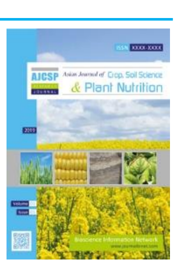
Published with Open Access at Journal BiNET
Vol. 04, Issue 02: 157-164

Asian Journal of Crop, Soil Science and Plant Nutrition

Journal Home: https://www.journalbinet.com/ajcsp-journal.html



Nitrogen effect on the growth and yield contributing characters of Binadhan-19

Md. Babul Akter[1], Nazmun Nahar[1], Md. Sohel Rana[1], Md. Niloy Hasan[2] and Md. Abu Rayhan[2]

[1]Bangladesh Institute of Nuclear Agriculture (BINA), Sub-station, Rahmatpur, Barishal-8211
[2]College of Agricultural Sciences, International University of Business Agriculture and Technology, Uttara-10, Dhaka

✉ Article correspondence: riponkachua@gmail.com (Akter, MB)
Article received: 01.10.2020; Revised: 02.11.2020; First published online: 30 December 2020.

ABSTRACT

The experiment was conducted at the BINA sub-station, Rahmatpur, Barishal, during the period from April 2020 to August 2020 to investigate the effect of nitrogen on the yield of transplant Aus rice cv. Binadhan-19. The experiment comprised four levels of nitrogen viz (a) N_0 (zero nitrogen), (b) N_1 (90 kg N/ha), (c) N_2 (110 kg N/ha) and (d) N_3 (130 kg N/ha). Nitrogen fertilizer was applied at two splits. The experiment was laid out in a randomized complete block design with three replications. Results revealed that plant height, effective tiller, non-effective tiller, flag leaf length, filled gran, unfilled grain and 1000 grain weight were increased with increasing nitrogen doses till 110 kg N ha^{-1}. Furthermore, the highest grain weight was recorded in 110 kg N ha^{-1} due to superior performance of yield contributing characters of BInadhan-19. A positive correlation was found between grain yield and total dry matter production. The experimental results concluded that 110 kg N ha^{-1} would be the best dose for higher gain yield in Binadhan-19 in aus season.

Key Words: *Rice, Nitrogen, Nitrogen level, Binadhan-19 and Yield*

Cite Article: Akter, M. B., Nahar, N., Rana, M. S., Hasan, M. N. and Rayhan, M. B. (2021). Nitrogen effect on the growth and yield contributing characters of Binadhan-19. Asian Journal of Crop, Soil Science and Plant Nutrition, 04(02), 157-164.
Crossref: https://doi.org/10.18801/ajcsp.040220.20

I. Introduction

Bangladesh is an agricultural country in which about 80% of the population relies on agriculture. Rice (*Oryza sativa* L.) is the second cereal crop next to wheat worldwide considering the production area and provides more calories than other cereals. In Bangladesh, rice cultivated a 10.5 million hectare area and contributes 25 million tons of grain production (BRRI, 2016). Bangladesh is one of the most highly populated countries, and rice is mainly regarded as a staple food. Due to high population pressure, Bangladesh faces a chronic food shortage during the year, and the total rice area is continuously declining due to urbanization and industrialization. These days the population is increasing, but the cultivable land is decreasing. In addition, some rice-growing areas are now being used for fish farming, as rice production is more lucrative than that. It has now become important for the growing population to ensure food security. Therefore, to feed those increased populations and get self-sufficiency in rice production, it is imperative to increase rice yield.

Bangladesh's soil and climate are favorable for rice cultivation throughout the year, but this crop yield is much below the potential level. The reasons are manifolds; some are varietal, some are technical and some are socio-economic. Rice is grown in three cropping seasons in our country viz. *Aus, Aman, Boro* rice. In Bangladesh, total rice areas are 1112.87, 5645.64 and 4770 thousand hectares in *Aus, Aman, Boro* seasons. Among these three rice crops; Transplant *aman rice* covers about 5645.64 thousand hectares of the total and contributes 12791.5 thousand metric tons of the country's total rice production (BBS, 2010).

