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RESPONSE OF RICE TO NITROGEN FERTILIZER SCHEDULING IN *T. AMAN* SEASON

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ABSTRACT

The experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh from July-November, 2019 to evaluate the response of rice to nitrogen fertilizer scheduling in *T. aman* field. The experiment comprised of three varieties viz. BRRI dhan34, BRRI dhan49 and Dhani Gold and five nitrogen treatments are no nitrogen (N_0), 110 kg N/ha as USG (N_1), 110 kg N/ha as Prilled Urea (1/3 at Basal + 1/3 at 30 DAT + 1/3 at 45 DAT) (N_2), 110 kg N/ha as Prilled Urea (1/3 at 15 DAT + 1/3 at 30 DAT + 1/3 at 45 DAT) (N_3) and 110 kg N/ha as Prilled Urea (1/4 at 15 DAT + 1/4 at 30 DAT + 1/4 at 45 DAT + 1/4 at 60 DAT) (N_4). The experiment was laid out in a randomized complete block design (RCBD) with three replications. The highest result for plant height (146.0 cm) was found for BRRI dhan-34 with 110 kg N/ha as prilled urea (1/4 at 15 DAT + 1/4 at 30 DAT + 1/4 at 45 DAT + 1/4 at 60 DAT) (N_4). The highest number of total tiller hill^{-1} (10.80), 1000 grain weight (24.11 g), grain yield (6.937 t ha^{-1}), straw yield (7.513 t ha^{-1}) and biological yield (14.45 t ha^{-1}) were found in Dahani gold with 110 kg N/ha as prilled urea (1/4 at 15 DAT + 1/4 at 30 DAT + 1/4 at 45 DAT + 1/4 at 60 DAT) (N_4). The highest harvest index (48.61%) was found for BRRI dhan-49 with 110 kg N/ha as prilled urea (1/3 at 15 DAT + 1/3 at 30 DAT + 1/3 at 45 DAT) (N_3). The result indicated that hybrid variety Dhani gold yielded the highest, while fine rice variety BRRI dhan34 yielded the lowest.

Key words: Rice, prilled urea, grain yield, *T. aman* season

Introduction

In Bangladesh, rice is the most extensively cultivated cereal crop. About 75% of cropped area of Bangladesh is used for rice production with an annual production of 36.28 million metric tons from an area of 11.45 million ha (BBS, 2020). There are three distinct growing seasons of rice according to change in seasonal conditions such as *Aus*, *Aman* and *Boro* which account for approximately 7%, 38% and 55% of total annual rice production, respectively (BBS, 2020). *Aman* rice covers the area of 5.62 million hectares with a production of 14.43 million metric tons (BBS, 2020). Nitrogen is one of the major plant nutrients required for plant growth. It is essential for the synthesis of protein, which is the constituent of protoplasm and chloroplast. It is a constituent of numerous important compounds found in living cells, including amino acid, protein (enzymes), nucleic acid and chlorophyll. This element is the most essential element in determining the yield potential of intensified agriculture system. BRRI (2000) reported that nitrogen has a positive influence on yield and yield components of rice. The important role of nitrogen fertilizers in increasing rice yield has been widely recognized particularly after the development of modern varieties. The nitrogen content of Bangladesh soil is low due to warm climate accompanied by extensive cultivation. The efficiency of applied nitrogen use by the rice plant is also low. Most of farmers have a tendency to apply more amount of nitrogen to obtain higher yield. Farmers mainly use urea as N fertilizer which is about 75% of the total fertilizer use in Bangladesh. Most of the rice soils of Bangladesh are deficient in N and consequently the response of modern rice varieties to nitrogen application has always been observed remarkable. Yield of improved rice varieties may reduce due to improper use of fertilizer, which also causes high cost of production. Inadequate amount of N fertilizer management might be the reason of low response of many high yielding improved varieties. Production potential of rice is released only when optimum condition for growth and development is available. Optimum level of nitrogen ensures proper plant growth and grain formation and this results higher yield (Wang, 2005). Therefore it is very much essential to find out optimum level of nitrogenous fertilizer application for efficient utilization of nitrogen

