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Response of Nitrogen Application at Different Growth Stages on Fine Aman Rice (CV. Kalizira)

M. A. Haque[1], M. N. H. Miah[1], M. E. Haque[2], M. S. Islam[2] and M. S. Islam[3]

[1]Department of Agriculture Chemistry, BAU, Mymensingh
[2]UAO, DAE and [3]PO, RKU Bank, Natore

Abstract

An experiment was conducted at the Agronomy Farm, Bangladesh Agricultural University during the aman season of 2005-2006 to investigate the response of different doses of nitrogen application at different growth stages on fine aman rice (cv. kalizira). The experiment consisted of 3 levels of N application namely, 50% of recommended N, 100% of recommended N (150kg ha^{-1}) and 25% higher than recommended N and 3 different plant growth stages of N application namely transplanting, maximum tillering and panicle initiation stage. The application of single super phosphate, muriate of potash, gypsum and zinc sulphate were same in all the plots at the rate of 125, 67, 20 and 5 kg ha^{-1}, respectively. The experiment was laid out in a split plot design (SPD) with three replications. All data were analyzed using the analysis of variance technique and the mean differences were adjusted by DMRT. The results revealed that different doses of nitrogen had significant positive effect on the most of the vegetative parameters. Plant height, numbers of tiller $hill^{-1}$, leaf $hill^{-1}$, dry matter $hill^{-1}$ were to be highest with the increasing rate of nitrogen at all sampling excluding final harvest.

Key words: Agronomic practice,Growth stages, Kalizira variety, Nitrogen fertilizer

Introduction

Bangladesh is known to be highly vulnerable to floods and faced every year minor to major of its effect. Abnormal floods submerge about 60% of the land, damage crops, property; disrupt economic activities and cause diseases and loss of life (Nasreen, 2004). About 60% land of Bangladesh is flood-prone while 25% areas in Bangladesh are inundated by monsoon flood water between June and October every year (Uddin, 2004). BRRI (1981) also reported that about 30-40% area under transplant *aman* rice is planted late beyond optimum time due to delayed harvest *aus* rice and jute crop coupled with the associated turn-around time.

Aromatic rice is the most highly valued rice commodity in Bangladesh agricultural trade market having small grain, pleasant aroma with soft texture upon cooking (Dutta *et al.*, 1998). Fine rice cultivar Kalizira can be transplanted late even up to last week of September, which keeps a high margin in comparison to local as well as the other indigenous transplant *aman* fine rice cultivars. But when transplanted late in September it has a poor opportunity to produce enough tillers before reaching its reproductive phase. Among different improved agronomic practices, rate and time of nitrogen application may compensate the yield loss of transplant *aman* rice due to late transplanting. BRRI (1990) reported that nitrogen has a positive influence on the production of effective tillers. But excess amount of nitrogen fertilizer results in lodging of plant, prolonging growing period, delaying maturity and reducing yield (Uddin,2003). Quite a large number of experiments have so far been carried out through out the world to find out the optimum level of nitrogen in rice. However, in the country sufficient research work have not yet been done on different level of nitrogenous fertilizer especially with late planted fine *aman* rice. The present piece of research work was, therefore, undertaken to find out the response of different doses of nitrogen application at different growth stages on fine aman rice (cv. kalizira).

Materials and Methods

The experiment was conducted at the Agricultural Farm, Bangladesh Agricultural University during the *aman* season of 2005-2006 to investigate the response of different doses of nitrogen application at different growth stages on fine *aman* rice (cv. kalizira). The experiment consisted of 3 levels of N application (kg ha^{-1}) namely, 50% of recommended dose of N (N_1), 100% of recommended dose of N (N_2) and 25% higher than recommended dose of N (N_3) and 3 different plant growth stages of N application namely transplanting (T_1), maximum tillering (T_2) and panicle initiation stage (T_3). According to the soil test values and their interpretations, the fertilizers dose were recommended with the help of FRG (2005) namely urea, single super phosphate, muriate of potash, gypsum and zinc sulphate at the rate of 150, 125, 67, 20 and 5 kg ha^{-1} respectively and except urea entire fertilizers were applied as same in all the plots at the time of final land preparation. Urea was applied in three equal splits at transplanting, maximum tillering