Proper management practices are the most effective means for increasing the yield of transplant *Aman rice*. Among different management practices, especially proper spacing and optimum nitrogen, are an important way of increasing rice per unit area yield. The qualities of transplant *Aman rice* and its quantity are supposed to be increased by the spacing arrangements. Efficient fertilizer management gives a higher crop yield and reduces fertilizer cost (Khairunniza-Bejo et al., 2017). The optimum dose of nitrogen fertilization plays a vital role in growth and development of rice plants. Nitrogen rate is one of the critical factors for considering in rice production. The vegetative growth, development and yield of rice largely depend on it (Sultana et al., 2019). Rice growth is hampered when a lower dose of nitrogen is applied, which drastically reduces the yield. On the other hand, unnecessary nitrogen fertilization encourages extreme vegetative growth, making the plant susceptible to insects, pests, and diseases, ultimately reducing yield. So, it is essential to determine the optimum nitrogen application rate for the efficient utilization of this element by the plants for better yield (BRRI, 2016).

Fertilizer is a precious input determining an appropriate dosage of application that would be economical and appropriate to enhance the farmers' productivity and consequent profit under a given situation (Islam et al., 2008). Among the different fertilizers, nitrogen is an essential factor for achieving higher production of rice. It is reported that the yield increases due to NP and NPK fertilizers (Yoseftabar 2013). Besides, nitrogen is an integral part of protoplasm, protein, and chlorophyll resulting in increased cell size, inhibiting plant height and crop yield. Nitrogen fertilizer has a significant effect on higher grain yield production (Akter et al., 2019). The use of nitrogen fertilizer at or below the optimum rate affects both yield and rice quality. Nitrogen absorbed by rice during the vegetative growth stages contributed to growth during reproduction and grain-filling through translocation (Bufogle et al., 1997). An increase in yield of cereals with an increasing nitrogen rate has been reported earlier (Khan et al., 1994). Judicious and proper use of fertilizers can significantly increase yield and improve rice quality (Alam et al., 2009). Fertilizer is a significant input for intensive rice production.

The profitability of rice production systems depends on yield and input quantities. So the appropriate fertilizer input is not only for getting high grain yield but also for attaining maximum profitability (Khuang et al., 2008). Nitrogen and phosphorus fertilizer is a major essential plant nutrient and key input for increasing crop yield (Alinajoatisisie and Mirshekari, 2011; Alam et al., 2009). In view of the importance of nitrogen fertilization for the yield of grain from the rice plant, it is important to know the best dose for each variety and its impact on the yield components and other agronomic parameters, such as the period, height of the plant, lodging and moisture content of the grain, in order to gain a better understanding of the efficient response. (Chaturvedi, 2005). Nitrogen plays a crucial role in rice production, and nitrogen is the most significant limiting nutrient in rice production and has extreme system losses when added as inorganic sources in rice fields (Alam et al., 2009). A holistic and intensive analysis of world rice was principally achieved by N fertilizer application and developing high N responsive rice cultivars (Azarpor et al., 2011).

Nitrogen alters plant composition much more than any other mineral nutrient as it is an indispensable elementary constituent of many organic metabolites, including amino acids, proteins, nucleic acids, and phytochromes (Marschner, 1995). Thus, N is the motor of plant growth and makes up1 to 4% of the plants' dry matter (Taiz and Zeiger, 2010). According to an estimate, 33% of N-fertilizers are being used worldwide for improving cereal grain production (Raun and Johnson, 1999). However, rice farmers usually do not apply balanced fertilizers in Bangladesh that causes low grain yield production in rice. Considering the importance of N fertilizer on rice grain production, this study was conducted to determine nitrogen fertilizer's effect on yield and yield contributing characters of Binadhan-19.

EISSN 2706-5510

II. Materials and Methods

Experimental site, soil and weather

The experiment was carried out at the BINA sub-station, Rahmatpur, Barishal, during the period from April 2020 to August 2020 to investigate the effect of nitrogen on the yield of transplant *Aus*rice cv. Binadhan-19.

