*Asian Journal of Advances in Agricultural Research*

*9(1): 1-11, 2019; Article no.AJAAR.46950*
*ISSN: 2456-8864*

# Influence of Nitrogen on the Plant Growth and Seed Quality of Three T. (Transplanting) Aman Rice Varieties

**Rezoana Sultana[1], Muhibur Rahaman Siddikee[1], Mahmudul Hasan[2*], Tanjina Rahman[2], Arif Ahmed[3] and A. K. M. Ruhul Amin[4]**

*[1]Institute of Seed Technology, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.*
*[2]Department of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.*
*[3]Department of Agroforestry and Environmental Science, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.*
*[4]Department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.*

***Authors' contributions***

*This work was carried out in collaboration between all authors. Authors RS, MRS and MH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors TR and AA managed the analyses of the study. Author MH managed the literature searches. All authors read and approved the final manuscript.*

***Article Information***

DOI: 10.9734/AJAAR/2019/v9i129989
Editor(s):
(1) Dr. Marco Aurelio Cristancho, Centre for Bioinformatics and Computational Biology, BIOS Parque los Yarumos Manizales, Caldas, Colombia.
Reviewers:
(1) Rahul Datta, Mendel University in Brno, Czech Republic.
(2) Khadeza Yasmin, Sylhet Agricultural University, Bangladesh.
Complete Peer review History: http://www.sdiarticle3.com/review-history/46950

***Original Research Article***

***Received 21 October 2018***
***Accepted 03 February 2019***
***Published 28 February 2019***

## ABSTRACT

A field experiment was conducted at the Agronomy field of central research farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from June 2014 to December 2014 to study the influence of nitrogen on growth and seed quality of T. Aman rice variety with interaction effects between nitrogen doses and T. Aman rice varieties. The experiment consisted of two factors such as nitrogen fertilizer and variety. these were as follows: Factor A: Nitrogenous fertilizer (6 levels) *viz.* $N_0$- controlled, $N_1$- 50% less than BRRI recommended dose, $N_2$- 25% less than BRRI recommended dose, $N_3$- BRRI Recommended dose, $N_4$- 25% higher than BRRI recommended

**Corresponding author: Email: mahmudhasansau@gmail.com;*

dose, $N_5$- 50% higher than BRRI recommended dose and Factor B: T. Aman rice (3 varieties) *viz.* $V_1$ – BRRI dhan44, $V_2$ - BRRI dhan54, $V_3$ - BRRI dhan56. The experiment was laid out in a split-plot design with three replications. Nitrogen was assigned to main plots and variety to sub-plots. In case of different levels of nitrogen, the treatment N4 (25% higher than BRRI recommended dose) showed good morphological growth and also produced good quality seed than other treatments which is also true for variety V1 (BRRI dhan44). The interaction of $N_4V_1$ (25% higher than recommended dose with BRRI dhan44) treatment is suitable for producing better plant growth and seed of T. Aman rice. The study was concluded that higher dose of urea than BRRI recommendation dose with BRRI dhan44 variety produced good quality seed.

*Keywords: Rice; urea; seed quality; BRRI T. Aman rice varieties.*

## 1. INTRODUCTION

Agriculture in Bangladesh is characterized by intensive crop production mainly rice. Rice plays absolutely dominant role in Bangladesh agriculture as it covers 68.35% of the total cropped area [1]. Annual per capita consumption of rice in Bangladesh is the highest in the world [2]. It provides about 70% of an average citizen's total calorie intake [3]. Rice (*Oryza sativa* L.) is one of the essential food of the human diet [4,5]. It contributes 76% of the caloric and 66% of the protein intake [6]. Rice accounts for nearly 18% of Bangladesh GDP [7].

The total production of rice in aus, aman and boro season was 2.40, 13.20 and 19.10 million metric tonnes, respectively [8]. Rapid population growth, increased urbanization and limited cultivated land etc. Are alarming issues for utilizing limited resources by adopting new cultivars and technology? Instead, some land should be released for other non-rice crops and farming practices. Therefore, it is an urgent need of time to increase rice production through increasing yield. At the same time, it is realized that the yield of high yielding varieties of rice has come to a stagnation in spite of using relatively high inputs and standard agronomic management practices. So, it is deemed important to look for an alternative way to boost up the production. Proper practices are the most effective means for increasing yield of rice at farmer's level which can be achieved by using inbred and hybrid varieties [9]. Scientists are quite optimistic to break the existing yield ceiling by introducing a new approach to rice production through the use of hybrid technology.

Advanced agronomic practices such as weed control, modern cultivars and fertilization can improve crop productivity and profitability also reduce adverse environmental impacts [10,11,12,13,14]. Nitrogen is the main nutrient associated with yield, but it responds differently to rice type, cultivar, geographic zone, and other crop practices [10,11,13,15,16,17].

One of the major constraints in rice production is insufficiency of quality seed for modern rice varieties in Bangladesh. Only 15-20% of total seed demand in the country is fulfill by Government and NGO seed supply systems. Use of quality seed can increase rice yield at 12-15% at a given management practices [18]. Rice yield can be increased up to 15-20% by using quality seed in alone [19,20]. In general, rice seed yield is often lower than the grain yield because of seedling mortality, rouging and low nutrient application. Nutrient management strategy in seed crop may be somewhat different from the normal grain crop. Grain yield and rice quality were significantly correlated with variations of N absorption and utilization [21]. Excessive doses of N fertilizer over recommended level produce succulent plants and enhance plants sensitivity to water and temperature stress, increase susceptibility to lodging, pest and disease attack which show negative impact in growth and produce quality seed of rice [22]. Considering the above facts, the present study was undertaken to investigate the suitable variety with interaction effect of nitrogen rate and T. Aman rice for production quality seed of T.

