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Effect of poultry litter, cowdung and chemical fertilizers on the performance of Basmati and Banglamati aromatic rice in *boro* season

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Abstract: The experiment was conducted at the Hajee Mohammad Danesh Science and Technology University Farm, Dinajpur, Bangladesh during *boro* season (January to May) of 2010 to observe the performance of Basmati and Banglamati aromatic rice varieties by using poultry litter, cowdung and NPKSZn fertilizers as a source of plant nutrients. The experiment was laid out in a randomized complete block design with three replications. The experiment comprised of four treatments viz., control (no fertilizer), cowdung @ 5t ha^{-1}, poultry litter @ 3t ha^{-1}, recommended dose of NPKSZn fertilizer. All the fertilizer treatments produced significantly higher grain yield than control. Yield contributing attributes of rice such as fertile tillers $hill^{-1}$, grains $panicle^{-1}$ and 1000 grain weight showed higher value with the incorporation of poultry litter @ 3 t ha^{-1}. Poultry litter @ 3 t ha^{-1} produced the highest grain yield. Grain yield differed significantly among the varieties. Therefore, it is suggested that poultry litter @ 3 t ha^{-1} may be used as a alternative source of fertilizer to get higher yield of Basmati and Banglamati aromatic rice under Dinajpur condition in *boro* season.

Key words: Fertilizer, Cow dung, Poultry litter, Yield, Basmati, Banglamati.

Introduction

The organic fertilizer is traditionally an important source for supplying nutrients for rice cultivation in Bangladesh but use of inorganic fertilizers has increased dramatically, whereas utilization of organic fertilizers decreased. Higher yields depend on rational and effective application of chemical fertilizers (Plucknett *et al.* 1986). Moreover, use of cowdung, organic waste, leaves and crop residues as fuel has been depriving the agricultural soils from their replenishment (Hossain *et al.* 1995). It is known that poultry litter can be utilized for rice production (BRRI, 2002 and 2006).There are 72.71 million poultry in Bangladesh (BBS, 2003), a source of huge wastes, which creates environmental pollution in some locations. This waste contains various nutrients, which can be used successfully for crop production and ruminant feed (Jacob *et al.* 1997; Kunkle *et al.* 1997). Availability of fertilizer at the right time is one of the major constraints now a day for rice production in Bangladesh. The cost of fertilizer is also high. So, poultry litter could be used under such conditions to supplement plant nutrients for rice production because it contains good amount of available nutrients (Jacob *et al.* 1997). Aromatic rice is rated best in quality and fetches much higher price than high quality non-aromatic rice in the domestic and international market. The demand of aromatic rice for internal consumption and also for export is increasing day by day (Das and Baqui, 2000). Dinajpur region is a native area of some indigenous aromatic rice cultivars. About 30% of rice land in Dinajpur is covered by aromatic rice varieties during '*Aman'* season (Baqui *et al.* 1997). But not a singe local aromatic rice variety is available for *boro* season (January to May) in Bangladesh. *Banglamati* (BRRI dhan50) a long grain aromatic rice variety developed by Bangladesh Rice Research Institute and Basmati of India and Pakistan are grown in *boro* season. Due to low yield and limited market facilities farmers seem to have little interest to continue growing these aromatic rice cultivars. Therefore, to economize fertilizer use and maintain soil productivity, the present investigation was aimed to observe the performance of Basmati and Banglamati by using poultry litter, cowdung along with chemical fertilizers as a source of plant nutrient in *boro* season under Dinajpur conditions.

Materials and Methods

The experiment was conducted at the Hajee Mohammad Danesh Science and Technology University Farm, Dinajpur, Bangladesh during boro season (January to May) of 2009. The experimental site was a medium high land with sandy loam soil having a pH value of 6.0. The experiment was laid out in a randomized complete block design with three replications. The experiment consisted of four fertilizer treatments viz., T_1= Control (No fertilizer), T_2=Cowdung @ 5t ha^{-1}, T_3= Poultry litter @ 3t ha^{-1}, T_4= Recommended dose of NPKSZn and two aromatic rice varieties namely, Basmati (V_1), Banglamati i.e.BRRI dhan50(V_2). The unit plot size was 4.0m X 2.5m. P, K, S and Zn were applied as basal through TSP 50 kg, MOP 100 kg, gypsum 50 kg and $ZnSO_4$ 10 kg ha^{-1} at final land preparation. Well decomposed sun dry cow-dung @ 5 t ha^{-1} and poultry litter @ 3 t ha^{-1} was mixed in the specific plots at the time of final land preparation. Nitrogen was applied in the form of urea @ 200 kg ha^{-1} in two equal splits at 20 and 45 days after transplanting. Thirty-day-old seedlings were transplanted in the plots at a spacing of 20 cm X 15 cm using 3 seedlings $hill^{-1}$. All other cultural practices were done uniformly as per recommendation. Whole plots were harvested to obtain grain yield. . Data were analyzed following the ANOVA technique and mean differences were adjudged with Duncan's Multiple Range Test (DMRT).