The experimental site belongs to the Ganges Tidal Floodplain (AEZ 13), having dark grey soil (UNDP and FAO, 1988) and located at $24^0 75'$ N latitude and $90^0 50'$ E longitude having an altitude of 18m above the mean sea level. Active Ganges Floodplain (3,334 sq km) this region occupies unstable alluvial land and adjoins the Ganges River. Complex mixtures of calcareous sandy, silty and clayey alluvium are found in this area. Soils are low in organic matter and slightly alkaline in reaction. The level of overall fertility is medium but deficient in N (AEZ 13). The soil type of experimental site located Babuganj Upazila, Barisal clay loam 13 Sand 30 %, Silt 38 %, and Clay 32 %. The experimental field was medium high land with moderate drained conditions. The land was sandy loam in texture, having a soil pH value of 6.5, low in organic matter content. The weather condition at Barishal during the experiment is presented in table 01.

Table 01. Weather condition at Barishal during experiment

Month	Temperature (°C)	Daylight (hours)	Rainfall (mm)
April	23.6/33.3	12.7	128
May	24.7/ 33	13.2	230
June	25.6/ 31.7	13.5	409
July	25.5/ 30.9	13.4	408
August	25.5/ 30.9	12.9	370

Treatments

Binadhan-19 was developed from NERIKA-10 through radiation and released in 2017. The Levels of nitrogen were as follows:

Levels of nitrogen (kg ha^{-1}):

i. N0 = Control
ii. N1 = 90 kg N/ha at 2 splits
iii. N2 = 110 kg N/ha at 2 splits
iv. N3 = 130 kg N/ha at 2 splits

Experimental design and data collection

The seeds of Binadhan-19 were immersed in water for 24 hours. The seeds were then taken out of water and kept thickly in gunny bags and sprouted seeds were sown in the seedbed. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Each of the replication represented as a block in the experiment. Each block was divided into three-unit plots. All the treatments were randomly allocated in the experimental plots. Altogether there were twelve-unit plots in this experiment. The size of the plot for a unit was (4.0 m x 3.0 m). 1m and 0.5 m, respectively, were the distances between replications and between plots. Intercultural operation and irrigation were done when needed.

The rice plant was harvested when about 90% of the grains turned to yellowish color. Five randomly selected plants per plot except border rows were calculated for data collection data on yield contributing characters at harvest. Grain yield was taken from one square meter and converted to tons per hectare (ha).

Statistical Analysis

The collected data were analyzed with the ANOVA technique and the mean differences were adjudged by Duncan's Multiple Range Test Gomez and Gomez (1984) using statistical computer packages MSTAT.

III. Results and Discussion

Nitrogen promotes rapid plant growth and improves grain yield and grain quality through higher tillering, leaf area development, grain formation, grain filling, and protein synthesis. The study results regarding the effect of nitrogen rate on yield and yield components of transplant *aus* rice cv. Binadhan-19 has been presented and discussed in this chapter.

Effect of Nitrogen on yield and yield contributing characters at harvest

Plant height: The plant height was influenced significantly due to the application of nitrogen. The highest plant height was obtained from 110 kg N ha^{-1} followed by 90 kg N ha^{-1}. The shortest plant height was found in control treatment (Table 02). Excess of nitrogen in the treatment of 130 kg N ha^{-1} might have encouraged more plant growth, producing the smallest plant. This result is in agreement with the findings of Chopra and Chopra (2004).

Number of effective tillers hill^{-1}: The rate of nitrogen had a significant effect on the production of effective tillers hill^{-1} production. The highest number of effective tillers hill^{-1} was produced in 110 kg N ha^{-1} followed by 130 kg N ha^{-1}. The lowest number of effective tillers hill^{-1} was recorded in control treatment or no nitrogen (Table 02). This result is supported by the findings of Adhikari et al. (2018).

Non-effective tillers hill^{-1}: The rate of nitrogen was a significant effect on the production of non-effective tillers hill^{-1}. The highest number of non-effective tillers hill^{-1} was obtained from 130 kg N ha^{-1} followed by without fertilizer and the lowest number of non-effective tillers hill^{-1} was found from 110 kg N ha^{-1}. This might be due to excess N application, which enhanced new tiller production at the later growth stage and caused, on the contrary, maximum non-effective tillers hill^{-1}.

