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Article

Effect of nitrogenous fertilizer on yield of mungbean [*Vignaradiata* (L.) Wilczek] in Patuakhali district of Bangladesh

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Abstract: An experiment was conducted at the research field of the Horticulture Research Center at Labukhali, Patuakhali during the period from January to March 2014 to find out the most suitable BARI mungbean variety and optimum rates of N concerning higher seed yield under the regional condition of Patuakhali (AEZ–13). Two BARI mungbean varieties namely BARI mung–5 (V_1) and BARI mung–6 (V_2) and five levels of N fertilizer including control *viz.* 0 kg N ha^{-1} (N_0), 30 kg N ha^{-1} (N_{30}), 45 kg N ha^{-1} (N_{45}), 60 kg N ha^{-1} (N_{60}), and 75 kg N ha^{-1} (N_{75}) were used for the present study as level factor A and B, respectively. In case of variety, BARI mung–6 produced significantly longest pod (7.56 cm), maximum pods (9.14) plant^{-1}, maximum seeds (9.14) pod^{-1}, higher weight of 100–seed (4.48 g), highest seed weight (4.33 g plant^{-1}) and highest seed yield (1.56 t ha^{-1}) than BARI mung–5 at harvest. In case of N fertilizer, longest pod (7.96 cm), maximum pods plant^{-1} (10.45), maximum seeds pod^{-1} (9.70), higher weight of 100–seed (4.52 g), higher weight of seed (5.73 g plant^{-1}) and greater seed yield (1.85 t ha^{-1}) were also obtained in 45 kg N ha^{-1} compare other N levels. The BARI mung–6 × 45 kg N ha^{-1} for seed yield was found under the regional condition of Patuakhali (AEZ-13).

Keywords: BARI mung–6; yield; nitrogenous fertilizer

1. Introduction

Mungbean [*Vignaradiata* (L.) Wilczek] is an important legume and short duration pulse crop of the South Asian Countries. In Bangladesh, it is grown annually on an area of 68 thousand acres and a total production of 19 thousand M tones with an average seed yield of 279 kg per acre during the year 2010–11 (BBS, 2012) which is very low as compared to other countries of the region. Nearly 65% of the total mungbean area is in the southern districts or Barisal region. The agro–climatic conditions of the region favor planting mungbean in late January to early February on the land where the preceding crop is usually wetland rice (Afzal*et al.*, 2004). A minimum intake of pulse by a human should be 80.0 g per day (FAO, 1999) whereas it is only 19.35 g per day in Bangladesh (BBS, 2009). It is rich in essential amino acids especially lysine, which is deficient in most of the cereal grains (Sarwar *et al*., 2004).Islam *et al*. (2013) reported that mungbean is a popular and widely grown pulse in Bangladesh. Coastal farmers are now cultivating BARI-Mung varieties, but many farmers are still

reluctant to adopt these improved varieties that need to be identified. Among the environmental factors, excess rain at the time of reproductive period causes enormous loss of both seed yield and seed quality of mungbean (Williams *et al.*, 1995). Besides, Salinity is a common a biotic stress factor seriously affecting crop production in different regions, particularly in arid and semi – arid regions (Munns, 2005). So, we need to develop and find out the suitable variety which would be more productive under saline and/or irrigated condition such as Southern region of Bangladesh. These mungbean mutants/varieties are needed to be assessed for their suitability with respect to photosynthetic and yield related parameters (Islam and Razzaque, 2010). Therefore, attention should be given to increasing yield through the proper selection of high yielding varieties (Singh *et al*., 2009). Haque (2008) also reported that the pulses although fix nitrogen from the atmosphere, there is evident that application of nitrogenous fertilizers becomes helpful in increasing the yield. Excessive nitrogen application causes physiological disorder (Obreza and Vavrina, 1993). Research revealed that mungbean yield and quality could improve by the use of balanced fertilizers (Aslam *et al*., 2010). Abbas (1994) reported that application of NPK at the rate of 25-50-75 kg ha^{-1} gave the highest grain yield of 1666 kg ha^{-1}. The maximum seed yield i.e., 224.2 g m^{-2} was obtained when 90 kg N was applied. The maximum number of pods $plant^{-1}$ (20.87), pods length (8.71 cm), seeds pod^{-1} (8.53), 1000 seeds (27.82 g) and seed yield (1.40 t ha^{-1}) obtained in fertilizer application at the rate of 45:80:55 kg NPK ha-1 + Rhizobium inoculation (Hossain *et al*., 2011).
Hence, the study was undertaken to maximize the seed yield of mungbean with optimum nitrogen dose under the regional condition of Patuakhali (AEZ–13).