by the crop plants for reaching maximum production with minimum cost. Many workers have reported a significant response of rice to nitrogen in different soil in Bangladesh. Therefore, the study was undertaken to investigate the effect of nitrogen scheduling on yield of *T. aman* rice.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh from July-November, 2019 to evaluate the response of rice to nitrogen fertilizer scheduling in *T. aman* season on that field. The experiment comprised of three varieties viz. BRRI dhan34, BRRI dhan49 and Dhani Gold and five nitrogen scheduling are no nitrogen (N_0), 110 kg N/ha as USG (N_1), 110 kg N/ha as Prilled Urea (1/3 Basal + 1/3 at 30 DAT + 1/3 at 45 DAT) (N_2), 110 kg N/ha as Prilled Urea (1/3 at 15 DAT + 1/3 at 30 DAT + 1/3 at 45 DAT) (N_3) and 110 kg N/ha as Prilled Urea (1/4 at 15 DAT + 1/4 at 30 DAT + 1/4 at 45 DAT + 1/4 at 60 DAT) (N_4). The experiment was laid out in a randomized complete block design (RCBD) with three replications. Total number of plots was 45 and the unit plot size was 4 m × 1.5 m (6 m^2). The distance maintained between two unit plots was 1.0 m and between blocks was 1 m. The seedlings were transplanted on 06 August 2019 following the spacing of 25 cm × 15 cm with three seedlings $hill^{-1}$. Fertilizers (except nitrogenous fertilizer) were applied in the field as per recommendation of Bangladesh Rice Research Institute with 100 kg triple super phosphate, 70 kg muriate of potash, 60 kg gypsum and 10 kg zinc sulphate ha^{-1} one day before transplanting as basal dose (FRG, 2012). Nitrogen was applied as per treatment in the different forms of urea as per treatment specification. Intercultural operations like gap filling, weeding, irrigation, drainage, bund repairs etc. were done as and when necessary. Five hills were randomly selected from each unit plot prior to harvest for recording different data on plant characters and yield components. The harvested crop was threshed and dried, and weights of grain and straw were recorded and converted into ton ha^{-1}. Data recorded for different parameters were tabulated in proper form. The recorded data on various plant characters were statistically analyzed. The mean of all treatments were calculated and the Analysis of variance (ANOVA) for each of the parameters under study was done with the help of computer package MSTAT. The differences among treatment means were compared by Duncan's New Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

The results revealed that nitrogen scheduling showed significant effect on growth, yield and different yield contributing characters of plants (Table 1). Among the varieties highest results for number of total tiller $hill^{-1}$ (9.35), 1000 grain weight (22.26 g), grain yield (6.11 t ha^{-1}), straw yield (6.65 t ha^{-1}), biological yield (12.77 t ha^{-1}) and harvest index (47.59%) were found from Dhani gold. Mittra (2005) found significant variation among the rice genotypes in terms of grain yield. The variation in yield of advanced lines might be due to the varietal characteristics. Kabir *et al*. (2004) reported that grain yield may differ due to genetic characteristics of the varieties. Yield performances and plant characters showed significant response to N scheduling. The highest plant height (115.4 cm), number of total tiller $hill^{-1}$ (10.13), 000 grain weight (19.18 g), grain yield (5.287 t ha^{-1}), straw yield (5.843 t ha^{-1}) and biological yield (11.13 t ha^{-1}) was found in 110 kg N/ha as prilled urea (1/4 at 15 DAT + 1/4 at 30 DAT + 1/4 at 45 DAT + 1/4 at 60 DAT) (N_4). Similar results were found elsewhere (Singh *et al.,* 2000 and Salahuddin *et al*., 2009). The highest harvest index was found for 110 kg N/ha as prilled urea (1/3 Basal + 1/3 at 30 DAT + 1/3 at 45 DAT) (N_2) as shown in Table 2. The interaction effect of nitrogen scheduling and rice varieties was statistically significant in terms of all plant characters and yield performances (Tables 1-2). The highest result for plant height (146.0 cm) was found for BRRI dhan-34 with 110 kg N/ha as prilled urea (1/4 at 15 DAT + 1/4 at 30 DAT + 1/4 at 45 DAT + 1/4 at 60 DAT) (N_4). The highest number of total tiller $hill^{-1}$ (10.80), 1000 grain weight (24.11 g), grain yield (6.937 t ha^{-1}), straw yield (7.513 t ha^{-1}) and biological yield (14.45 t ha^{-1}) was found in Dahani gold with 110 kg N/ha as prilled urea (1/4 at 15 DAT + 1/4 at 30 DAT + 1/4 at 45 DAT + 1/4 at 60 DAT) (N_4). The highest harvest index (48.61%) was found for BRRI dhan-49 with 110 kg N/ha as prilled urea (1/3 at 15 DAT + 1/3 at 30 DAT + 1/3 at 45 DAT) (N_3).