## 2. MATERIALS AND METHODS

### 2.1 Experimental Site

The experiment was conducted at the Sher-e-Bangla Agricultural University research farm, Dhaka, Bangladesh during the period from June, 2014 to December 2014. The experimental site was located at 23°77′ N latitude and 90°37′ E longitudes with an altitude of 9 m [23]. The geographical location of the experimental site was under the sub-tropical climate characterized

by three distinct seasons. The monsoon or rainy season extend from May to October which is associated with high temperature, high humidity and heavy rainfall. The land was well drained with good irrigation practices. The experimental site was a medium high land. The top soil was silty clay in texture, red brown terrace soil type, olive–grey with common fine to medium distinct dark yellowish brown mottles. The soil pH was 5.6 and organic carbon was 0.45%.

## 2.2 Planting Material

The three test varieties were BRRI dhan44, BRRI dhan54 and BRRI dhan56. The rice seeds were collected from Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur, Bangladesh.

## 2.3 Fertilizers and Manure Application

The fertilizers were N, P, K, S and Zn in the form of urea, Triple superphosphate (TSP), Muriate of Potash (MoP), Gypsum and Zinc sulphate, respectively which were applied @ 250, 150, 175, 100 and 15 kg $ha^{-1}$ (BRRI recommendation dose). The full doses of all fertilizers except urea were applied as basal dose through broadcasting method. Urea was applied in three equal splits at 20 and 40 days after transplanting (DAT) and during maximum tillering stage as per treatment.

## 2.4 Experimental Design and Treatment

The experiment was laid out in a split-plot design with three replications thus comprised 54 plots. Nitrogen was assigned to main plots and Varieties to sub-plots. The layout of the experiment was prepared for distributing the combination of nitrogen and variety. The size of each unit sub plot 4 m × 2.5 m. The spacing between blocks and plots was 1.0 m and 0.5 m, respectively. The experiment consisted of two factors such as nitrogenous fertilizer and T. Aman rice varieties. The treatments were as follows: Factor A: Nitrogenous fertilizer (6 levels) viz. No- $N_o$ nitrogen, $N_1$- 50% less than BRRI recommended dose, $N_2$- 25% less than BRRI recommended dose, $N_3$- BRRI Recommended dose, $N_4$- 25% higher than BRRI recommended dose, $N_5$- 50% higher than BRRI recommended dose and Factor B: Varieties (3 types) viz. $V_1$ – BRRI dhan44, $V_2$ – BRRI dhan54 and $V_3$ – BRRI dhan56.

## 2.5 Data Collection

Data were collected on the following parameters – plant height (cm) (at 25, 45, 65, 85 DAT and at harvest), total tillers $hill^{-1}$ (no.) (at 25, 45, 65 and 85 DAT), Dry matter weight $hill^{-1}$ (g) (at 30, 60 and 90 DAT), germination (%), dry weight $seedling^{-1}$ (g), root length $seedling^{-1}$ (cm),Shoot length $seedling^{-1}$ (cm) and Seedling length (cm).

## 2.6 Statistical Analysis

The data obtained for different characters were statistically analysed to observe the significant difference among the treatment by using the MSTAT-C computer package program. The significance of the difference among the treatments means was estimated by the Least Significant Different (LSD) at 5% level of probability [24].

# 3. RESULTS AND DISCUSSION

## 3.1 Growth Parameter

### 3.1.1 Nitrogen response

Plant height, total number of tillers $hills^{-1}$ and dry matter weight $hill^{-1}$ of T. Aman rice was significantly influenced by the application of different levels of nitrogen (Figs. 1, 2 and 3). The rate of increase in plant height was much higher into 65 DAT and then the rate was slower than earlier stage of growth. Whereas, the tallest plants at 25, 45, 65, 85 DAT and harvest (55.81, 96.52, 116.70, 127.30 and 130.00 cm, respectively) were recorded from $N_4$ (25% higher than recommended dose) treatment. In comparison, the shortest plants at 25, 45, 65, 85 and harvest (45.82, 72.45, 87.89, 103.20 and 114.00 cm, respectively) were obtained from $N_0$ (no nitrogen) treatment. Zhilin et al. [25] stated that pant height was increased significantly due to nitrogen application.

The figure indicated that irrespective of N doses increased the tiller number $hill^{-1}$ into 45 DAT but after that, it gradually declined into harvesting. This may perhaps the dying of late tillering at the end of the life cycle. The maximum number of tiller $hill^{-1}$ at 25, 45, 65 and 85 DAT (8.17, 14.53, 11.36 and 9.86, respectively) was recorded from $N_4$ (25% higher than BRRI recommended dose) treatment. On the other hand, the minimum number of tiller $hill^{-1}$ at 25, 45, 65 and 85 DAT

(5.83, 8.36, 8.50 and 7.30, respectively) was obtained from $N_0$ (no nitrogen) treatment.

The figure indicated that irrespective of N doses increased the tiller number hill$^{-1}$ into 45 DAT but after that, it gradually declined into harvesting. This may perhaps the dying of late tillering at the end of the life cycle. The maximum number of tiller hill$^{-1}$ at 25, 45, 65 and 85 DAT (8.17, 14.53, 11.36 and 9.86, respectively) was recorded from $N_4$ (25% higher than BRRI recommended dose) treatment. On the other hand, the minimum number of tiller hill$^{-1}$ at 25, 45, 65 and 85 DAT (5.83, 8.36, 8.50 and 7.30, respectively) was obtained from $N_0$ (no nitrogen) treatment.

