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Yield Pattern of Blackgram As Affected By Different Nitrogen Application Methods

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Abstract
The experiment was conducted at the farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during the period from September to December, 2017 to study the response of black gram with maximum utilization of nitrogen given in different method. The variety BARI mass-3 was used as the test crop. The experiment consisted of 16 treatments. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Results revealed that data on different growth, yield and yield contributing characters of black gram were recorded and significant variations were observed among the studied characters. Treatment T_1 (Prilled Urea given in furrows) registered the maximum plant height (22.22cm, 53.91cm, 53.91cm, 74.86cm and 76.53cm), leaves plant^{-1} (4.03, 10.20, 17.93, 20.50 and 22.57), branches plant^{-1} (1.53, 4.26, 4.57, 5.11 and 6.00) and highest total dry weight (0.43g, 4.57g, 15.0 g, 28.31g and 21.19g) at 15, 35, 55, 75 DAS and harvest, respectively. The maximum yield contributing characters like pods plant^{-1} (20.10), pod length (4.57cm), seeds pod^{-1} (6.80) and 1000-seeds weight (60.93g) were found when crop was given prilled urea in furrow (T_1). The highest seed yield, stover yield and biological yield were noted as 1.32 tha^{-1}, 2.23 tha^{-1} and 3.55 tha^{-1} from T_1, respectively, when T_{15} showed the minimum seed yield (1.00t ha^{-1}), stover yield (1.52 tha^{-1}) and biological yield (2.39 tha^{-1}). It was evident that black gram plant gave maximum seed yield when prilled urea given in furrows near the seed may facilitate plant to uptake maximum nitrogen for better growth, development and yield of black gram.

Keywords: *Black gram, Nitrogen, Application Method, Yield*

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I. Introduction

Blackgram (*Vigna mungo* L.) is an important legume protein rich crop, which belongs to sub-family Papillionaceae under the family fabaceace. This is the native of India, and is well known by the names of mashkalai and urid. Blackgram plays an important role to supplement protein in the cereal-based low-protein diet of the people of Bangladesh, but the acreage production of blackgram is gradually declining (BBS, 2017). In fact, it is one of the least cared crops. When nitrogen is very loosing nutrient with broadcast application. 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 (Hussain *et al*., 2008). Soils of Bangladesh are mostly deficient in nitrogen. Nitrogen increases the dry matter and protein percentage of grain as well as methionine and triptophen contents in seed with the increased of levels of applied nitrogen (Vidhate *et al*., 1986). Probably that is why blackgram is highly responsive to nitrogen. The higher grain yield of blackgram is associated with significantly superior yield attributes e.g. pods per plant and 1000-seed weight (Singh *et al*., 1993). In trifoliate stage the root nodules are not well established it faced with lack of nitrogen fixation and seed yield decreased (Sarparast, 2000). So, nitrogen management is required synchronizing this demand of plant growth stages. Triggering nitrogen at the plant demand would be attempt towards yield improvements of pulse. Keeping this in mind attention is given on nitrogen placement or use of Urea Super Granule (USG) in pulse. Both these ways of nitrogen placement might have some influencing technique that would be better utilization by the major nutrient nitrogen for its maximum seed yield. Bhardwaj and Singh (1993) found maximum grain yield in rice (6.8 t ha^{-1}) when placing nitrogen fertilizer as prilled or USG. Hence, the present study was undertaken to maximize the growth and seed yield of blackgram with nitrogen fertilizer application as prilled urea (PU) and urea super granule (USG).

