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Short Communication

Effect of nitrogen and transplanting date on yield and yield components of aromatic rice

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Abstract

A field experiment was conducted to find out the effect of nitrogen levels and transplanting dates on the yield and yield components of aromatic rice cv. *Kalizira*. The experiment was laid out in a randomized complete block design with three replications using four(0, 50, 100, and 150 kg N ha^{-1}) levels of nitrogen and three transplanting dates (10 August, 22 August and 04 September, 2007) along with the basal doses of triple super phosphate (TSP), muriate of potash (MoP) and gypsum. The study revealed that most of the yield and yield contributing characters with few exceptions were significantly influenced by nitrogen levels and transplanting dates. They had significant positive effect on tillers $hill^{-1}$, tillers $hill^{-1}$, grains $panicle^{-1}$ and straw yield. The highest grain yield (2.63 t ha^{-1}) was observed in 100 kg N ha^{-1} with 10 August transplanting treatment and straw yield (6.43 t ha^{-1}) was found highest in 150 kg N ha^{-1} with same date of transplanting and the lowest grain (1.83 t ha^{-1}) and straw yields (5.14 t ha^{-1}) were found in N control treatment with transplanting date of 04 September. The highest grain length (4.68 mm), grain breadth (2.49 mm) and imbibition ratio (6.93) were observed with 100 kg ha^{-1} N rate coupled with 10 August transplanting, and for length-breadth ratio, the same rate recorded the highest result, but with different transplanting date i.e. 22 August.

Keywords: Aromatic rice, *Kalizira*, Nitrogen, Transplanting date

Introduction

Rice (*Oryza sativa*) is the staple food for more than three billion people that is over half of the world's total population (FAO, 2004). In Bangladesh, about 80% of the total lands are used for rice cultivation. Rice contributes 91.1% of the total grain production and covers 74% of the total calorie intake for the people of Bangladesh. (MOA, 2001). There are two types of rice grain: coarse grain and fine grain. Fine grain varieties are generally aromatic and popular aromatic rice is *kalizira*,

Aromatic rice as reported by Singh *et al.* (2000), had 15 times more 2- acetyl -1- pyrroline content than non - aromatic rice (0.14 and 0.009 ppm, respectively). Aromatic rice is an important commodity in international trade having small grain with pleasant aroma. Islam *et al*. (1996) observed that the yield of aromatic rice was low (1.5-2.0 t ha^{-1}) but its high price and low cost of cultivation generated higher profit margins compared to other varieties. Aromatic rice of Bangladesh on account of its high export potential and taste better eating quality like polau, khir, firny, paish, chiram khoi, birany, etc. has high demand.

Nitrogen fertilizer is a key input for rice production in Bangladesh. Unfortunately, the N reserve of Bangladesh soil is very low due to sub - tropical humid climate accompanied with centuries of cultivation. Excess amount of N application can result in lodging of plant and reduction of yield and similarly deficiency of N may affect rice yield, so judicious application of N is important for obtaining better yield.

Beside nutritional factor transplanting date is an important factor, which affects tremendously the grain yield of transplanted aman rice. Chowdhury *et al.* (2000) reported that grain and straw yields gradually decreased after 10 August plantation. Islam (1986) concluded that time between 15 July and 20 August is the optimum for transplanting of aman rice especially in case of photosensitive rice varieties. So, the main objective of the study was to determine the optimum dose of nitrogen and the proper date of transplanting for obtaining satisfactory yield of *Kalizira* variety of aromatic rice.

Materials and Methods

The field experiment was conducted in the main farm of Bangladesh Agricultural University, Mymensingh. Chemical analyses of the initial soil sample of the experimental plots showed that the basic soil properties like pH, organic matter, total N, exchangeable K, Mg, P and available S were 6.49, 1.30 %, 0.11 %, 0.06 cmol kg^{-1}, 2.29 cmol kg^{-1}, 12.1 µg g^{-1} and 9.29 µg g^{-1} soil respectively. The experiment was laid out in a randomized complete block design with three replications. There were four levels of nitrogen viz. 0, 50, 100, and 150 kg N $ha^{-1}$and three dates of transplanting viz. 10 August, 22 August and 04 September, 2007. Basal doses of TSP, MoP and gypsum were applied during land preparation. The unit plot size was 4 m × 2.5 m. Thirty day old seedlings of aman rice cv. *Kalizira* were transplanted on 10 August, 22 August and 04 September with a spacing of 15 cm from hill to hill and 25 cm from row to row. Intercultural operations like irrigation, weeding, and insect pest control were performed whenever required. The crop was harvested after 103 days of transplantation at full maturity. Plot-wise yield and yield attributes were recorded. All data were statistically analyzed using the MSTATC. Duncan's Multiple Range Test (DMRT) was used to compare the treatments means.