2. Materials and Methods

A field experiment was conducted at the research field of Horticulture Research Center at Labukhali, Patuakhali during the period from January to March 2014 (during *Rabi* season) to study the growth, development, yield and yield attributing of two BARI mungbean (*Vigna radiate* L.) varieties as influenced by five different rates of mineral nitrogen under the regional condition of Patuakhali (AEZ–13).This section for convenience of presentation has been divided into various sub–sections such as experimental site, soil, climatic condition, experimental materials, land preparation, experimental design, nutrient application, seed sowing, intercultural operations, harvesting and threshing, data collection and statistical analysis.

2.1. Site selection

Geographically, the research farm is located at $22^0 37'$ N latitude and $89^0 10'$ E longitudes. The maximum area is covered by Gangetic Tidal Floodplains and falls under Agroecological Zone "AEZ– 13". The area lies at 0.9 to 2.1 meter above mean sea level.

2.1.1. Soil

Soil characteristics of the experimental area are silty loams having pH value of 6.5.

2.1.2. Climate

Generally, Patuakhali region falls under the sub–tropical climate, which is characterized by high temperature and humidity, heavy rainfall with occasional gusty winds in the month of April to September and less rainfall associated with moderately low temperature during October to March (Biswas, 1987).

2.2. Description of the experimental materials

The study consists of two sets of treatments; the first set comprised of two BARI mungbean varieties and the second set consisted of nitrogen doses.

2.2.1. Plant materials

Two BARI mungbean varieties were used for this experiment as level factor A. The seeds of both varieties were collected from the BADC, Jessore on 2 January, 2014. The two varieties of mungbean are as follows

V_1 : BARImung–5
V_2 : BARImung–5

2.2.2. Treatments

The experiment was undertaken to study the effects of five different levels of mineral nitrogen including control as level factor B on the growth and yield of mungbean. These five treatments were as follows

Factor A: BARI Mung-5

BARI Mung-6

Factor B: Five levels of nitrogen

N_0: control (without N)

N_{30}: Nitrogen at 30 kg ha^{-1}

N_{45}: Nitrogen at 45 kg ha^{-1}

N_{60}: Nitrogen at 60 kg ha^{-1}

N_{75}: Nitrogen at 75 kg ha^{-1}

So, therefore the treatments combinations were as follows

$V_1 \times N_0$: BARI mung–5 × control (Without N)

$V_2 \times N_0$: BARI mung–6 × control (Without N)