II. Materials and Methods

The experiment was conducted at the Agronomy field of Sher-e-Bangla Agricultural University, Dhaka-1207 during the period from September, 2017 to December, 2017. The experimental area was situated at $23^0$77'N latitude and $90^0$33'E longitude at an altitude of 8.6 meter above the sea level (Anon., 2004). The experimental site belongs to the Agro-ecological zone of "The Modhupur Tract", AEZ-28. A composite sample was made by collecting soil from several spots of the field at a depth of 0-15 cm before the initiation of the experiment and analyzed from Soil Resources Development Institute (SRDI), Khamarbari, Farmgate, Dhaka. The collected soil was air-dried, grind and passed through 2 mm sieve and analyzed for some important physical and chemical properties. The analytical data of the soil sample collected from the experimental area were 27% sand, 43% silt, 30% clay, organic matter 0.78% and details are presented in Appendix II. The variety BARI mash-3 was used as the test crops. Urea, Triple super phosphate (TSP) and Muriate of potash (MoP) were used as a source of nitrogen, phosphorous and potassium, respectively in the experimental plot. Urea was applied as prilled urea (PU) and urea super granule (USG) as per treatment. Prilled urea was applied in broadcasts, furrow and between two furrows. TSP and MoP were applied at the rate of 40 and 50 kg per hectare, respectively following the Bangladesh Agricultural Research Institute (BARI) recommendation for blackgram cultivation. All of the fertilizers were applied during final land preparation. USG (1.8 g) placed at 10 cm depth following treatments variables. The experiment consists of 16 treatments such as T_0 = Prilled urea (PU) broadcast, T_1 = PU given in furrows, T_2 = PU given between two rows, T_3 = PU and seeds given in same furrows, T_4 = USG placed at 10 cm distance (avoid one row), T_5 = USG placed at 10 cm distance (avoid two rows), T_6 = USG placed at 10 cm distance (avoid three rows), T_7 = USG placed at 20 cm distance (avoid one row), T_8 = USG placed at 20 cm distance (avoid two rows), T_9 = USG placed at 20 cm distance (avoid three rows), T_{10} = USG placed at 30 cm distance (avoid one row), T_{11} = USG placed at 30 cm distance (avoid two rows), T_{12} = USG placed at 30 cm distance (avoid three rows), T_{13} = USG placed at 40 cm distance (avoid one row), T_{14} = USG placed at 40 cm distance (avoid two rows), T_{15} = USG placed at 40 cm distance (avoid three rows). USG (1.8 g) placed at 10 cm depth in each case. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. An area of 57.5 m × 19.0 m was divided into three equal blocks. Each block was divided into 16 plots where 16 treatments were allotted at randomly. There were 48 unit plots altogether in the experiment. The size of the each unit plot was 5.0 m × 3.0 m. The space between two blocks and two plots were 1.0 m and 0.5 m, respectively. The seeds of blackgram were sown on 09 September, 2012. Before sowing seeds were treated with Bavistin to control the seed borne disease. The seeds were sown in solid rows in the furrows having a depth of 2-3 cm. Row to row distance was 30 cm. The crop was harvested on two times, first harvest was done on December 06, 2012 and second harvest was done December 13, 2012 at full maturity of the crop when the color of leaf turned yellow and dropped off. The first crop sampling was done on 20 days after sowing (DAS) starts from 15 DAS and continued up to harvest. Harvesting of the blackgram was done after 85 days of sowing. Data were recorded for 10 individual plants per plots in each replication. Yield data were also collected after harvest. The plants were separated into shoot including leaf and roots and then their dry weight were recorded after drying them in oven at 80±2°C for 72 hours. The data obtained from experiment on various parameters were statistically analyzed by MSTAT-C computer program. The mean values for all the parameters were calculate and the analysis of variance (ANOVA) for the characters was accomplished. The significant of differences between pair of means was tested by the Least Significant Differences (LSD) test at 5 % levels of probability (Gomez and Gomez, 1984).