Table 02. Effect of nitrogen doses on the growth and yield contributing characters of rice

Treatment (kg N ha^{-1})	Plant height (cm)	Effective tiller hill^{-1}	Non-effective tiller hill^{-1}	Flag leaf length (cm)	Flag leaf width (cm)	Panicle length (cm)	Rachis branchespanicle^{-1}	Filled grains panicle^{-1}	Unfilled grains panicle^{-1}	1000 seed weight (g)
Control	100.67 a	9.33 b	1.66 ab	28.80 b	1.21	22.83	8.40	90.93 b	22.66 a	22.10 c
90	102.33 ab	13.33 ab	1.33 ab	30.90 ab	1.25	23.76	8.73	98.53 a	18.40 b	22.93 b
110	105.00 a	14.00 a	0.66 b	30.93 ab	1.34	23.76	9.26	103.00 a	12.53 c	23.56 a
130	105.67 a	14.33 a	2.00 a	32.01 a	1.30	22.00	8.73	92.33 b	23.00 a	22.43 bc
CV%	11.24	4.15	12.90	3.58	0.20	2.83	1.79	21.48	9.48	3.53

Number of leaves hill^{-1}: Nitrogen rate had a significant effect on the total number of leaves hill^{-1}. The highest number of leaves hill^{-1} was obtained from 130 kg N ha^{-1} and 110 kg N ha^{-1}. The lowest number of leaves hill^{-1} was found in control (Figure 01). Considerable activity was investigated whether the suspected limit can be extended by changes in fertilizer application rates and timing and reported the same results (Dobermann et al., 2000).

Panicle length: Panicle length is a significant character that directly contributes to rice grain production. The rate of nitrogen had no significant effect on panicle length. The longest panicle was found from 110 kg N ha^{-1} followed by 90 kg N ha^{-1} and the shortest panicle was recorded in 130 kg N ha^{-1} followed by control (Table 02). This result was supported by another study reported by Djaman et al. (2018).

Number of filled grains panicle^{-1}: Nitrogen had a significant effect on number of filled grains panicle^{-1}. The highest number of grains panicle^{-1} was obtained from 110 kg N ha^{-1}, followed by 90 kg N ha^{-1}. Besides, the lowest number of grains panicle^{-1} was recorded in control (Table 02). Awan et al. (2011) also observed that the N rates significantly affected panicle length.

Number of unfilled grains panicle^{-1}: Nitrogen rate also had a significant effect on the number of unfilled grains panicle^{-1}. The maximum number of unfilled grains panicle^{-1} was recorded in 130 kg N ha-1 followed by 0 kg N ha-1. The lowest number of unfilled grains panicle-1 was 110 kg N ha-1 and control (Table 02).

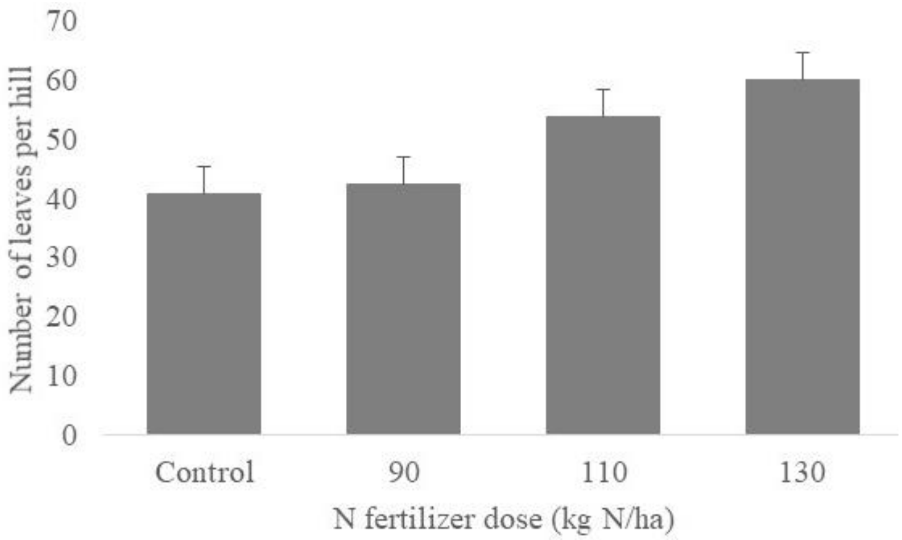


Figure 01. Effect of different levels of nitrogen on leaves number per hill of Binadhan-19