$V_1 \times N_{30}$: BARI mung–5 × Nitrogen at the rate of 30 kg ha^{-1}

$V_2 \times N_{30}$: BARI mung–6 × Nitrogen at the rate of 30 kg ha^{-1}

$V_1 \times N_{45}$: BARI mung–5 × Nitrogen at the rate of 45 kg ha^{-1}

$V_2 \times N_{45}$: BARI mung–6 × Nitrogen at the rate of 45 kg ha^{-1}

$V_1 \times N_{60}$: BARI mung–5 × Nitrogen at the rate of 60 kg ha^{-1}

$V_2 \times N_{60}$: BARI mung–6 × Nitrogen at the rate of 60 kg ha^{-1}

$V_1 \times N_{75}$: BARI mung–5 × Nitrogen at the rate of 75 kg ha^{-1}

$V_2 \times N_{75}$: BARI mung–6 × Nitrogen at the rate of 75 kg ha^{-1}

2.3. Experimental design and layout

The experiment consisted of two mungbean varieties and five different rate of nitrogen and was laid out in a randomized complete block design with three replications. The size of unit plot was 2.5 × 2.0 m^2 where block to block and plot to plot distance were 1.0 and 0.5 m, respectively. Row to row and seed to seed distance were also 25 and 10 cm, respectively, in each plot. So, the total plots were 30 (varieties 2 × N- level × replication 3).

2.4. Seed sowing

The seed of mungbean were sown in the research field on January 27, 2014. Seed were sown in rows by hand plough. The distances between row to row and seed to seed were 25 and 10 cm, respectively. Mature 2 seeds were placed in each point at 2–3 cm depth from the soil surface. The other activity with this research includemanuring and fertilizing, intercultural operations, thinning out, weeding, irrigation and drainage, disease and pest management etc.

2.5. Harvesting, threshing and drying

The crop was harvested with hand on different dates based on sowing time (27–29 March, 2014) at full maturity of the crop when the colour of leaf turned yellow and dropped off. The harvested crop of each plot was bundled separately and tagged properly. The bundles were dried in sunshine for 3–4 days and brought to a clean floor. Seeds and other plant parts were separated for collecting the data.

2.6. Sampling and data collection

The crop sampling was done at harvest. Harvesting of the mungbean was done after 66 days of sowing. Yield data were collected after harvest.

2.7. Data collection

The data of following parameters were collected. From the study area we used to collect Pod length, Number of pods $plant^{-1}$, Number of seed pod^{-1}, 100–grains weight, Seed weight, Seed yield. After harvesting, the grains were removed from the separated pods and then drayed in sun for 2–3 days. Finally, grain weights were taken on individual plot basis at moisture content of 12% and then converted into t ha^{-1}.

2.8. Statistical analysis

Data recorded for yield and yield contributing characters and seed quality characters were compiled and tabulated in proper form for statistical analyses. Analysis of variance was done following the split plot design with the help of MSTAT–C computer package programme. The mean differences among the treatments were evaluated with LSD test.

3. Results and Discussion

The experiment was conducted to investigate the effect of variety along with mineral nitrogen on the yield of mungbean under the regional condition of Patuakhali (AEZ-13). The main effect and interaction between the varieties and different rates of N were noticeable from the presented data. The mean values of these parameters have been presented in Tables 1 to 3. A detailed discussion on the presented results and possible interpretations are given in this chapter under the following headings.

3.1. Effect of varieties and rate of nitrogen on yield and yield attributes of mungbean

3.1.1. Length of pod

3.1.1.1. Effect of varieties

Differences in pod length were also observed between mungbean varieties where their effect had significant. Between two varieties, BARI mungbean produced significantly the longest pod (7.56 cm). These results indicated that the pod length differ significantly among the genotypes. Kabir and Sarkar (2008) reported that the highest length of pod was found in the variety BARI Mung–5 and the lowest was found in BARI Mung–2. Mondal *et al*. (2012) also reported that the variety BARI Mung–6, BINAmoog–6, and BUmung–2, produced larger pod than the other three high yielding varieties (BARIMung–4, BINAMoog–7, and BUMung–1).

3.1.1.2. Effect of rate of nitrogen

Effect of different doses of nitrogen influenced significantly in respect of pod length. It was found that the length of pod increased significantly due to increasing dose of nitrogen up to 45 kg N ha^{-1} and thereafter it decreased. The longest pod of mungbean (7.93 cm) was found in 45 kg N ha^{-1} followed by both 30 and 60 kg N ha^{-1} (7.56 and 7.53 cm, respectively) where both doses were statistically identical in respect of pod length. On the other hand, the shortest pod (6.54 cm) was observed from the control (0 kg N ha^{-1}). This result is in full agreement with Moniruzzaman *et al*. (2009). He reported that pod length was significantly influenced by higher dose of nitrogen. Noor-e-Alam Siddiqui (2010); Hossain (2007) also found significant variation in pod length due to nitrogen application.