and panicle initiation stage of the crop. The experiment was laid out in a split plot design (SPD) with three replications. The unit plot size was 5 m x 2 m with an inter-plot and inter-block spacing of 0.5 m and 1.5 m respectively. Thirty days old two healthy seedlings were transplanted per hill in the experimental plots at a plant spacing of 20 cm x 15 cm on 16 September, 2005 and the crop was harvested at maturity on 7 January, 2006. All the intercultural practices such as gap filling, weeding, water and pest management were done in time as and when necessary. Five hills were randomly selected from each plot for data collection excluding border rows. The data recorded at vegetative stage continued at 15 day intervals beginning from 45 DAT up to 75 DAT and harvesting of the crop and the parameters were plant height (cm), number of tillers $hill^{-1}$, number of leaves $hill^{-1}$, shoot dry matter gm $hill^{-1}$. All data were analyzed using the analysis of variance technique and the mean differences among the treatment were adjusted by DMRT (Gomez and Gomez, 1984).

Results and Discussions

Plant height

Plant height was significantly affected by both the nitrogen application at different growth stage and the amount of nitrogen applied at all dates of sampling. At 45, 60 and 75 DAT, the tallest plant height was found 59.37, 80.20 and 102.63 cm when N was applied at transplanting, maximum tillering and panicle initiation stage respectively. At all the DAT (45, 60 and 75), the longest plant was found 62.62, 83.81 and 107.29 cm respectively in 25% higher N level than recommended dose (Table 1). The results indicated that plant height increased with higher level of N applied. The result is similar to the findings of Lawal and Lawal (2002) that plant height responded to N up to 120 kg N ha^{-1}.

Table 1. Effect of N application stage and N levels on different plant characters at different days after transplanting (DAT)

Treatment	Plant height (cm)			No. of total tiller $hill^{-1}$			No. of leaf $hill^{-1}$		
	45 DAT	60DAT	75DAT	45DAT	60DAT	75DAT	45DAT	60DAT	75DAT
T_1	59.37a	78.05ab	90.37b	14.85a	10.42b	7.46b	83.65a	57.38ab	48.72b
T_2	55.57ab	80.20a	97.77ab	13.55b	11.82a	8.18ab	80.40a	64.00a	55.40ab
T_3	51.59b	75.35b	102.63a	12.15c	8.83c	9.02a	75.87b	54.71b	58.06a
Level of significance	**	**	**	**	**	**	**	**	**
CV(%)	6.32	4.54	6.49	5.24	7.15	7.78	3.20	6.46	7.64
N_1	48.90b	72.46b	88.68b	11.83c	8.61b	7.02b	77.44b	54.59b	42.60c
N_2	56.01a	77.33b	94.79b	13.40b	10.58a	8.27a	80.36ab	58.53ab	55.03b
N_3	62.62a	83.81a	107.29a	15.31a	11.88a	9.37a	82.12a	62.98a	64.55a
Level of significance	**	**	**	**	**	**	**	**	**
CV(%)	6.32	4.54	6.49	5.24	7.15	7.78	3.20	6.46	7.64

In a column figurers with same letter or with out letters do not differ significantly at the level of 5% as per DMRT. NS = Not significant, ** = 1% level of significant.

T_1= Transplanting stage
T_2 =Maximum tillering stage
T_3 = Panicle initiation stage

N_1= 50% of recommended dose of N
N_2 =100% of recommended dose of N
N_3 = 25% higher than recommended dose of N

Effect of interaction on nitrogen application at different growth stage and the amount of nitrogen applied was not significantly affected by plant height for all sampling except at 45 DAT. At 45 DAT, the tallest plant was observed (64.95cm) when 100% of recommended level of N applied at transplanting stage. In general finding, at 60 DAT the tallest plant was observed (79.53cm) where N was applied at maximum tillering stage with 100% of recommended level of nitrogen. At 75 DAT, the tallest plant was

observed (110.22cm) when N applied at panicle initiation stage with 25% higher than of recommended level of N (Table 2). Plant height gradually increased at different DAT as a normal phenomenon. Reddy *et al*. (1988) reported that 120 kg N ha^{-1} applied in three split dressing at transplanting (50%), tillering(25%) and panicle initiation stage(25%) gave higher plant height than the same amount of N when applied in tow equal split dressing at transplanting and tillering or in a single dressing at transplanting.

Number of total tiller hill^{-1}

Total tillers hill^{-1}was also significantly affected by both the nitrogen application at different growth stage and the amount of nitrogen applied at all dates of sampling. At 45 DAT, the highest tillers hill^{-1}(14.85) was found when N was applied at transplanting stage. At 60 DAT and 75 DAT, The highest tillers hill^{-1}were observed (11.82) when N applied at maximum tillering and panicle initiation stage respectively. Total tillers hill^{-1} gradually decreased first reached at a peak and there after it with advancement of age after 40 DAT. At all the DAT (45, 60 and 75), total tillers hill^{-1}was found 15.31, 11.81 and 9.37 respectively in 25% higher N level than recommended dose (Table 1).