Table 1. Effect of variety, N fertilizer scheduling and their interaction on plant height and no. of total tillers hill^{-1} of *T.aman* rice at different growth stages

Treatment and their interaction	Plant height (cm) at different days after transplanting (DAT)			No. of total tillers hill^{-1} at different days after transplanting (DAT)		
	30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest
Variety						
BRRI dhan34 (V_1)	6.807	8.82	8.373b	52.79a	98.52a	136.7a
BRRI dhan49 (V_2)	6.569	8.24	9.153a	50.31ab	67.11b	94.80b
Dhani Gold (V_3)	6.530	8.34	9.353a	49.31b	64.03b	89.22c
Level of significance	NS	NS	**	*	**	**
N fertilizer scheduling						
N_0	6.083	7.894	6.767c	42.17c	63.26d	89.13c
N_1	6.972	8.850	9.356ab	55.98a	86.24a	111.7a
N_2	6.394	8.206	8.789b	46.96b	74.04c	104.4b
N_3	6.890	8.701	9.756a	54.47a	80.06b	113.9a
N_4	6.836	8.713	10.13a	54.44a	79.18b	115.4a
Level of significance	NS	NS	**	**	**	**
Interaction						
V_1N_0	6.24	8.24	6.233	44.10fg	81.80	117.8
V_1N_1	7.49	9.62	8.833	63.93a	111.1	143.3
V_1N_2	6.59	8.52	8.533	48.83cdef	95.17	134.1
V_1N_3	6.91	8.84	8.933	52.97bcd	100.8	142.1
V_1N_4	6.80	8.90	9.333	54.10bcd	103.7	146.0
V_2N_0	6.10	7.66	7.167	42.17fg	56.97	77.70
V_2N_1	6.60	8.30	9.500	51.10bcde	75.33	97.77
V_2N_2	6.34	8.04	9.033	47.00defg	64.90	92.13
V_2N_3	7.03	8.73	9.800	57.20b	70.40	102.4
V_2N_4	6.76	8.50	10.27	54.07bcd	67.97	104.0
V_3N_0	5.90	7.77	6.900	40.23g	51.00	71.90
V_3N_1	6.82	8.62	9.733	52.90bcd	72.30	94.03
V_3N_2	6.25	8.05	8.800	45.03efg	62.07	86.87
V_3N_3	6.72	8.52	10.53	53.23bcd	68.93	97.10
V_3N_4	6.94	8.74	10.80	55.17bc	65.87	96.20
Level of significance	NS	NS	NS	*	NS	NS

Table 2. Effect of variety, N fertilizer scheduling and their interaction on 100-grain weight and yield of *T.aman* rice

Treatment and their interaction	1000 grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Variety					
BRRI dhan34 (V_1)	10.65c	2.35c	2.81c	5.19c	44.86
BRRI dhan49 (V_2)	20.08b	5.21b	5.79b	11.01b	47.03
Dhani Gold (V_3)	22.26a	6.11a	6.65a	12.77a	47.59
Level of significance	**	**	**	**	NS
N fertilizer scheduling					
N_0	14.18d	2.74c	3.41c	6.21d	43.12b
N_1	18.42b	4.97ab	5.46a	10.44b	47.39a
N_2	17.74c	4.55b	5.03b	9.58c	47.27a
N_3	18.79ab	5.23a	5.67a	10.91ab	47.62a
N_4	19.18a	5.28a	5.84a	11.13a	47.06a
Level of significance	**	**	**	**	*

Treatment and their interaction	1000 grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Interaction					
V_1N_0	8.23h	1.30h	1.74g	3.22h	40.38
V_1N_1	11.20g	2.56fg	2.91f	5.48g	46.67
V_1N_2	10.97g	2.35g	2.77f	5.13g	46.18
V_1N_3	11.27g	2.74fg	3.26f	6.01g	45.77
V_1N_4	11.57g	2.78fg	3.36f	6.15g	45.29
V_2N_0	16.17f	3.28ef	4.19e	7.47f	43.67
V_2N_1	20.87cd	5.59cd	6.26c	11.86d	47.19
V_2N_2	20.17d	4.96d	5.43d	10.40e	47.75
V_2N_3	21.33bc	6.07bc	6.42c	12.50cd	48.61
V_2N_4	21.86b	6.13abc	6.65bc	12.79cd	47.94
V_3N_0	18.13e	3.64e	4.31e	7.95f	45.30
V_3N_1	23.20a	6.75ab	7.22ab	13.98ab	48.33
V_3N_2	22.10b	6.33abc	6.89abc	13.23bc	47.90
V_3N_3	23.77a	6.89ab	7.33a	14.23ab	48.48
V_3N_4	24.11a	6.93a	7.51a	14.45a	47.95
Level of significance	**	*	**	**	NS

Here, in a column, figures with same letter(s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly as per DMRT. * = Significant at 5% level of probability, ** = Significant at 1% level of probability

Conclusion

It can be concluded that hybrid variety Dhani gold yielded the highest, while fine rice variety BRRI dhan34 yielded the lowest. Application of prilled urea in 3 or 4 splits (without basal application) or USG after transplanting resulted in similar rice yield.

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