3.1.1.3. Interaction effect between varieties and rate of nitrogen

The data on pod length was significantly affected due to interaction effect between varieties and combination of nitrogen. Among the interaction treatments, the longest pod (8.06 cm) was taken from the variety BARI Mung–6 while it was treated by 45 kg N ha^{-1} which was statistically differed from other treatment combinations. On the other hand, the shortest pod (6.17 cm) was obtained from the variety BARI Mung–5 grown under without N. Significant variation in pod length was also obtained by Noor-e-Alam Siddiqui (2010) who reported that nitrogen levels exerted significant influence on pod length where pod length increased up to 150 kg N ha^{-1} in BARI Jharsheem-1 and up to 100 kg N ha^{-1} in the genotypes BB-9 and BB-15.

3.1.2. Number of pods plant^{-1}

3.1.2.1. Effect of varieties

Number of pods plant^{-1} data was significantly influenced by the effect of varieties (Table 1). Between two varieties, BARI mung-6 recorded the maximum number of pods plant^{-1} (9.14) than that of BARI mung-5 (8.68). The variation in number of pods plant^{-1} was found due to the variation of branch production and also the genetic variations of genotypes. Similar findings were also trend by Hussain *et al*. (2011) who studied on growth and yield response of two mungbean (*Vignaradiata* L.) cultivars. He reported that the variation among varieties was significant and ChakwalMung–06 produced more no. of podsplant^{-1} than NM–92. Variation in pods plant^{-1} between varieties can be attributed to genetic makeup of the crop plants. Similarly, Hadi *et al*. (2012) also found that the overall maximum pods plant^{-1} (8.89) was yielded by Kulat–I compare to other tested varieties. He also reported that the local varieties gave better result as compare to Australian variety in salinity condition for their genetic variation. A similar finding was also found by Kabir and Sarkar (2008) in mungbean.

3.1.2.2. Effect of rate of nitrogen

The number of pods plant^{-1} in observing with different levels of nitrogen was found to be significant at 1% level of probability (Table 2). The maximum number of pods plant^{-1} (10.45) was obtained in 45 kg N ha^{-1} followed by 30 kg N ha^{-1} (9.50 cm). On the other hand, the control treatment (without N) produced the minimum number of pods plant^{-1} (7.55). It may be due to adequate supply of nitrogen to develop pod bearing branches. This result is in full agreement with Singh *et al*. (2009) who reported that higher number of pods plant^{-1} was in 180 kg ha^{-1} N application. Moniruzzaman *et al*. (2008) also reported that there was a significant effect of N fertilizers on pods production plant^{-1} whereas the maximum pods plant^{-1} was obtained with 120-120-60-20-4-1 kg of N-P_2O_5-K_2O-S-Zn-B.Parvez (2011) also found that high N dose (50 kg ha^{-1}) gave significantly higher number of pods and seeds pod^{-1}.

3.1.2.3. Interaction effect between varieties and rate of nitrogen

Interaction effect had also significant on production of pods plant^{-1} at harvest where it was significantly varied from 7.30 to 10.60 (Table 3). From the Table 3, it was found that the maximum number of pods plant^{-1} (10.60) was produced from the variety BARI mung–6 grown under 45 kg N ha^{-1} followed by the variety BARI mung–5 grown under similar doses of N (10.30). Similarly, the minimum number of pods plant^{-1} (7.30) was taken from the variety BARI Mung–5 grown under without N which was statistically differed from other interaction treatments.