Figure indicated that irrespective of N doses increased dry matter production/hill. Among the all nitrogen doses dry matter production was highest with $N_4$ (25% higher than BRRI recommended dose) followed by $N_3$ (BRRI recommended dose) and $N_2$ (25% lower than BRRI recommended dose). The highest dry matter weight hill$^{-1}$ at 30, 60 and 90 DAT (6.61, 20.84 and 38.44 g, respectively) was recorded from $N_4$ (25% higher than BRRI recommended dose) treatment. On the other hand, the lowest dry matter weight hill$^{-1}$ at 30, 60 and 90 DAT (4.44, 12.76 and 23.56 g, respectively) was obtained from $N_0$ (no nitrogen) treatment.

### 3.1.2 Variety response

Different varieties exhibited significant effect on plant height, total number of tillers hills$^{-1}$ and dry matter weight hill$^{-1}$ of T. Aman rice (Figs. 4, 5 and 6). The $V_1$ (BRRI dhan44) variety performed better and produced the tallest plant followed by variety $V_2$ (BRRI dhan54) and $V_3$ (BRRI dhan56).The tallest plant were 56.32, 94.09, 111.20, 127.70 and 131.10 cm respectively, produced by the variety $V_1$ (BRRI dhan44) treatment at 25, 45, 65, 85 and harvest. Whereas, the shortest plant were 48.52, 84.44, 98.17, 115.20 and 119.20 cm respectively, produced by the variety $V_3$ (BRRI dhan56) treatment at 25, 45, 65, 85 and harvest. Variation of plant height might be due to the differences in their genetic make-up. Mishra et al. [26] observed plant heights vary among the variety to variety.

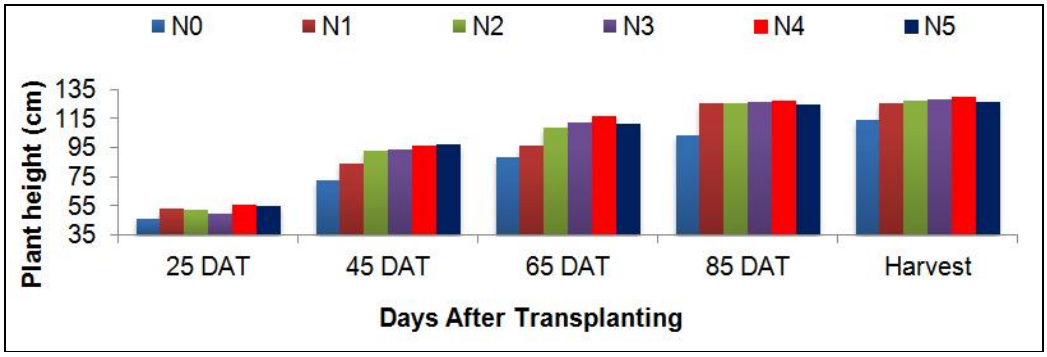


**Fig. 1. Effect of nitrogen level on plant height of T. Aman rice**
*(LSD value = 2.44, 3.01, 0.81, 0.49 and 0.63 at 25, 45, 65, 85 DAT and harvest, respectively)*

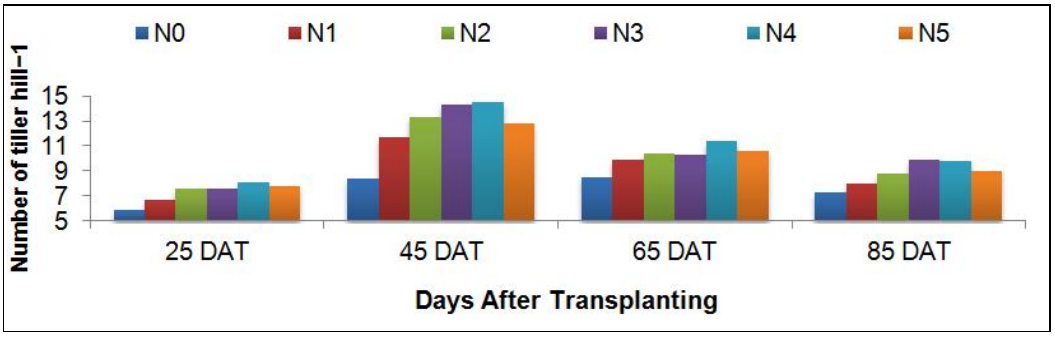


**Fig. 2. Effect of nitrogen on number of tiller hill$^{-1}$ of T. Aman rice**
*(LSD value = 0.29, 0.05, 0.24 and 0.30 at 25, 45, 65 and 85 DAT, respectively)*

The figure indicated that irrespective of varieties increased rapidly the tiller number hill$^{-1}$ into 45 DAT but after that, gradual full up to at 85 DAT. The variety $V_1$ (BRRI dhan44) produced the highest tillers hill$^{-1}$ followed by $V_2$ (BRRI dhan54) and $V_3$ (BRRI dhan56). Numerically, the highest number of tillers hill$^{-1}$ at 25, 45, 65 and 85 DAT (8.21, 13.76, 11.45 and 9.92, respectively) was recorded from $V_1$ (BRRI dhan44) treatment. On the other hand, the lowest number of tillers hill$^{-1}$ at 25, 45, 65 and 85 DAT (6.27, 10.80, 8.87 and 7.75, respectively) was observed from $V_3$ (BRRI dhan56) treatment.

