control group had the fewest pods per plant (11.8). Pod length of Blackgram significantly influenced by variety and foliar spray. Results showed that highest pod length (4.58) was observed in V_1T_5 which is statistically similar with V_1T_4, V_1T_8, V_2T_1, $V_2T_3$and V_2T_5 whereas the lowest pod length (3.93) was observed

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in V_1T_7 which was statistically similar with all other treatment except V_1T_4, V_1T_5, V_1T_8, V_2T_1, V_2T_3 and V_2T_5 (Table 2). According to [23], foliar spraying with 2% urea increased the number of pods per plant (44.72), and Blackgram yield increased significantly in comparison to the control (21.31). Blackgram was significantly influenced by combined effects of varieties and foliar application on seeds pod^{-1} (Table 2). The highest seeds pod^{-1} (6.27) was recorded with the treatment combination of V_2T_5 which was statistically similar with V_1T_1, V_1T_2, V_1T_3, V_1T_5, V_2T_1, V_2T_2, V_2T_3 and V_2T_8. The lowest seeds pod^{-1} (5.10) was found in V_1T_7 treatment which was statistically similar with V_1T_4, V_1T_6, V_1T_8, V_2T_4, V_2T_6 and V_2T_7. 1000 seeds weight of Blackgame also influenced significantly with variety and foliar application. It was found that the highest 1000 seed weight (56.67 g) was recorded from the treatment combination of V_1T_5 followed by V_2T_5. The lowest 1000 seeds weight (30.00 g) was found in V_2T_7 treatment which was statistically identical with V_1T_1, V_1T_7, V_2T_1 and V_2T_6 (Table 3). According to [15], 100 seed weight (5.19 g) of Mungbean was achieved by applying 1.5% urea alone or a mixture of nitrogen and several micronutrients, such as boron, molybdenum, zinc, calcium, and iron @ 0.1% with four sprays at 4-day intervals from flowering to pod. [24] found that the chickpea's 1000 seed weight increased significantly when 2% urea spray was applied at 75 DAS (16.9), with the exception of the control treatment, which was comparable to other treatments. In case of seed yield, the result revealed that, the highest seed yield (1.29 t ha) was contained of the combination V_1T_5 which was statistically not similar with any other treatment. The lowest seed yield (0.82 t ha^{-1}) was recorded from the combination V_2T_7 which was statistically similar with $V_1T_7$and V_2T_6 combination (Table 2). According to [16] study, foliar spraying of urea at a rate of 1.5% three times throughout the reproductive stages of soybeans can be utilized to improve seed yield (3.19 t ha-1) by improving physiological characteristics and yield. By delaying the loss of chlorophyll and leaf nitrogen with tumid photosynthetic efficiency, foliar application of urea improved seed output [17]. This outcome is consistent with recent research findings [5] and [6] that shown the beneficial effects of nano nitrogen on seed yield and for several legume crops. Stover yield ha^{-1} was significantly influenced by the combined effect of variety and foliar application. It was recorded that the highest stover yield ha^{-1} (1.64) was found from the treatment combination of V_1T_5 followed by V_1T_3. On the contrary, the lowest stover yield (1.01t ha^{-1}) was recorded from V_2T_7 followed by $V_1T_7$and V_2T_7 (Table 2). In field trials, [9] discovered that foliar treatment of planto zyme (liquid biofertilizer) combined with macronutrient (N, P, K, etc.) and micronutrient (Zn, B, Mn, etc.) at 50 ml ha1 resulted in an additional 214 kg ha1 (24.4%) of grain yield in Blackgram. The effects of different variety and foliar application on the biological yield of Blackgram was significantly varied (Table 2). The maximum biological yield (2.93t ha^{-1}) was observed with the interaction of V_1T_5 which were statistically similar with V_1T_3. On the other hand, the minimum biological yield (1.84 t ha^{-1}) was recorded in V_2T_7 treatment combination which was statistically similar with V_1T_7 and V_2T_6. Combined effects of variety and foliar application on harvest index was significantly influenced of Blackgram. It was found that the highest harvest index (44.05%) was recorded from the treatment combination of V_2T_6 which was statistically similar with all other treatment except V_1T_1, V_1T_2, V_1T_3, V_1T_6 and V_1T_7.The lowest harvest index (42.11%) was found from V_1T_3 followed by V_1T_1, V_1T_2, V_1T_3, V_1T_6 and V_1T_7 (Table 2).

CONCLUSION

The current study demonestrated that variety and foliar application had significant effect on plant height, number of leaves, number of branches, nodules per plant and yield and yield contributing characters of BARI Mash-2 and BARI Mash-3. The optimum results were observed in BARI Mash-2 Blackgram variety. Therefore, our findings suggest that foliar application of urea (2%) + boron (1%) at flowering stage along with recommended fertilizer giving maximum seed yield, 1000 seed weight, stover and biological yield.

RECOMMENDATION

Further study may be conducted at different growing areas of Bangladesh for justification of the treatment variability towards improvement of the crop.

CONFLICT OF INTEREST

No conflicts of interests exist.

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