3.1.3. Number of seeds pod^{-1}

3.1.3.1. Effect of varieties

Number of seeds pod^{-1} varied significantly due to mungbean varieties in this study (Table 1). Between two varieties, BARI mung–6 produced significantly the more seeds pod^{-1} (9.38) than BARI mung–5 (8.90) which might be due to the variation in characteristics of the studied both BARI mungbean varieties. The findings of Hussain *et al*. (2011) also similar with the present study in case of their investigation, they also found significant variant in seeds pod^{-1} due to mungbean varieties while the variety M–06 produced higher no of seeds pod^{-1} (7.49) than NM–92 (7.09). Sadeghipour (2008) reported that among the three varieties, Parietypartow gave significantly higher number of pods plant^{-1} than variety Barymung 2 and vc 6368. Similarly, Miah *et al*. (2009) also found significant variation in pod production while the highest number of pods plant^{-1} was found in BINA moog 7 which differences among the varieties might be due to their genetic constituents. Chowdhury (2006) also found significant variation where seed pod^{-1} was recorded from BU mung–4 than other genotypes which indicating the genetic superiority.

3.1.3.2. Effect of rate of nitrogen

A significant variation was found due to the effect of nitrogen in respect of seeds pod^{-1} (Table 2). Among the nitrogen doses, nitrogen at the rate of 45 kg ha^{-1} produced significantly the more seeds pod^{-1} (9.70) followed by 30 kg N ha^{-1} (9.30) while the minimum number of seeds pod^{-1} (8.70) was taken from the control or without nitrogen in this study (Table 2). The variation in pod production due to variation in rate of nitrogen was also found by Mian and Hossain (2014). They found that the no. of pods plant^{-1} (29.98) had maximum in N_{40} kg ha^{-1}. Similar results was also obtained by Parvez (2011) who found that high nitrogen dose gave significantly higher number of pods and seeds pod^{-1}.

3.1.3.3. Interaction effect between varieties and rate of nitrogen

Interaction effect had also significant on the production of seeds pod^{-1} at harvest (Table 3). From the Table 3, it was found that the variety BARI mung–6 produced significantly the more seeds pod^{-1} (10.10) while it was grown under 45 kg N ha^{-1} which was statistically differed from other interactions. Similarly, the minimum number of seeds pod (8.50) was taken from the variety BARI mung–5 grown under without N in this study which was also statistically differed from other interactions.

3.1.4. Hundred-seed weight (g)

3.1.4.1. Effect of varieties

Hundred seeds weight showed significant variation due to the effect of mungbean varieties in this study (Table 1). Between tow mungbean varieties, weight of 100–seed had higher (4.48 g) in BARI mung–6 than BARI Mung–5 (3.69 g). This variation in 1000-seed weight between varieties can be attributed to genetic makeup of the varieties. Kabir and Sarkar (2008) also found similar results in mungbean. He said the variation in 1000–seed weight among the varieties of mungbean might be due to their different genetic characteristics. This also might be due to the variation in seed weight pod^{-1} and plant^{-1}. The differences between varieties for 1000 seeds weight were also significant where the variety M– 06 produced significantly higher 1000–seed weight (37.59 g) than NM–92 (34.99 g) which was reported by Hussain *et al*. (2011). Chowdhury (2006) also found significant variation on 1000–seed weight due to mungbean varieties where higher 1000 seed weight was recorded from BU mung–4 than other varieties which indicating the genetic superiority.

3.1.4.2. Effect of rate of nitrogen

Effect of nitrogen had also significant on weight of 100–seed in this study (Table 2). Among the N doses, N at the rate of 45 kg ha^{-1} recorded the highest weight of 100–seed (4.52 g) followed by 30 kg N ha^{-1} (4.35 g) while it was lowest (3.74 g) in control treatment. Similarly, Mian and Hossain (2014) also found significant variation on 1000–seed weight where 1000-seed weight (37.70 g) had higher in N_{40} kg ha^{-1}. Similalry, Ayub *et al*. (1999) also found that the N at the rate of 40 kg ha^{-1} produced highest 1000-grain weight.