III. Results and Discussion

Pods plant^{-1} of blackgram varied significantly due to different nitrogen management under the present trial. The highest number of pods plant^{-1} (22.17) was recorded from T_1 which was statistically similar to T_2, T_3, T_4 and T_5 whereas the lowest number of pods plant^{-1} (14.44) was observed from T_0 treatment which was statistically similar to T_6, T_7, T_8, T_9, T_{10}, T_{11}, T_{12}, T_{13}, T_{14}, and T_{15} (Table 5). Treatment T_1 registered 34.24% more pods plant^{-1}over T_{15} Treatment. Data represents that use of prilled urea and USG supported plant with maximum dry matter production which eventually produced maximum number of pods plant^{-1}. Patel and Parmer (1986) observed that increasing N application to rainfed blackgram (cv. Gujrat-1) from 0 to 50 kg N ha^{-1} increased the number of pods plant^{-1}. Due to different nitrogen management system, number of seeds pod^{-1} of blackgram varied significantly. The highest number of seeds pod^{-1} (8.52) was recorded from T_1, while the lowest number of seeds pod^{-1} (4.73) was observed in T_0 which was similar to T_8, T_9, T_{10}, T_{11}, T_{12}, T_{13}, T_{14}, and T_{15} (Table 5). Treatment T_1 produced 42.61% more seeds pod^{-1} over T_{15} Treatment. Malik *et al.* (2003) reported that number of seeds pod^{-1} was significantly influenced by varying levels of nitrogen. Pod length of blackgram did not varied significantly due to different nitrogen management practices. Numerically, it varied from 3.87cm to 4.57cm. Longest pod length (4.57 cm) was recorded from T_1 whereas the shortest pod length (3.87 cm) was observed from T_{15} (Table 1). Statistically no significant variation was recorded for weight of 1000-seed of blackgram due to different nitrogen management system. Numerically, it varied from 55.95g to 60.93g. The

highest weight of 1000-seed (60.93g) was found from T_1 treatment; whereas the lowest 1000-seed weight (55.95 g) was recorded from T_{15} (Table 5). Akter (2010) reported that 1000-seed weight was highest when USG (1.8 g) was applied as basal dose and lowest when USG was applied at 25 DAS in mustard. Statistically significant variation was recorded for stover yield hectare^{-1} of blackgram due to different nitrogen management. The highest stover yield (2.23 tha^{-1}) was observed in T_1, which was statistically similar to T_0 and T_2, while the lowest stover yield (1.39 tha^{-1}) was observed in T_{15} treatment which was significantly different from all other treatments (Table 1). Srinivas *et al.* (2002) observed that stover yield increased with increasing rates of N up to 40 kg ha^{-1}. Statistically significant variation was recorded for biological yield of blackgram due to different nitrogen management. The highest biological yield (3.55t ha^{-1}) was observed in T_1 which was statistically similar to T_0 and T_2, while the lowest biological yield (2.39 t ha^{-1}) was observed in T_{15}, which was similar to T_{14} treatment (Table 1). Rajender *et al*. (2003) reported that biological yield increased with increasing N rates up to 20 kg ha^{-1} and further increase in N did not affect biological yield. Harvest index of blackgram showed statistically significant variation due to different nitrogen management. The highest harvest index (41.82%) was observed from T_{15}, whereas the lowest harvest index (33.81%) was observed from T_{12} treatment (Table 1).

Yield of blackgram varied significantly with treatment variations. The highest seed yield (1.32 tha^{-1}) was recorded from T_1, which was statistically similar to T_0, T_3, T_4, T_5, T_6 and T_7, respectively, whereas the lowest seed yield (1.00 tha^{-1}) was observed from T_{15} which was similar to T_7, T_8, T_9, T_{10}, T_{11}, T_{12}, T_{13} and T_{14} treatment, respectively (Figure 1).

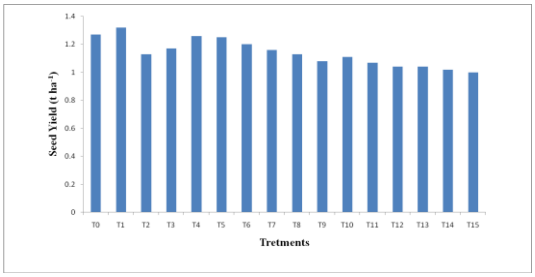

Figure 1. Effect of nitrogen managements on seed yields of blackgram (SE value- 54.50)

Treatment T_1 registered 24.24% more yield over T_{15} Treatment. The maximum yield was harvested due to maximum pods plant^{-1}, pod length, which had greater number of seeds and 1000-grain weight. It may be reported that prilled urea was placed in furrow probably lost minimum and maximum used by plants in reproductive stage this sources threats growth and yield values. Nadeem *et al*. (2004) reported that the application of fertilizer significantly increased the yield and the maximum seed yield was obtained when 30 kg N ha^{-1} was applied. Patel *et al*. (1992) reported that application of nitrogenous fertilizers becomes helpful in increasing the yield. The placement of USG at 8-10 cm depth of soil can save 30% nitrogen than prilled urea, increases nutrient absorption, improves soil health and ultimately increases the yields (Singh *et al*., 1993). Akter (2010) reported that seed yield was highest when USG (1.8 g) was applied as basal dose and lowest value USG was applied at 25 DAS in mustard.