It can be observed from the figure, the variety $V_1$ (BRRI dhan44) produced the highest dry matter plant$^{-1}$ followed by $V_2$ (BRRI dhan54) and $V_3$ (BRRI dhan56). Numerically, the maximum dry matter weight hill$^{-1}$ at 30, 60 and 90 DAT (6.51, 20.58 and 37.58 g, respectively) was recorded from $V_1$ (BRRI dhan44) treatment. On the other hand, the minimum dry matter weight hill$^{-1}$ at 30, 60 and 90 DAT (4.15, 15.07 and 28.88 g, respectively) was obtained from $V_3$ (BRRI dhan56) treatment.

### 3.1.3 Nitrogen and variety interaction

Plant height, number of tillers hill$^{-1}$ and dry matter weight hill$^{-1}$ of T. Aman were significantly influenced by the interaction of different levels of nitrogen doses and varieties (Table 1). The tallest plants 25, 45, 65, 85 DAT and harvest (61.34, 104.00, 122.70, 134.90 and 137.00 cm, respectively) were recorded from $N_4V_1$ (25% higher than recommended dose with BRRI dhan44) treatment combination. On the other hand, the shortest plants at 25, 45, 65, 85 DAT and harvest (42.00, 68.49, 78.67, 94.33 and 107.00 cm, respectively) were observed in $N_0V_3$ (no nitrogen with BRRI dhan56) treatment combination.

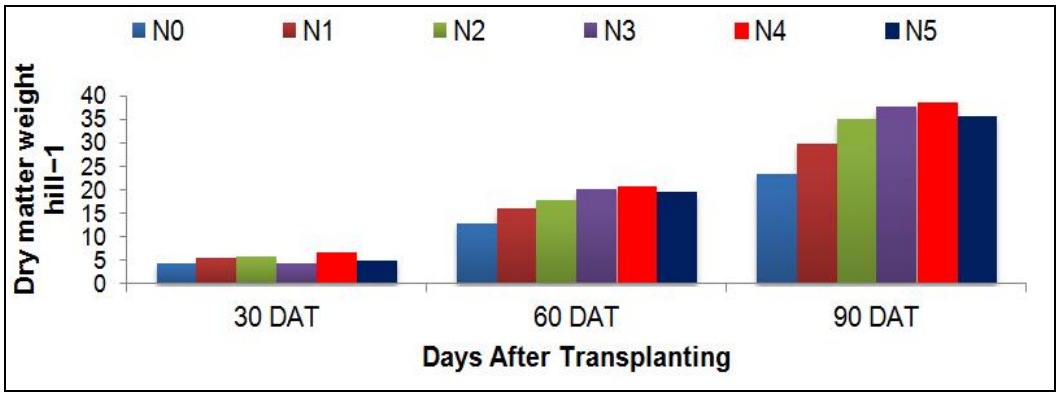


**Fig. 3. Effect of nitrogen on dry matter weight hill$^{-1}$ of T. Aman rice**
*(LSD value = 0.10, 0.38 and 0.46 at 30, 60 and 90 DAT, respectively)*

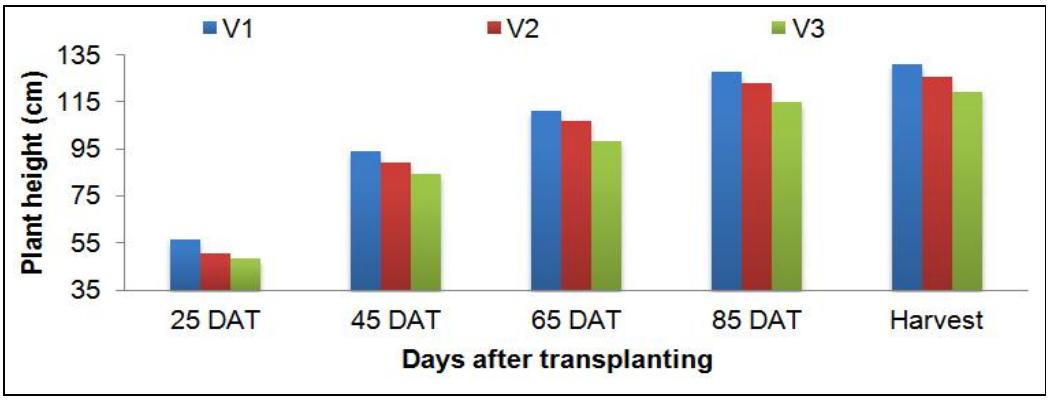


**Fig. 4. Effect of variety on plant height of T. Aman rice**
*(LSD value = 1.62, 2.07, 2.62, 0.40 and 0.56 at 25, 45, 65, 85 DAT and harvest, respectively)*

The highest number of tillers hill$^{-1}$ at 25, 45, 65 and 85 DAT (9.50, 16.50, 14.03 and 12.40, respectively) were recorded from $N_4V_1$ (25% higher than recommended dose with BRRI dhan44) treatment combination. Whereas, the lowest (4.50, 6.03, 7.10 and 6.20, respectively) were observed in $N_0V_3$ (no nitrogen with BRRI dhan56) treatment combination.

The highest dry matter weight hill$^{-1}$ at 30, 60 and 90 DAT (8.20, 25.00 and 44.33 g, respectively) was recorded from $N_4V_1$ (25% higher than recommended dose with BRRI dhan44) treatment combination. Whereas, the lowest at 30, 60 and 90 DAT (3.08, 10.08 and 19.50 g, respectively) was observed in $N_0V_3$ (no nitrogen with BRRI dhan56) treatment combination.