3.1.4.3. Interaction effect between varieties and rate of nitrogen

A significant variation was also found due to interaction effect between varieties and different doses of nitrogen in this study (Table 3). The highest weight of 100–seed (4.97 g) was found from the variety BARI Mung–6 while N was applied at the rate of 45 kg ha^{-1}. Similarly, the lowest weight of 100–seed (3.37 g) was found from the variety BARI mung–5 grown under without N while similar variety grown under 75 kg N ha^{-1} obtained the statistically similar lowest weight of 100–seed (3.41 g) (Table 3).

3.1.5. Weight of seeds

3.1.5.1. Effect of varieties

Seeds weight plant^{-1} was significantly influenced by the effect of mungbean varieties (Table 1). Between two varieties, BARImung–6 recorded the highest weight of seeds plant^{-1} (4.33 g) than BARI mung–5 (2.74 g). Similarly, Islam and Razzaque (2010) found that the BINA Moog–7 showed the highest seed yield which was identical to those of Binamoog–5, Binamoog–6, MBM–18, N_4J–210, N_4J–207, E_1J–608 and MBM–292 due to their genetic differences. The results of the present study was also similar to Miah *et al*. (2009); Chowdhury (2006). They reported that the variation in 1000–seed weight due to mungbean varieties indicating the genetic variability. Similarly, Hussain *et al*. (2011) also reported the variation in seed weight between varieties can be attributed to genetic make up of the crop plants.

3.1.5.2. Effect of rate of nitrogen

The weight of seeds plant^{-1} was significantly influenced by the application of different doses of nitrogen (Table 2). The higher weight of seeds plant^{-1} (5.73 kg) was obtained from 45 kg N ha^{-1} followed by 30 kg N ha^{-1} (4.49 g) while it was lowest (1.78 g) in control or without N. This might be due to better growth and development and larger pod formation with 45 kg N ha^{-1}. Kamanu *et al*. (2012) reported the similar findings and they found that inorganic fertilizer of 91 kg N ha^{-1} as DAP-CAN showed higher yield. Similarly, Ali *et al*. (2010) reported that all fertilizer doses enhanced chickpea seed yield significantly over control. However, higher grain yield (2140 kg ha^{-1} during 2006-07 and 2476 kg during 2007-08) with the application of 24 kg N was noted. Noor-e-Alam Siddiqui (2010) also reported that seed weight increased up to 150 kg N ha^{-1} in BARI Jharsheem.

3.1.5.3. Interaction effect between varieties and rate of nitrogen

A significant variation was also found due to interaction the variety and nitrogen doses in respect of seed weight in this study (Table 3). Among the treatments combination, the highest weight of seeds plant^{-1} (6.80 g) was observed from the variety BARI mung–6 while it was grown under 45 kg N ha^{-1} which was statistically differed from other treatments combination. On the other hand, the lowest weight of seeds plant^{-1} (1.42 g) was taken from the variety BARI mung–5 while N fertilizer was not applied.

3.1.6. Seed yield (t ha^{-1})

3.1.6.1. Effect of varieties

Analysis of variance data regarding to grain yield was significantly influenced by the effect of Mungbean varieties at harvest (Table 1). Table 1 indicated that the variety BARI Mung–6 produced comparatively higher yield of grain (1.56 t ha^{-1}) than BARI Mung–5 (1.16 t ha^{-1}). Genotypes play an important role in determining the yield of crops and the potential of genotypes within genetic limits and regional adaptability of 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. Variation in grain yield could be attributed to variation in yield components such as pod length and diameter, seed and 100–grain weight etc. In general, it was observed in the present study that the genotypes which had a good combination of yield contributing traits in terms of yield. Similarly, Bhuiyan *et al*. (2008) reported that the higher number of pods plant^{-1}, seeds pod^{-1}, pod and seed weight, 100–seed weight etc. exhibited the higher grain yield. Inoculated BARIMung–2 produced the highest seed yields as well as yield attributes such as pods plant^{-1} and seeds pod^{-1}. Similar findings were also found by Miah *et al*. (2009) who found that the variety BINA moog7 was ranked first in terms of seed yield followed in order of BINA moog 6, BINA Moog -5 and BINA Moog2. The differences among the varieties might be due to their genetic constituents. Kabir and Sarkar (2008) also found similar results in mungbean where they reported the variation in seed yield among the varieties of mungbean might be due to their different genetic characteristics. Similar observation was also obtained by Hossain (2007).