1000-grain weight (g): The effect of rate of nitrogen on 1000-grain weight was found significant in Binadhan-19 cultivation. The highest 1000-grain weight was found at 110 kg N ha-1. The lowest 1000-grain weight was found from the control (Table 02). The result indicated that the increase in nitrogen rate increased the 1000-grain weight until 110 kg N ha-1 then gradually decreased. This result was supported by the findings of Lawal and Lawal (2002).

Total dry matter (g): The total dry matter (TDM) production in rice varieties increased with age up to maturity, but TDM accumulation was rapid up to 70 DAT followed by slowly increasing physiological maturity (Figure 02). The highest TDM was recorded in 110 kg N ha-1 followed by90 kg N ha-1 and the lowest TDM was recorded in kg N ha-1 at all growth stages except that was probably due to better photosynthesis rate and chlorophyll content in leaves (Mondal et al., 2012). Results indicated that dry matter production was found in 110 kg N ha-1that might contribute to grain yield production.

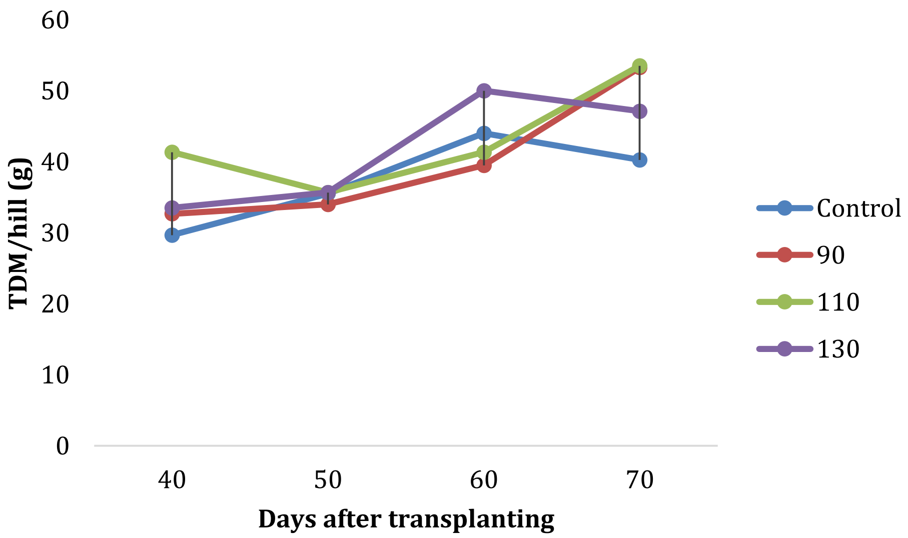


Figure 02. Total dry mass production at different growth stages of five aus rice varieties

Grain yield: Nitrogen application rate had a significant effect on grain yield production of Binadhan-19. The highest grain yield was produced in 110 kg N ha-1 and the lowest grain yield was obtained in control (Figure 03). The increase in grain yield from 110 kg N ha-1 might be due to the cumulative effect of the highest number of total grains panicle-1, 1000-grain weight, longest panicle length and the highest number of effective tillers hill^{-1} obtained from the supply of more nitrogen for the plants. Rice yield is significant and controlled by the N fertilizer application was also reported by Jahan et al. (2014).