## 3.2 Seed Quality Parameter

### 3.2.1 Nitrogen response

Germination, dry weight seedling$^{-1}$, root length seedling$^{-1}$, shoot length seedling$^{-1}$ and seedling length of T. Aman rice was significantly influenced by the application of different levels of nitrogen (Table 2). The highest germination (90.00%), highest dry weight seedling$^{-1}$ (0.13 g), longest root (6.32 cm) , longest shoot length (27.41 cm) and tallest seedling (33.35 cm) were recorded from $N_4$ (25% higher than recommended dose) treatment. Whereas, the lowest germination (75.00 %), the lowest dry weight seedling$^{-1}$ (0.07 g) , shortest root (4.57 cm) , shortest shoot length (22.06 cm) and shortest seedling (26.59 cm) were observed in $N_0$ (no nitrogen) treatment. This result is similar to Hossain *et al*. [27] stated that, N fertilizer much affected seed germination of the vigor of aromatic rice seeds.

### 3.2.2 Variety response

Different varieties showed significant effect on germination, dry weight seedling$^{-1}$, root length seedling$^{-1}$, shoot length seedling$^{-1}$ and seedling length of T. Aman rice (Table 3). The maximum germination (88.33 %), maximum dry weight seedling$^{-1}$ (0.12 g), maximum root length (5.91 cm) , maximum shoot length (26.43 cm) and tallest seedling (32.35 cm) were recorded from $V_1$ (BRRI dhan44) treatment. In comparison, the minimum germination (81.00 %), minimum dry weight seedling$^{-1}$ (0.08 g), minimum root length (4.58 cm), minimum shoot length (23.27 cm) and shortest seedling (27.84 cm) was observed in $V_3$ (BRRI dhan56) treatment.

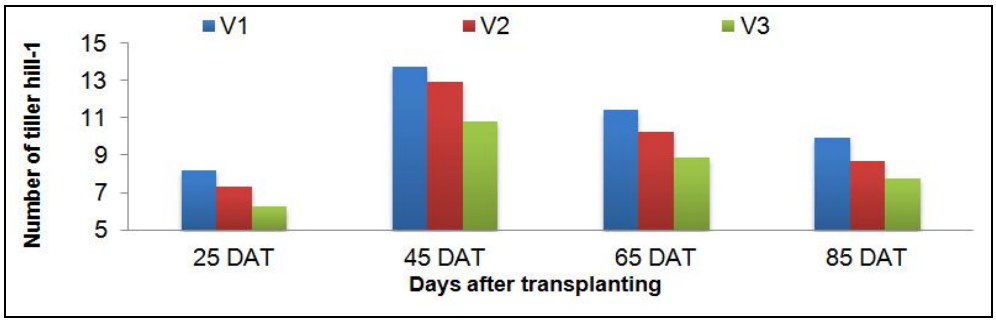


**Fig. 5. Effect of variety on number of tiller hill$^{-1}$ of T. Aman rice**
*(LSD value = 0.20, 0.04, 0.15 and 0.18 at 25, 45, 65 and 85 DAT, respectively)*

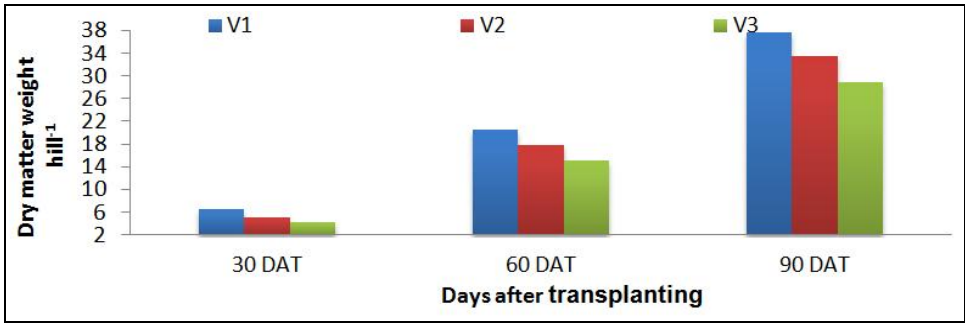


**Fig. 6. Effect of variety on dry matter weight hill$^{-1}$ of T. Aman rice**
*(LSD value = 0.07, 0.23 and 0.40 at 30, 60 and 90 DAT, respectively)*

**Table 1. Interaction effect of nitrogen and variety on plant height, number of tillers Hill$^{-1}$ and dry matter weight hill$^{-1}$ of T. Aman rice at different days after transplanting**