3.1.6.2. Effect of rate of nitrogen

The seed yield was significantly elevated by the application of nitrogen doses (Table 2). Among the various doses of nitrogen, the seed yield had higher (1.85 t ha^{-1}) in 45 kg N ha^{-1} followed by 30 kg N ha^{-1} (1.55 t ha^{-1}) and the minimum seed yield (0.99 t ha^{-1}) was obtained from the control treatment (Table 2). Similarly, Kamanu *et al*. (2012) reported that the inorganic fertilizer application 91 kg N ha^{-1} as DAP-CAN had the highest total yield. Eric Simonne *et al*. (2012), Ayub *et al*. (2010), Noor-e-Alam Siddiqui (2010) and Sen *et al*. (2010) and so many researchers were found significant variation in grain yield. Similarly, Rahman *et al*. (2009) also found similar result where BARC recommended fertilizer dose (T_2) gave better yield (0.86 t ha^{-1}) than that with farmer's doses in T_6 treatment. Kamithi and Akuja (2009) also found that the highest grain yield was 2,574.4 and 2,353.7kg grain ha^{-1} under 20 and 40 kg N ha^{-1}, respectively in seasons I. Similarly, Hussain *et al*. (2011) reported that the variation in seed weight between varieties can be attributed to genetic make up of the crop plants. Besides, N at the rate of 45 kg ha^{-1} showed the greater yield which might be due to the higher number of seeds, pods and larger sizes grain were obtained under this N levels which ultimately resulted the higher grain yield which findings are similar to Mondal *et al*. (2012).

Table 1. Effect of BARI mungbean varieties on yield and yield contributing characters at harvest.

Varieties	Number of pods plant^{-1}	Number of seeds pod^{-1}	100-seed weight (g)	Seed weight (g plant^{-1})	Seed yield (t ha^{-1})
BARI mung–5	8.680 b	8.900 b	3.690 b	2.744 b	1.158 b
BARI mung–6	9.140 a	9.380 a	4.482 a	4.332 a	1.564 a
CV (%)	1.12	0.35	1.36	0.30	2.46
$LSD_{(0.05)}$	0.04968	0.1987	0.04968	0.1571	0.1571

Figures followed by same letter(s) are statistically identical as per DMRT at 5% and dissimilar letter(s) showed significant different among them

Table 2. Effect of various doses of nitrogen on yield and yield contributing characters at harvest.

Nitrogen rate (kg ha^{-1})	Number of pods plant^{-1}	Number of seeds pod^{-1}	100-seed weight (g)	Seed weight (g plant^{-1})	Seed yield (t ha^{-1})
0	7.550 e	8.700 e	3.740 d	1.775 e	0.990 e
30	9.500 b	9.300 b	4.350 b	4.485 b	1.550 b
45	10.45 a	9.700 a	4.520 a	5.730 a	1.845 a
60	9.050 c	9.100 c	4.020 c	3.550 c	1.330 c
75	8.000 d	8.900 d	3.800 d	2.150 d	1.090 d
CV (%)	1.12	0.35	1.36	0.30	2.46
$LSD_{(0.05)}$	0.1224	0.0387	0.06704	0.0387	0.0387

Figures followed by same letter(s) are statistically identical as per DMRT at 5% and dissimilar letter(s) showed significant different among them

Table 3. Interaction effect of mungbean varieties and nitrogen rates on yield and yield contributing characters at harvest.