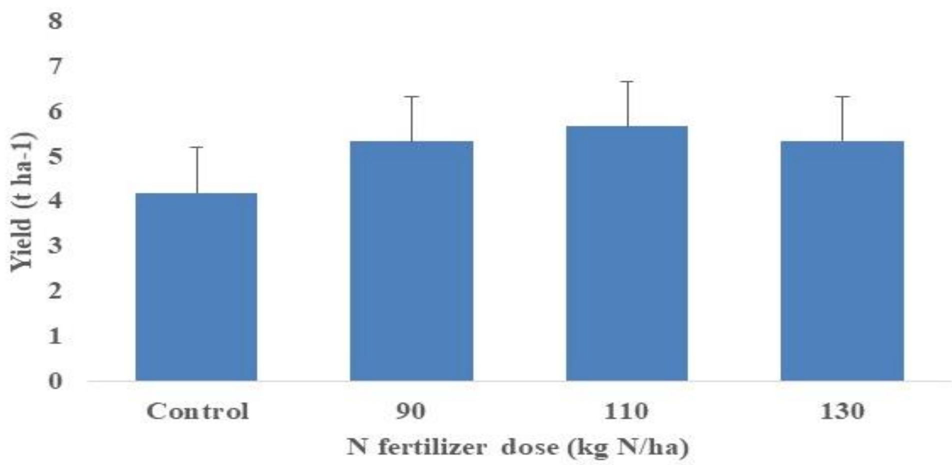


Figure 03. Effect of different levels of nitrogen on grain yield production of Binadhan-19

Relationship between dry weight and grain weight

Dry matter allocation per spikelet from heading to maturity was important for higher grain yield in rice. The poor grain filling might be related to poor partitioning of assimilates to rice grain (Puteh et al., 2014). It is observed that the grain yield increased with increased total dry matter production between grain yields and observed a positive correlation with total dry mass production (Figure 04). These results indicated that higher dry matter production during grain filling helps grain filling in rice previously reported by Akter et al. (2019).

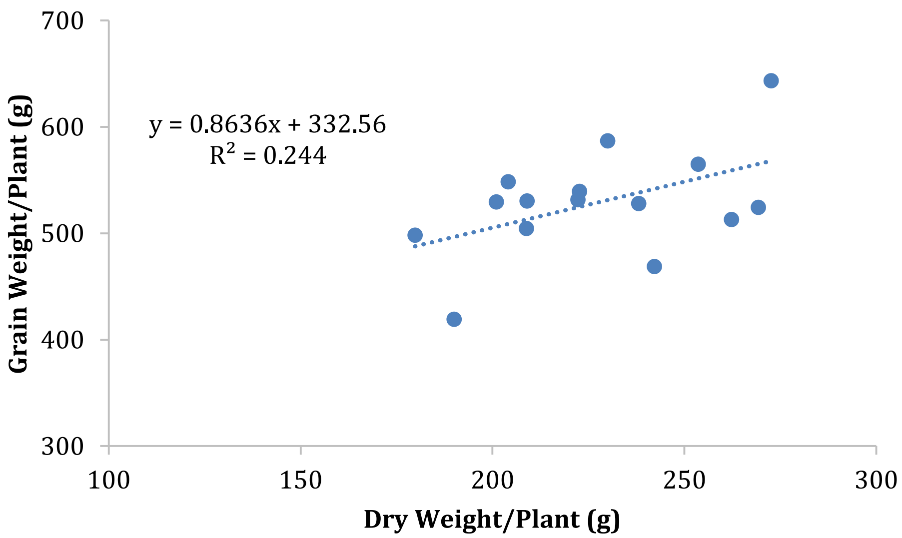


Figure 04. Relationship between dry weight and grain weight per plant

IV. Conclusion

Different levels of nitrogen application had a significant influence on morphological, yield and yield attributes. Results revealed that plant height, effective tiller, non-effective tiller, flag leaf length, filled gran, unfilled grain and 1000 grain weight were increased with increasing nitrogen doses till 110 kg N ha^{-1}. The highest grain weight was recorded in 110 kg N ha^{-1} due to superior performance of yield contributing characters of BInadhan-19. A positive correlation was found between grain yield and total dry matter production. To sum up, 110 kg N ha^{-1} would be the best dose for higher yield production of Binadhan-19 in *aus* season.

Acknowledgement

This work was supported by BINA substation strengthening program, Ministry of Agriculture, The People's Republic of Bangladesh.