Table 1. Effect of nitrogen managements on pods plant^{-1}, seeds pod^{-1}, pod length and 1000-seed weight, Stover yield, biological yield and harvest index of blackgram at harvest

Treatments	Pod plant^{-1}	Seed pod^{-1}	Pod length (cm)	1000-seed weight (g)	Stover yield (tha^{-1})	Biological yield (tha^{-1})	Harvest index (%)
T_0	14.44 d	4.73 d	4.43	60.62	2.08 a-c	3.35 ab	37.90 e
T_1	22.17 a	8.52 a	4.57	60.93	2.23 a	3.55 a	37.18 f
T_2	20.89 ab	6.85 b	4.30	57.60	2.13 ab	3.27 a-c	34.71 h
T_3	20.77 ab	6.84 b	4.23	58.53	2.04 bc	3.21 b-d	36.61 g
T_4	19.30 a-c	6.69 b	4.33	60.02	1.92 c-e	3.17 b-d	39.60 c
T_5	19.14 a-c	6.57 b	4.30	59.83	1.90 c-e	3.15 b-e	39.69 c
T_6	17.91 b-d	6.47 bc	4.17	59.63	1.79 d-f	2.99 c-g	40.23 b
T_7	17.73 b-d	6.45 bc	4.13	58.10	1.91 c-e	3.07 b-f	37.79 e
T_8	16.93 cd	5.75 b-d	4.10	57.43	1.96 b-d	3.09 b-e	36.52 g
T_9	16.43 cd	5.78 b-d	4.03	57.17	1.66 f	2.74 fg	39.41 c
T_{10}	16.87 cd	5.73 b-d	4.03	57.37	1.79 d-f	2.90 d-g	38.43 d
T_{11}	16.22 cd	5.85 b-d	4.00	56.72	1.81 d-f	2.89 d-g	37.14 f
T_{12}	15.87 cd	5.82 b-d	4.00	56.15	2.04 bc	3.09 b-e	33.81 i

T_{13}	15.88 cd	5.75 b-d	3.97	56.47	1.75 ef	2.80 efg	37.29 f
T_{14}	15.12 d	5.08 cd	3.93	56.02	1.68 f	2.70 gh	37.77 e
T_{15}	14.58 d	4.89 d	3.87	55.95	1.39 g	2.39 h	41.82 a
SE	1.180	0.42	0.21	2.441	0.05	0.11	0.13
CV %	11.67	11.95	8.94	7.29	8.94	9.13	10.87

T_0 = Prilled urea (PU) broadcast, T_1 = PU given in furrows, T_2 = PU given between two rows, T_3 = PU and seeds given in same furrows, T_4 = USG placed at 10 cm distance (avoid one row), T_5 = USG placed at 10 cm distance (avoid two rows), T_6 = USG placed at 10 cm distance (avoid three rows), T_7 = USG placed at 20 cm distance (avoid one row), T_8 = USG placed at 20 cm distance (avoid two rows), T_9 = USG placed at 20 cm distance (avoid three rows), T_{10} = USG placed at 30 cm distance (avoid one row), T_{11} = USG placed at 30 cm distance (avoid two rows), T_{12} = USG placed at 30 cm distance (avoid three rows), T_{13} = USG placed at 40 cm distance (avoid one row), T_{14} = USG placed at 40 cm distance (avoid two rows), T_{15} = USG placed at 40 cm distance (avoid three rows). USG (1.8 g) placed at 10 cm depth in each case.

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability

IV. Conclusion

From the observed data of present experiment, it may be concluded that black gram plant gave maximum seed yield when prilled urea given in furrows near the seed may facilitate plant to uptake maximum nitrogen for better growth, development and yield of black gram.

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