Varieties	Nitrogen rate (kg ha^{-1})	Number of pods plant^{-1}	Number of seeds pod^{-1}	100-seed weight (g)	Seed weight (g plant^{-1})	Seed yield (t ha^{-1})
BARI mung–5	0	7.300 i	8.500 g	3.370 h	1.420 i	0.840 h
	30	9.100 e	9.100 d	3.870 f	3.340 e	1.280 e
	45	10.30 b	9.300 c	4.070 e	4.660 c	1.560 c
	60	8.800 f	8.900 e	3.730 g	2.750 f	1.170 f
	75	7.900 h	8.700 f	3.410 h	1.550 h	0.940 g
BARI mung–6	0	7.800 h	8.900 e	4.110 de	2.130 g	1.140 f
	30	9.900 c	9.500 b	4.830 b	5.630 b	1.820 b
	45	10.60 a	10.10 a	4.970 a	6.800 a	2.130 a
	60	9.300 d	9.300 c	4.310 c	4.350 d	1.490 d
	75	8.100 g	9.100 d	4.190 d	2.750 f	1.240 e
CV (%)		1.12	0.35	1.36	0.30	2.46
$LSD_{(0.05)}$		0.1731	0.05474	0.09481	0.05474	0.05474

Figures followed by same letter(s) are statistically identical as per DMRT at 5% and dissimilar letter(s) showed significant different among them

3.2. Interaction effect between varieties and rate of nitrogen

Seed yield of the present study had also significant due to the interaction effects of varieties and various doses of N (Table 3). Among the treatments combinations, the highest seed yield (2.13 t ha^{-1}) was found from the variety BARI Mung–6 in the combination with 45 kg N ha^{-1} followed by the similar variety in with the association 30 kg N ha^{-1} (1.82 t ha^{-1}). Similarly, the lowest seed yield (0.84 t ha^{-1}) was taken from the variety BARI Mung–5 in along with control or without nitrogen.

4. Conclusions

Two BARI mungbean varieties namely BARI Mung–5 (V_1) and BARI Mung–6 (V_2) were used as planting materials as level factor A and five levels of nitrogen fertilizer including control *viz.* 0 kg N ha^{-1} (N_0), 30 kg N ha^{-1} (N_{30}), 45 kg N ha^{-1} (N_{45}), 60 kg N ha^{-1} (N_{60}), and 75 kg N ha^{-1} (N_{75}) were also perform as level factor B for the present study. BARI mung–6 produced significantly longest pod (7.56 cm), maximum pods plant^{-1} (9.14), maximum seeds pod^{-1} (9.14), higher weight of 100–seed (4.48 g), highest seed weight (4.33 g plant^{-1}) and highest seed yield (1.56 t ha^{-1}) than BARI mung–5 (0.80, 7.14 cm, 8.68, 8.90, 3.69 g, 2.74 g plant^{-1} and 1.16 t ha^{-1}, respectively) at harvest. Longest pod (8.06 cm), maximum pods plant^{-1} (10.60), maximum seeds pod^{-1} (10.10), higher weight of 100–seed (4.97 g), higher weight of seed (6.80 g plant^{-1}) and highest seed yield (2.13 t ha^{-1}) were exhibited from the variety BARI mung–6 grown under 45 kg N ha^{-1} while shortest pod (6.17 cm), minimum pods plant^{-1} (7.30), minimum seeds pod^{-1} (8.50), lowest weight of 100–seed (3.37 g), lowest weight of seed (1.42 g plant^{-1}) and lowest seed yield (0.84 t ha^{-1}) were taken from the variety BARI mung–5 in control or without N levels.From the above results it could be found that BARI mung–6 showed appreciative advantage concerning yield and yield attributes than BARI mung–5. Similarly, yield and yield attributing had highly significant in 45 kg ha^{-1} than control and over other all treatments.

Conflict of interest

None to declare.

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