References

[1]. Adhikari, J., Sarkar, A. R., Uddin M. R., Sarker, U. K., Hossen, K. and Rosemila, U. (2018). Effect of nitrogen fertilizer and weed management on the yield of transplant aman rice. Journal of Bangladesh Agricultural University, 16(1), 12–16. https://doi.org/10.3329/jbau.v16i1.36473

[2]. Akter, M. B., Islam, M. T., Mondal, M. M., Hoque, M. I., Kamruzzaman, M., Nafis, M., Sultana, A. and Ali, M. S. (2019). Morpho-physiological Basis of Yield Performance of Early Maturing Rice Varieties in Bangladesh. Annual Research & Review in Biology, 32(5), 1-13. https://doi.org/10.9734/arrb/2019/v32i530097

[3]. Alam, M. M., Ali, M. H., Ruhul, A. K. M. and Hassanuzzaman, M. (2009). Yield attributes, yield and harvest index of three irrigated rice varieties under different levels of phosphorus. Advance in Biological Research, 3(3-4), 132-139.

[4]. Alinajati, S. S. and Mirshekari, B. (2011). Effect of phosphorus fertilization and seed bio fertilization on harvest index and phosphorus use efficiency of wheat cultivars. Journal of Food Agricultural and Environment, 9(2), 388-397.

[5]. Awan, T. H., Ali, R. I., Manzoor, Z., Ahmad, M. and Akhtar M. (2011). Effect of different nitrogen levels and row spacing on the performance of newly evolved medium grain rice variety KSK-133. Journal of Animal Plant Science, 21(2), 231-234.

[6]. Azarpor, E., Tarighi, F., Moradi, M. and Bozorgi, H.R. (2011). Evaluation effect of different nitrogen fertilizer rates under irrigation management in rice farming. World Applied Sciences Journal 13(5), 1248-1252.

[7]. BBS (Bangladesh Bureau of Statistics), (2010). 'Agriculture Crop Cutting'. URL: www.bbs.gov.bd/PageWebMenuContent.aspx?MenuKey=166

[8]. BRRI (Bangladesh Rice Research Institute), (2016). Annual Report 2014-15. Gazipur 1701, Bangladesh.

[9]. Bufogle, A., Bollich, P. K., Norman, R. J., Kovar, J. L., Lindau, C. W. and Macchiavelli, R. E. (1997). Rice plant growth-and nitrogen accumulation in drill seeded and water-seeded culture. Soil Science Society of America Journal, 61, 832-839. https://doi.org/10.2136/sssaj1997.03615995006100030017x

[10]. Chaturvedi, I. (2005). Effect of nitrogen fertilizers on growth, yield and quality of hybrid rice (*Oryza sativa* L.). Journal of central European Agricultural, 6(4), 611-618.

[11]. Chopra, N K, and Chopra, N. (2004). Seed yield and quality of 'pusa 44'rice (*Oryza sativa*) as influenced by nitrogen fertilizer and row spacing. Indian Journal of Agricultural Science, 74(3), 144-146.

[12]. Djaman, K., Mel, V. C., Ametonou, F. Y., Namaky, R. E., Diallo, M. D., et al. (2018). Effect of Nitrogen Fertilizer Dose and Application Timing on Yield and Nitrogen Use Efficiency of Irrigated Hybrid Rice under Semi-Arid Conditions. Journal of Agricultural Science and Food Research, 9, 223.

[13]. Dobermann, A., Dawe, D., Roetter, R. P., Cassman, K. G. **(**2000)**.** Reversal of rice yield decline in a long-term continuous cropping experiment. Agronomy Journal, 92, 633–643. https://doi.org/10.2134/agronj2000.924633x

[14]. Gomez, K. A. and Gomez, A. A. (1984) Duncan's multiple range test. Statistical Procedures for Agricultural Research. 2nd Edition, John Wiley & Sons.

[15]. Islam, M. A., Islam, M. R. and Sarker, A. B. S. (2008). Effect of Phosphorus on Nutrient Uptake of Japonica and Indica Rice. Journal of Agricultural Rural Development, 6(1&2), 7-12 https://doi.org/10.3329/jard.v6i1.1651

[16]. Jahan, N., Islam, M. R., Siddique, A. B., Islam, M. R., Hassan, M. M., Shamsuzzaman, S. M. and Samsuri, A. W. (2014). Effects of integrated use of prilled urea, urea super granule and poultry manure on yield of transplant aus rice and field water quality. Life Science Journal, 11, 101–108.