Results and Discussion

Plant height was significantly influenced by fertilizer treatment. The tallest plant (90.38 cm) was found with poultry litter @ 3 t ha^{-1} and the lowest plant height (80.81 cm) was observed in control treatment (T_1). The tallest plant with poultry litter might be due to sufficient supply of nitrogen to crop. This result agreed with the findings of Hossain *et al*. (1997) and Sarkar *et al*. (2004). The highest number of total tillers $hill^{-1}$ (16.81) was observed poultry litter @ 3 t ha^{-1}. Lowest total tillers $hill^{-1}$ (12.49) observed under control treatment (T_1) (Table1). The highest fertile tillers $hill^{-1}$ (15.65) was observed with poultry litter @ 3 t ha^{-1} (T_3). The lowest number of fertile tillers $hill^{-1}$ (10.35) was found in control treatment (T_1) (Table 1).

Table 1. Effect of fertilizer and varieties on the yield and yield contributing characteristics of modern aromatic rice varieties in ***boro*** season

Treatment	Yield and yield components								
	Plant height(cm)	Total tillers hill^{-1}	Fertile tillers hill^{-1}	Panicle length (cm)	Spikelets panicle^{-}	Grains panicle^{-1}	1000 grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
Fertilizer dose									
T_1	80.81c	12.49d	10.35d	19.90b	94.06b	83.16b	20.35b	1.79d	2.24d
T_2	82.64bc	13.36c	11.78c	20.29ab	96.96b	86.48b	20.58ab	2.20c	2.74c
T_3	90.38a	16.81a	15.65a	20.41a	107.70a	95.79a	20.91a	3.50a	4.09a
T_4	85.10b	14.56b	13.00b	20.19ab	109.36a	94.50a	20.71ab	2.80b	3.25b
Variety									
V_1	85.29a	13.13b	12.27b	20.12	93.75b	81.53b	19.96b	2.47b	2.84b
V_2	82.18b	15.48a	13.12a	20.28	110.29a	98.44a	21.32a	2.68a	3.32a
CV(%)	2.61	6.13	6.47	1.47	3.66	4.93	1.25	9.81	10.76

*Figures in a column followed by different letters differ significantly but with common letter (s) do not differ significantly at 5% level of probability, T_1=Control (No fertilizer), T_2=Cow dung (5 tha^{-1}), T_3=Poultry litter (3 tha^{-1}), T_4= Recommended dose of NPKSZn (urea @ 200 kgha^{-1}, TSP @ 50 kgha^{-1}, MOP @ 100 kgha^{-1}, Gypsum @ 50 kgha^{-1}, Zn SO_4 @ 10 kgha^{-1}), V_1=Basmati, V_2= Banglamati

Table 2. Interaction effect of fertilizer and variety on the yield and yield contributing characteristics of aromatic rice in ***boro*** season

Treatment	Yield and yield components								
	Plant height (cm)	Total tillers hill^{-1}	Fertile tillers hill-^{1}	Panicle length (cm)	Spikelets panicle^{-1}	Grains panicle^{-1}	1000 grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_1 x V_1	81.15	10.80d	10.33	19.58	82.73c	72.275	19.68	1.58	1.88
T_1 x V_2	80.48	14.18c	10.38	20.23	105.40b	94.05	21.03	2.00	2.60
T_2 x V_1	83.53	11.58d	10.78	20.20	86.50c	76.88	19.93	2.18	2.55
T_2 x V_2	81.75	15.15bc	12.78	20.38	107.43ab	96.08	21.23	2.23	2.93
T_3 x V_1	90.98	16.35ab	15.13	20.48	102.13b	89.10	20.28	3.45	4.05
T_3 x V_2	89.78	17.28a	16.18	20.35	113.28a	102.48	21.55	3.55	4.13
T_4 x V_1	85.50	13.80c	12.85	20.23	103.65b	87.85	19.95	2.65	2.88
T_4 x V_2	84.70	15.33bc	13.15	20.15	115.08a	101.15	21.48	2.95	3.63
CV(%)	2.61	6.13	6.47	1.47	3.66	4.93	1.25	9.81	10.76