| Treatment | Plant height at different days after transplanting (cm) | | | | | Number of tiller hill$^{-1}$ at different days after transplanting | | | | Dry matter weight per hill at different days after transplanting (g) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25 | 45 | 65 | 85 | Harvest | 25 | 45 | 65 | 85 | 30 | 60 | 90 |
| $N_0V_1$ | 50.34eh | 75.23 j | 97.67 k | 110.30 k | 120.30 j | 7.00e | 10.03 k | 8.49 j | 8.00 g | 6.00d | 15.20 j | 27.87 k |
| $N_0V_2$ | 45.11 j | 73.62 j | 87.33 m | 105.00 l | 114.70 k | 6.00 f | 9.00 l | 9.90 f | 7.70 h | 4.23 i | 13.00 l | 23.00 m |
| $N_0V_3$ | 42.00 k | 68.49 k | 78.67 n | 94.33 m | 107.00 l | 4.50 g | 6.03 m | 7.10 k | 6.20 j | 3.08 k | 10.08 m | 19.50 n |
| $N_1V_1$ | 57.54 bc | 88.39 fg | 102.00 j | 126.00 e | 130.30 d | 8.00cd | 12.75 g | 10.47 d | 8.80 ef | 7.00 b | 17.67 f | 33.48 g |
| $N_1V_2$ | 49.87 f-i | 83.58 h | 97.33 k | 131.70 c | 126.00 g | 6.03 f | 12.13 i | 9.80 f | 7.60 hi | 5.48 g | 16.30 i | 30.93 i |
| $N_1V_3$ | 51.22 ef | 79.69 i | 90.00 l | 118.30 j | 120.30 j | 6.00 f | 10.07 k | 9.40 g | 7.40 i | 4.08 j | 14.00 k | 24.59 l |
| $N_2V_1$ | 58.79 bc | 96.79bc | 114.30 d | 130.00 d | 132.70 c | 8.00cd | 14.00 d | 11.85 b | 9.83 c | 6.00 d | 21.20 c | 38.00 d |
| $N_2V_2$ | 48.17 hi | 93.11de | 110.30 f | 125.10 f | 128.00 f | 7.80 d | 13.53 e | 10.13 e | 8.70 f | 6.10 c | 17.50 fg | 35.50 f |
| $N_2V_3$ | 49.65 f-i | 88.13 fg | 101.70 j | 120.10 hi | 121.30 i | 7.00 e | 12.47 h | 9.17 hi | 7.73 h | 5.00 h | 15.00 j | 32.00 h |
| $N_3V_1$ | 50.79eg | 98.22 b | 118.00 b | 132.90 b | 134.00 b | 8.40 b | 15.00 b | 12.00 b | 10.51 b | 5.90 e | 22.22 b | 41.10 b |
| $N_3V_2$ | 48.76 gi | 94.35cd | 113.00 e | 125.00 f | 129.00 e | 8.20bc | 15.00 b | 10.00 ef | 10.00 c | 4.00 j | 21.10 c | 36.67 e |
| $N_3V_3$ | 47.95 i | 87.54 g | 104.30 i | 120.00 i | 121.70 i | 6.00 f | 13.00 f | 9.00 i | 9.17 d | 3.00 k | 17.00 h | 35.50 f |
| $N_4V_1$ | 61.34 a | 104.0 a | 122.70 a | 134.90 a | 137.00 a | 9.50 a | 16.50 a | 14.03 a | 12.40 a | 8.20 a | 25.00 a | 44.33 a |
| $N_4V_2$ | 53.92 d | 95.00cd | 118.70 b | 126.30 e | 130.30 d | 8.00cd | 15.00 b | 10.79 c | 9.00 de | 5.90 e | 20.20 d | 39.00 c |
| $N_4V_3$ | 52.18de | 90.60 ef | 108.70 g | 120.60 h | 122.70 h | 7.00 e | 12.10 i | 9.27 gh | 8.00 g | 5.72 f | 17.33 g | 32.00 h |
| $N_5V_1$ | 59.13ab | 101.9 a | 112.30 e | 132.00 c | 132.00 c | 8.33 b | 14.30 c | 11.85 b | 10.00 c | 6.00 d | 22.20 b | 40.67 b |
| $N_5V_2$ | 56.82 c | 96.39bc | 115.30 c | 124.30 g | 126.00 g | 8.00cd | 13.00 f | 10.87 c | 9.00 de | 5.00 h | 19.00 e | 36.33 e |
| $N_5V_3$ | 48.11 hi | 92.20de | 105.70 h | 118.00 j | 121.30 i | 7.10 e | 11.10 j | 9.20 g-i | 8.00 g | 4.00 j | 17.00 h | 29.67 j |
| **$LSD_{(0.05)}$** | **2.29** | **2.93** | **0.89** | **0.56** | **0.79** | **0.28** | **0.05** | **0.21** | **0.26** | **0.09** | **0.32** | **0.56** |
| **CV (%)** | **2.62** | **4.94** | **3.5** | **3.98** | **5.38** | **2.3** | **4.3** | **5.25** | **4.17** | **5.97** | **4.08** | **6** |

*In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability.*

*Note: $N_0$- No nitrogen, $N_1$- 50% less than recommended dose, $N_2$- 25% less than recommended dose, $N_3$- Recommended dose, $N_4$- 25% higher than recommended dose, $N_5$- 50% higher than recommended dose and $V_1$- BRRI dhan44, $V_2$- BRRI dhan54, $V_3$- BRRI dhan56*

**Table 2. Effect of nitrogen on germination, dry weight seedling$^{-1}$, root length seedling$^{-1}$, shoot length seedling$^{-1}$ and seedling length of T. Aman rice**

| Treatment | Germination (%) | Dry weight seedling$^{-1}$ (g) | Root length seedling$^{-1}$ (cm) | Shoot length seedling$^{-1}$ (cm) | Seedling length (cm) |
|---|---|---|---|---|---|
| $N_0$ | 75.00 d | 0.07 c | 4.57 f | 22.06 f | 26.59 e |
| $N_1$ | 82.00 c | 0.11 b | 5.20 c | 23.42 e | 28.60 d |
| $N_2$ | 86.00 b | 0.11 b | 5.93 b | 25.36 c | 30.13 c |
| $N_3$ | 87.00 b | 0.10 b | 4.77 e | 26.12 b | 32.44 b |
| $N_4$ | 90.00 a | 0.13 a | 6.32 a | 27.41 a | 33.35 a |
| $N_5$ | 80.00 c | 0.10 b | 5.06 d | 25.07 d | 30.15 c |
| $LSD_{(0.05)}$ | **2.61** | **0.02** | **0.08** | **0.09** | **0.25** |
| CV (%) | **1.25** | **1.83** | **3.37** | **1.00** | **1.12** |