[17]. Khairunniza-Bejo, S., Zulkifli, Z. and Muharam, F. M. (2017). Effect of nitrogen fertilizer to growth, biomass and grain yield of paddy. Acta Horticulture, 1152, 159-164. https://doi.org/10.17660/ActaHortic.2017.1152.22

[18]. Khan, A., Sarfaraz, M., Ahmad, N. and Ahmad, B. (1994). Effect of N dose and irrigation depth on nitrate movement in soil and N uptake by maize. Agricultural Research, 32. 47-54.

[19]. Khuang, T. Q., Huan, T. T. and Hach, C. V. (2008). Study on fertilizer rates for getting maximum grain yield and profitability of rice production. Omonrice, 16, 93-99.

[20]. Lawal, M. I. and Lawal, A. B. (2002). Influence of nitrogen rate and placement methods on growth and yield of rice (*Oryza sativa* L.) at Kadawa. Nigerian Journal, 23(3), 403-441.

[21]. Marschner, H. (1995). Mineral Nutrition of Higher Plants. 2nd edition. Academic Press, London.
[22]. Mondal, M. M. A., Puteh, A. B., Malek, M. A., Ismail, M. R., Rafii, M. Y., Latif, M. A. (2012). Seed yield in relation to growth and developmental aspects of mungbean. The Scientific World Journal, 2012, 425168.
[23]. Puteh, A. B., Mondal, M. M. A., Ismail, M. R. and Latif, M. A. (2014). Grain Sterility in relation to Dry Mass Production and Distribution in Rice (*Oryza sativa* L.). BioMed Research International, 2014, 302179.
[24]. Raun, W. R. and Johnson, G .V. (1999). Improving nitrogen use efficiency for cereal production. Agronomy Journal, 91, 357-363. https://doi.org/10.2134/agronj1999.00021962009100030001x
[25]. Sultana, A., Salim, M., Kader, M. A., Akter, M. B., Kamruzzaman, M. and Hoque, M. I. (2019). International Journal of Plant & Soil Science, 27(4), 1-8. https://doi.org/10.9734/ijpss/2019/v27i430084
[26]. Taiz, L. and Zeiger, E. (2010). Plant physiology, 5Th edition. Sinauer Associates Publishers, Sunderland, MA.
[27]. UNDP and FAO. (1988). Land Resources Appraisal of Bangladesh for Agricultural Development. Report 2. Agro-ecological Regions of Bangladesh. United Nation Dev. Prog. and Food and Agric. Org, pp. 212-221.
[28]. Yoseftabar, S. (2013). Effect of Nitrogen and Phosphorus Fertilizer on spikelet Structure and yield in rice (*Oryza sativa* L). International Journal of Agricultural Crop Science, 5 (11), 1204-1208.

HOW TO CITE THIS ARTICLE?

MLA

Akter, M. B. et al. "Nitrogen effect on the growth and yield contributing characters of Binadhan-19". Asian Journal of Crop, Soil Science and Plant Nutrition, 04(02), (2020): 157-164.

APA

Akter, M. B., Nahar, N., Rana, M. S., Hasan, M. N. and Rayhan, M. B. (2020). Nitrogen effect on the growth and yield contributing characters of Binadhan-19. *Asian Journal of Crop, Soil Science and Plant Nutrition*, 04(02), 157-164.

Chicago

Akter, M. B., Nahar, N., Rana, M. S., Hasan, M. N. and Rayhan, M. B. "Nitrogen effect on the growth and yield contributing characters of Binadhan-19". Asian Journal of Crop, Soil Science and Plant Nutrition, 04(02), (2020): 157-164.

Harvard

Akter, M. B., Nahar, N., Rana, M. S., Hasan, M. N. and Rayhan, M. B. 2020. Nitrogen effect on the growth and yield contributing characters of Binadhan-19. Asian Journal of Crop, Soil Science and Plant Nutrition, 04(02), pp. 157-164.

Vancouver

Akter, MB, Nahar, N, Rana, MS, Hasan, MN and Rayhan, MB. Nitrogen effect on the growth and yield contributing characters of Binadhan-19. Asian Journal of Crop, Soil Science and Plant Nutrition, 2020 December 04(02), 157-164.