In general, the increasing trend of total tillers hill^{-1} was observed up to 45 and than declined up to 75 DAT. Singh and Singh (2002) reported that increasing levels of nitrogen significantly increased total tiller hill^{-1}up to a certain stage. Interaction effect of N application of different growth stages and different levels of N were not significantly affected by total tillers hill^{-1} for all sampling dates (Table 2).

Number of leaf hill^{-1}

Leaf number hill^{-1} was significantly affected by both the nitrogen application at different growth stage and the amount of nitrogen applied at all dates of sampling. Number of leaf hill^{-1} was significantly increased with the advancement of growth stage. At 45, 60 and 75 DAT, the highest number of leaf hill^{-1} was obtained 63.65, 64.00 and 58.06 when N was applied at transplanting, maximum tillering and panicle initiation stage respectively. A decreasing trend was observed on leaf number hill^{-1} after 60 DAT (Table 1). At 45, 60 and 75 DAT, the highest number of leaf hill^{-1} was found 82.12, 62.98 and 64.55 respectively from 25% higher N level than recommended dose (Table 1). A decreasing trend of leaf number hill^{-1} was observed after 45 up to 75 DAT (Table 1). Hossain *et al.* (1995) noticed for all nitrogen levels in general increased leaf number hill^{-1}until the following stage and it declined there after till harvesting possibly due to leaf senescence. Interaction effect of N application of different growth stages and different levels of N was not significantly affected by leaf number hill^{-1} at all the sampling dates (Table 2).

Table 2. Interaction effect of N application stage and N levels on different plant characters at different days after transplanting (DAT)

Treatment	Plant height (cm)			No. of total tiller hill^{-1}			No. of leaf hill^{-1}		
	45 DAT	60DAT	75DAT	45DAT	60DAT	75DAT	45DAT	60DAT	75DAT
$T_1 N_1$	54.95cd	74.82	79.50	13.02	8.74	6.22	8.25	55.72	38.20
$T_1 N_2$	58.22bc	77.44	87.91	14.97	10.72	7.28	83.77	56.57	47.45
$T_1 N_3$	64.95a	81.95	103.68	16.55	11.79	8.90	84.92	59.85	60.52
$T_2 N_1$	51.20d	76.07	88.84	11.95	9.90	7.05	76.92	61.07	45.00
$T_2 N_2$	56.72bcd	79.53	96.50	13.27	12.27	8.40	81.32	63.80	56.50
$T_2 N_3$	58.80bc	85.01	107.98	15.45	13.31	9.08	82.97	67.15	64.70
$T_3 N_1$	40.55e	66.48	97.71	10.52	7.20	7.80	73.15	46.97	44.62
$T_3 N_2$	53.10cd	75.08	99.97	11.97	8.77	9.12	76.00	55.22	61.15
$T_3 N_3$	61.12ab	84.48	110.22	13.95	10.54	10.13	78.47	61.95	68.42
Level of significance	*	NS	NS	NS	NS	NS	NS	NS	NS
CV(%)	6.32	4.54	6.49	5.24	7.15	7.78	3.20	6.46	7.64

In a column figurers with same letter or with out letters do not differ significantly at the level of 5% as per DMRT.
NS = Not significant, * = 5% level of significant.

T_1= Transplanting stage
T_2 =Maximum tillering stage
T_3 = Panicle initiation stage
N_1= 50% of recommended dose of N,
N_2 =100% of recommended dose of N and
N_3 = 25% higher than recommended dose of N

Total dry matter production

Total dry matter production was significantly influenced by both the nitrogen application at different growth stage and the amount of nitrogen applied at all dates of sampling. At 45, 60 and 75 DAT, the highest TDM was obtained 30.75, 40.02 and 49.23 gm hill^{-1} when N was applied at transplanting, maximum tillering and panicle initiation stage respectively. At 45, 60 and 75 DAT, the highest TDM was found 30.71, 39.60 and 49.16 gm hill^{-1} respectively from 25% higher N level than recommended dose. An increasing trend was observed on TDM up to 45-75 DAT by both the nitrogen application at different growth stage and the amount of nitrogen applied at all dates of sampling (Figure 1 and 2). Chowdhury *et al.* (1994) noticed the same that the dry matter yield increased due to nitrogen applied at active tillering and panicle initiation stages. Interaction effect of N application of different growth stages and different levels of N were not significantly affected by total dry matter gm hill^{-1} at all the sampling dates (Fig. 3)