*In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability.*

*Note: $N_0$- No nitrogen, $N_1$- 50% less than recommended dose, $N_2$- 25% less than recommended dose, $N_3$- Recommended dose, $N_4$- 25% higher than recommended dose, $N_5$- 50% higher than recommended dose*

### 3.2.3 Nitrogen and variety interaction

The interaction of nitrogen doses with varieties showed significant influenced on germination, dry weight seedling$^{-1}$, root length seedling$^{-1}$, shoot length seedling$^{-1}$ and seedling length of T. Aman. Rice (Table 4). The highest germination (95.00 %), highest dry weight seedling$^{-1}$ (0.17 g), longest root (6.76 cm), longest shoot (29.14 cm) and tallest seedling (35.38 cm) were recorded from $N_4V_1$ (25% Higher than recommended dose with BRRI dhan44) treatment combination. On the other hand, the lowest germination (74.00%), lowest dry weight seedling$^{-1}$ (0.07 g), shortest root (3.70 cm), shortest shoot (20.10 cm) and shortest seedling (24.20 cm) were observed in $N_0V_3$ (no nitrogen with BRRI dhan56) treatment combination.

**Table 3. Effect of variety on germination, dry weight seedling$^{-1}$, root length seedling$^{-1}$, shoot length seedling$^{-1}$ and seedling length of T. Aman rice**

| Treatment | Germination (%) | Dry weight seedling$^{-1}$ (g) | Root length seedling$^{-1}$ (cm) | Shoot length seedling$^{-1}$ (cm) | Seedling length (cm) |
|---|---|---|---|---|---|
| $V_1$ | 88.33 a | 0.12 a | 5.91 a | 26.43 a | 32.35 a |
| $V_2$ | 84.67 b | 0.10 b | 5.42 b | 25.02 b | 30.44 b |
| $V_3$ | 81.00 c | 0.08 c | 4.58 c | 23.27 c | 27.84 c |
| **$LSD_{(0.05)}$** | **1.64** | **0.01** | **0.05** | **0.05** | **0.16** |
| **CV (%)** | **1.62** | **2.15** | **3.91** | **1.19** | **1.43** |

*In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability.*

*Note: $V_1$- BRRI dhan44, $V_2$- BRRI dhan54, $V_3$- BRRI dhan56*

**Table 4. Interaction effect of nitrogen and variety on germination, dry weight seedling$^{-1}$, root length seedling$^{-1}$, shoot length seedling$^{-1}$ and seedling length of T. Aman rice**

| Treatment | Germination (%) | Dry weight seedling$^{-1}$ (g) | Root length seedling$^{-1}$ (cm) | Shoot length seedling$^{-1}$ (cm) | Seedling length (cm) |
|---|---|---|---|---|---|
| $N_0V_1$ | 85.00 e | 0.08 gh | 4.30 k | 22.48 o | 26.78 l |
| $N_0V_2$ | 90.00 cd | 0.11 c-e | 4.20 l | 23.60 l | 28.80 i |
| $N_0V_3$ | 74.00 j | 0.07 h | 3.70 n | 20.10 p | 24.20 m |
| $N_1V_1$ | 85.00 e | 0.12 b-d | 5.62 e | 24.38 i | 30.00 g |
| $N_1V_2$ | 82.00 fg | 0.10 d-f | 4.50 j | 22.78 n | 27.19 k |
| $N_1V_3$ | 79.00 hi | 0.10 d-f | 5.50 f | 23.10 m | 28.60 i |
| $N_2V_1$ | 82.00 fg | 0.13 b | 6.24 b | 26.70 e | 32.70 de |
| $N_2V_2$ | 78.00 hi | 0.12 b-d | 5.52 f | 25.34 gh | 30.86 f |
| $N_2V_3$ | 92.00 bc | 0.13 b | 6.04 c | 27.76 c | 33.80 c |
| $N_3V_1$ | 92.00 b | 0.13 b | 6.26 b | 28.00 b | 34.70 b |
| $N_3V_2$ | 88.00 d | 0.09 fg | 5.50 f | 24.28 j | 29.78 h |
| $N_3V_3$ | 83.00 ef | 0.11 c-f | 6.00 c | 26.08 f | 32.84 d |
| $N_4V_1$ | 95.00 a | 0.17 a | 6.76 a | 29.14 a | 35.38 a |
| $N_4V_2$ | 90.00 cd | 0.09 ef | 5.20 h | 24.00 k | 27.70 j |
| $N_4V_3$ | 88.00 d | 0.11 d-f | 4.60 i | 25.38 g | 29.98 gh |
| $N_5V_1$ | 83.00 ef | 0.12 b-c | 5.75 d | 26.78 d | 32.51 e |
| $N_5V_2$ | 80.00 gh | 0.09 e-g | 4.08 m | 23.14 m | 27.29 k |
| $N_5V_3$ | 77.00 i | 0.11 d-f | 5.35 g | 25.30 h | 30.65 f |
| **$LSD_{(0.05)}$** | **2.32** | **0.02** | **0.07** | **0.07** | **0.22** |
| **CV (%)** | **1.62** | **2.15** | **3.91** | **1.19** | **1.43** |

*In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability.*

*Note: $N_0$- No nitrogen, $N_1$- 50% less than recommended dose, $N_2$- 25% less than recommended dose, $N_3$- Recommended dose, $N_4$- 25% higher than recommended dose, $N_5$- 50% higher than recommended dose and $V_1$- BRRI dhan44, $V_2$- BRRI dhan54, $V_3$- BRRI dhan56*