Results and Discussion

Plant height, panicle length, no. of grains $panicle^{-1}$ and sterile spikelets $panicle^{-1}$ were significantly affected by both N application and transplanting date (Tables 1-3). The maximum plant height (137 cm, 135 cm respectively) was observed in 100 kg N ha^{-1} and 10 August transplanting date. Chopra and Chopra (2004) reported the significant effect of nitrogen on the increase of plant height. The maximum number of effective tillers $hill^{-1}$ (12.2, 9.40 respectively) was also observed with same N rate and transplanting date. The highest number of grains $panicle^{-1}$ was obtained (191) in 150 kg N ha^{-1} treatment with 10 August transplanting date and the lowest number was obtained (175) in N control. Kalita and Sharma (1992) showed that nitrogen had significant positive effect on number of grains $panicle^{-1}$. Single effect of N and transplanting date significantly affected the 1000-grain weight. The highest 1000-grain weight (12.0 g) was obtained in 150 kg N ha^{-1} with transplanting date10 August and the lowest (10.7 g) in 0 kg N ha^{-1} with transplanting date 10 August. Chopra and Chopra (2004) reported the significant effect of nitrogen on increase in grain weight. The highest grain yield (2.40 t ha^{-1}) was achieved for 100 kg N ha^{-1} and the lowest grain yield from N control. Concerning straw yield, the highest (6.23 t ha^{-1}) yield being observed in 150 kg N ha^{-1} and the lowest (5.38 t ha^{-1}) in observed in N control.

Table 1. Effect of different levels of nitrogen on the yield and yield attributes of aromatic rice cv. *Kalizira*

Levels of nitrogen	Plant height (cm)	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	1000- grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
N_o	126	8.66	7.68	20.0	173	36.0	11.34	1.88	5.38
N_{50}	133	12.6	8.77	22.1	180	33.7	11.43	2.32	5.90
N_{100}	135	12.9	12.2	23.4	185	31.4	12.00	2.40	5.62
N_{150}	137	11.7	9.82	23.8	180	31.4	11.47	2.23	6.23
$LSD_{(0.05)}$	2.83	0.92	0.71	1.07	8.18	2.21	0.90	0.08	0.31
CV (%)	1.86	6.59	5.83	3.60	3.42	5.04	5.86	2.84	4.12

N_0 =0 kg N ha^{-1}, N_{50} =50 kg N ha^{-1}, N_{100} =100 kg N ha^{-1}, N_{150} =150 kg N ha^{-1}

Table 2. Effect of different transplanting dates on growth and yield of aromatic rice cv. *Kalizira*

Date of transplanting	Plant height (cm)	No. of total tillers hill^{-1}	No. of effective tillers hill^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
10 August	135	11.1	9.43	23.0	182	31.4	11.9	2.34	5.84
22 August	133	12.3	9.07	22.2	181	32.7	11.5	2.16	5.92
04 September	128	9.94	8.86	21.6	176.	35.1	11.2	2.13	5.58
$LSD_{(0.05)}$	2.83	0.79	0.45	0.92	8.25	1.92	0.56	0.02	0.27
CV. (%)	1.86	6.59	5.83	3.59	3.42	5.04	5.86	2.84	4.12

Table 3. Interaction effect of different levels of nitrogen and transplanting date on growth and yield of aromatic rice cv. *Kalizira*

Interaction	Plant height (cm)	No. of total tillers hill^{-1}	No. of -effective tillers hill^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	1000- grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
N_0 Aug $_{10}$	125	8.62	8.28	20.6	175	36.1	10.7	1.96	5.40
N_0 Aug $_{22}$	126	8.83	7.62	19.9	176	34.3	10.8	1.87	5.60
N_0 Sep $_{04}$	125	8.50	7.15	19.2	167	37.4	10.4	1.83	5.14
N_{50} Aug $_{10}$	135	12.7	9.17	22.9	182	32.3	11.4	2.43	5.83
N_{50} Aug $_{22}$	135	12.5	8.55	21.7	179	33.5	11.0	2.28	6.13
N_{50} Sep $_{04}$	128	12.5	8.60	21.5	180	35.3	11.2	2.25	5.73
N_{100} Aug$_{10}$	138	11.9	12.3	24.5	191	27.4	12.9	2.63	5.96
N_{100} Aug$_{22}$	136	12.5	9.83	23.9	188	32.3	11.4	2.34	5.80
N_{100} Sep $_{04}$	129	12.3	9.34	21.7	176	34.4	11.5	2.25	5.72
N_{150} Aug$_{10}$	142	13.2	11.1	25.4	189	28.5	12.0	2.47	6.43
N_{150} Aug$_{22}$	138	11.5	12.2	23.4	180	30.5	11.2	2.16	6.16
N_{150} Sep $_{04}$	131	10..2	6.23	22.4	172	34.3	11.1	2.08	6.10
$LSD_{(0.05)}$	5.60	0.47	1.22	1.84	14.1	3.82	1.13	0.14	0.54
CV. (%)	1.86	6.59	5.83	3.59	3.42	5.04	5.86	2.84	4.12