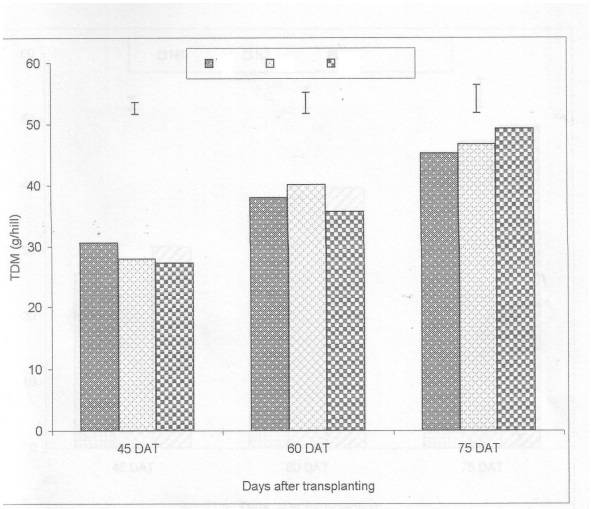

Fig. 1 Effect of N application stage on TDM production at different days after transplanting. Vertical bars represent $LSD_{0.05}$

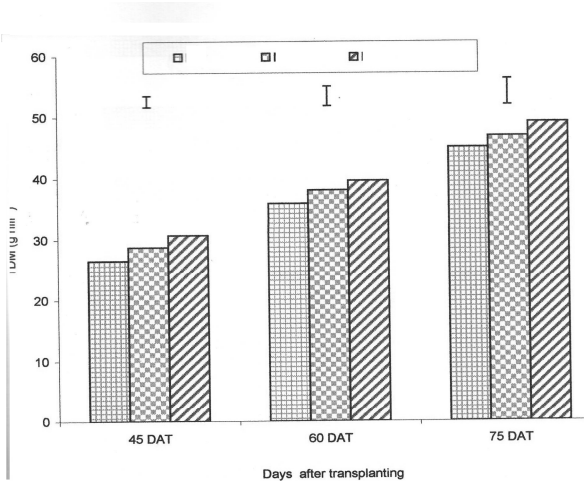

Fig. 2. Effect of level of N on TDM at different days after transplanting. Vertical bars represent $LSD_{0.05}$

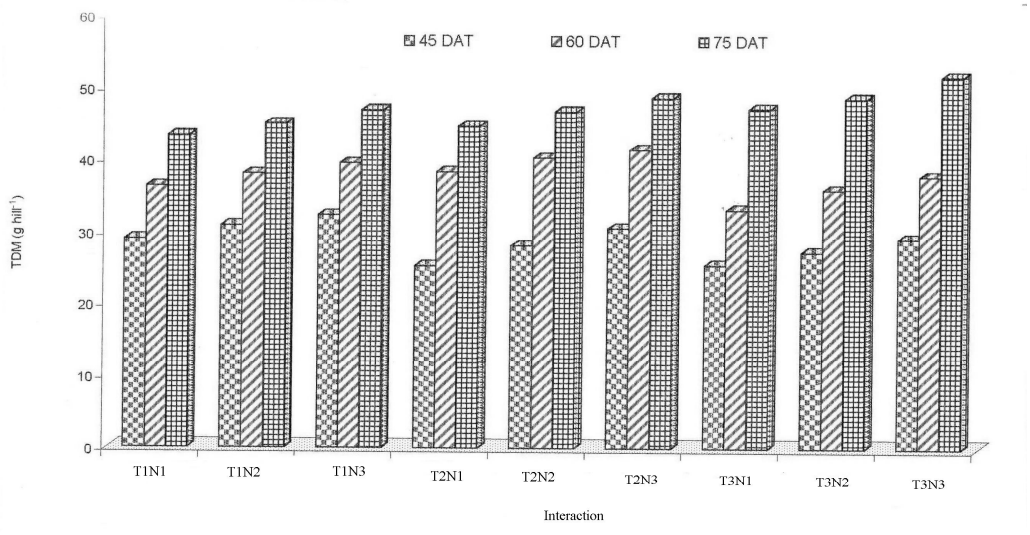

Fig. 3 Interaction effect of N application stage and N levels on TDM production at different days after transplanting

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