## 4. CONCLUSION

From these results, it might be concluded that application of nitrogen (25% higher than BRRI recommended dose) in alone or with interaction between variety (BRRI dhan44) showed better performance on plant growth and produced high quality seed of T. Aman rice.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. AIS (Agriculture Information Service). Krishi Diary, AIS, Khamarbari, Dhaka; 2014.
2. FAO. FAOSTAT. Food and Agriculture Organization of the United Nations. 2011. Available:ftp://ftp.fao.org
3. BRRI (Bangladesh Rice Research Institute). Annual Report for 2013. Bangladesh Rice Res. Inst., Joydebpur, Gazipur, Bangladesh. 2013;20-23.
4. FAO. Estimaciones globales de las emisiones gaseosas de NH3, NO y N2O provenientes de las tierras agrícolas. FAO, Roma, Italia. 2004;1-22. Available:ftp://ftp.fao.org/docrep/fao/009/y2780s/y2780s00.pdf
5. Juliano BO. Rice in human nutrition. FAO Food and Nutrition Series No 26. FAO, Rome, Italy. International Rice Research Institute (IRRI), Los Baños, Laguna, Philippines. 1993;162.
6. BNNC (Bangladesh National Nutrition Council). Bangladesh National Nutrition Council, Dhaka, Bangladesh; 2008.
7. BRRI (Bangladesh Rice Research Institute). Annual Report for 2008.BRRI, Joydebpur, Gazipur, Bangladesh. 2010; 15–25.
8. BBS (Bangladesh Bureau of Statistics). Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka; 2018.
9. BBS (Bangladesh Bureau of Statistics). National estimates of area and production of different crops, June, 2014. Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka. 2013;47–159.
10. Angus JF. Ohnishi M. Horie T, Williams L. A preliminary study to predict net nitrogen mineralization in a flooded rice soil using anaerobic incubation. Australian Journal of Experimental Agriculture. 1994:34:995-999.
11. De-Xi L, Xiao-Hui F, Fena H, Hong-Tao Z, Jia-Fa L. Ammonia volatilization and nitrogen utilization efficiency in response to urea application in rice fields of the Taihu Lake region, China. Pedosphere, 2007; 15:639-645.
12. Soon Y, Haq A, Arshad M. Sensitivity of nitrogen mineralization indicators to crop and soil management. Communications in Soil Science and Plant Analysis. 2007;38: 2029- 2043.
13. Hirzel J, Cordero K. Fertilización del cultivo de arroz. In Hirzel J. (ed.) Fertilización de cultivos en Chile. Colección Libros INIA No 28. Instituto de Investigaciones Agro-pecuarias INIA, Centro Regional de Investigación Quilamapu, Chillán, Chile. 2011;434.
14. Aziz MSM, Akter T, Ali M, Nasif SO, Shahriar SA, Nowrin F. Effect of nitrogen, phosphorus and potassium (NPK) application on insect pests infesting transplanting aman rice (*Oryza sativa* L.). Asian Res. J. Agric. 2018:9(3):1-15. DOI: 10.9734/ARJA/2018/42953
15. Bouman BAM, Humphreys E, Tuong TP, Barker R, Donald L.S. Rice and water. Advances in Agronomy. 2007;92:187-237.
16. Huang J, He F, Cui K, Buresh R, Xu B, Gong W. Determination on optimal nitrogen rate for rice varieties using a chlorophyll meter. Field Crops Research. 2008;105:70-80.
17. Jing Q, Bouman B, van Keulen H, Hengsdijk H, Cao W, Dai T. Disentangling the effect of environmental factors on yield and nitrogen uptake of irrigated rice in Asia. Agricultural System. 2008;98:177-188.
18. Gomosta AR. Emerging technologies for sustainable rice production in Bangladesh. Keynote presented in the 20th HYV; 2004.
19. Bhuiyan NI, Paul DNR, Jabber MA. Feeding the extra millions by 2025: Challenges for rice research and extension in Bangladesh. Proceedings of the workshop on modern rice cultivation in Bangladesh. Jointly organized by Bangladesh Rice Research Institute (BRRI) and Department of Agricultural Extension (DAE), held at BRRI, Bangladesh. 2002;1-24.

20. Farooq A. Demand and supply of different crop seeds: Perspective (2005-2011). Proceedings of the workshop on National seed conference and Fair 2006. Organized by Ministry of Agriculture, held at Bangladesh-China Friendship conference centre; 2006.
21. Xia W, Wang W, Zhang Q. Potetial production simulation and optimal nutrient management of two hybrid rice varieties in Jinhuna, Zhejiang, Proviance. J. Zhejiang Univ. Sci. 2007;8(7):486-492.
22. Balasubramaniyan P, Palaniappan SP. Principles and practices of agronomy. Agrobios (India), Agro house, Chopasani road, Jodhpur 342 002, India. 2007;185-186.
23. Anonymous. Feeding the world: Facts and Figures; 1989. Available:http://www.riceweb.org
24. Gomez KA, Gomez AA. Statistical procedure for agricultural Research (2nd ed.). Int. Rice Res. Inst., A willey Int. Sci. 1984;28-192.
25. Zhilin L, Sarker RS, Nayak SK, Ravi I, Li JL. Physiological effect of nitrogen application on aromatic rice. J. South China Agric. University. 1997;18:13–7.
26. Mishra BN, Singh KN, Bhattacharyya HC. Response of wetland direct seeded rice varieties to nitrogen. Indian J. Agron. 1988;33:218–20.
27. Hossain MF. Impact of fertilizers on the seed quality of aromatic rice. Journal of Agricultural Science. 2014;6(6):35-40.



*Peer-review history:*
*The peer review history for this paper can be accessed here:*
*http://www.sdiarticle3.com/review-history/46950*