Islam (2007) reported application the highest grain (3.65 t ha^{-1}) was recorded in 100 kg N ha^{-1} and the lowest (2.57 t ha^{-1}) was found in control. The application of N with transplanting date significantly affected grain yield while straw yield remain unaffected. The highest straw yield was obtained (6.43 t ha^{-1}) in treatment 150 kg N ha^{-1} with transplanting date 10 August and the lowest straw yield (5.14 t ha^{-1}) was found in 0 kg N $ha^{-1}$with transplanting date 04 September. (Khalid, 2006) reported as boro rice that the highest grain yield of (5.10 t ha^{-1}) was obtained from 10 January transplanting with 150 kg N ha^{-1}.

Grain length, grain breadth, grain length-breadth ratio and imbibition ratio were also significantly affected by N rate and transplanting dates but their interaction effect was not significant (Tables 4-6). The longest grain (4.68) was obtained in 100 kg N ha^{-1} with transplanting date 10 August and the shortest grain was obtained in 04. The highest grain breadth (2.49 mm) was obtained in treatment 100 kg N $ha^{-1}$with transplanting date 10 August and the lowest (1.95 mm) was obtained in 0 kg N ha^{-1} with 04 September transplanting date. The maximum length-breadth ratio of rice grain (2.23) was observed in 100 kg N ha^{-1} with transplanting date 22 August) and the minimum was in 150 kg N $ha^{-1}$with transplanting date 04 September. Imbibitions ratio of grain was significantly affected by single effect of N and transplanting date however their interaction effect was not significant. The maximum imbibitions ratio (6.93) was obtained at 100 kg N ha^{-1} with 10 August transplanting treatment and the minimum (4.70) was obtained at 100 kg N ha^{-1} with 04 September transplanting date.

Table 4. Effect of different levels of nitrogen on physical characteristics of aromatic rice cv*. Kalizira*

Levels of nitrogen	Grain length (mm)	Grain breadth (mm)	Length/Breadth ratio	Imbibition ratio
N_0	4.43	2.09	2.12	5.30
N_{50}	4.43	2.08	2.13	5.53
N_{100}	4.49	2.16	2.09	6.02
N_{150}	4.40	2.14	2.06	6.18
$LSD_{(0.05)}$	0.13	0.14	0.02	0.44
CV. (%)	1.91	7.95	3.31	7.89

Table 5. Effect of different transplanting dates on physical characteristics of aromatic rice cv*. Kalizira*

Transplanting date	Grain length(mm)	Breadth (mm)	Length/Breadth ratio	Imbibition ratio
10 August	5.53	2.29	2.41	6.27
22 August	4.58	2.14	2.14	5.85
04 September	4.19	2.04	2.05	5.15
$LSD_{(0.05)}$	0.07	0.14	0.12	0.38
CV. (%)	1.91	7.95	3.13	7.09

Table 6. Interaction effect of different levels of nitrogen and transplanting dates on physical characteristics of aromatic rice cv. *Kalizira*

Interaction	Grain length(mm)	Breadth (mm)	Length/Breadth ratio	Imbibitions ratio
N_0 Aug $_{10}$	4.23	2.12	1.99	5.60
N_0 Aug $_{22}$	4.49	2.12	2.18	5.60
N_0 Sep $_{04}$	4.12	1.95	2.11	4.70
N_{50} Aug $_{10}$	4.58	2.21	2.07	4.83
N_{50} Aug $_{22}$	4.61	2.14	2.15	6.00
N_{50} Sep $_{04}$	4.58	2.15	2.13	5.76
N_{100} Aug $_{10}$	4.68	2.49	1.88	6.93
N_{100} Aug $_{22}$	4.58	2.05	2.23	5.83
N_{100} Sep $_{04}$	4.20	1.93	2.18	5.30
N_{150} Aug $_{10}$	4.21	2.08	2.02	5.76
N_{150} Aug $_{22}$	4.55	2.41	1.89	6.56
N_{150} Sep $_{04}$	4.46	2.14	2.08	6.23
$LSD_{(0.05)}$	0.02	0.14	0.11	0.77
CV. (%)	1.91	7.95	3.13	7.09

Finally, it may be concluded that yield and yield attributing characters of aromatic rice were found to vary significantly at moderate dose of ie, 100 Kg N $ha^{-1}$and at date (10 August). The reason might be that the interaction of N and transplanting date was synergistic at the moderate dose but antagonistic at higher dose. However, further trials may be conducted in different agro-ecological zones to determine the optimum dose of nitrogen and the date transplanting in specific location.

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