*Figures in a column followed by different letters differ significantly but with common letter (s) do not differ significantly at 5% level of probability, T_1=Control (No fertilizer), T_2=Cow dung (5 tha^{-1}), T_3=Poultry litter (3 tha^{-1}), T_4= Recommended dose of NPKSZn (urea @ 200 kgha^{-1}, TSP @ 50 kgha^{-1}, MP @ 100 kgha^{-1}, Gypsum @ 50 kgha^{-1}, Zn So_4 @ 10 kgha^{-1}) and V_1= Basmati, V_2= Banglamati

Number of spikelets panicle^{-1} was significantly influenced due to fertilizer treatment. The highest number of spikelets panicle^{-1} (109.36) was observed in recommended dose of chemical fertilizers (T_4) that was statistically similar to poultry litter @ 3 t ha^{-1} (T_3). The lowest number of spikelets panicle^{-1} (94.06) was obtained from control treatment (T_1) (Table 1). The highest grains panicle^{-1} (95.75) was recorded in poultry litter @ 3 t ha^{-1} (T_3) and it was statistically similar to recommended dose of chemical fertilizers (T_4). Lowest number of grains panicle^{-1} (83.16) was found in control treatment (T_1) (Table 1). Grain yield was significantly affected due to fertilizer treatments. The application of poultry litter @ 3 t ha^{-1} (T_3) showed a positive effect on the yield components of aromatic rice. This treatment significantly increased fertile tillers hill^{-1} and grains panicle^{-1} which might have the contribution to highest grain yield (3.50 t ha^{-1}). Lowest grain yield (1.79 t ha^{-1}) was found in control treatment (T_1). Reduction of grain yield in control treatment might be attributed due to significant reduction in fertile tillers hill^{-1} and grains panicle^{-1}.The highest straw yield (4.09 t ha $^{-1}$) was obtained with poultry litter @ 3 t ha^{-1} (T_3). The lowest straw yield (2.24 t ha^{-1}) was found in control treatment (T_1). Plant height significantly influenced due to variety. The tallest plant (85.29 cm) was produced by Basmati and shortest plant (82.18 cm) was observed in Banglamati (Table 2). Lodging of the tested varieties at mature stage was not observed. The highest number of total tillers hill^{-1} (15.48) was observed in Banglamati and lowest(13.13) in Basmati. The highest number of fertile tillers hill^{-1} (13.12) was found in Banglamati. The lowest number of fertile tillers hill^{-1} (12.27) in Basmati (Table 1). Length of panicle was not significantly influenced by variety. Highest number of spikelets panicle^{-1} (110.29) was observed in Banglamati and lowest number of spikelets panicle^{-1} (93.75) was observed in Basmati (Table 1). Significant variation was observed due to variety on grains panicle^{-1}. Highest number of grains panicle^{-1} (98.44) was observed in Banglamati and lowest number grains panicle^{-1} (81.53) was observed in Basmati (Table 1). Significant variation of individual grain weight was observed among the tested varieties. Among the tested varieties the Banglamati produced the highest grain yield (2.68 t ha^{-1}) due to the of higher number of fertile tillers hill^{-1} and grains panicle^{-1}. The lowest grain yield (2.47 t ha^{-1}) was obtained from Basmati (Table 1).The highest straw yield (3.32 t ha^{-1}) was obtained from Banglamati and the lowest straw yield (2.84 t ha^{-1}) was obtained from Basmati (Table 1). The interaction effect of fertilizer and variety was significant in respect to total tillers hill^{-1} and Spikelets panicle^{-1} (Table 2). Banglamati and Basmati gave the highest grain yield when applied poultry litter @ 3 t ha^{-1}. Banglamati and Basmati are more responsive to organic fertilizer in respect of growth and yield. Therefore, it is concluded that poultry litter @ 3 t ha^{-1} may be used as alternate manure to get higher yield of Banglamati and Basmati aromatic rice in *boro* season.

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