Growth and yield performance of local *T. aman* aromatic genotypes under the southern region

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Abstract: The present experiment was conducted at the Research Field Laboratory of the Department of Agricultural Botany, Patuakhali Science and Technology University (PSTU), Patuakhali during the period from July to December 2013 to evaluate the local *T. aman* aromatic rice genotypes for obtaining the most productive genotype considering growth and yield performance under southern region. The five local *T. aman* aromatic rice genotypes *viz. Kataribhog*, *Radhunipagal*, *Kalizira*, *Shakhorkhana* and *Chinigura* were as used planting materials and laid out in RCBD with three replications. The genotype *Chinigura* produced significantly the tallest plant (155.2 cm), no. of total tillers per hill (12.03), LAI (2.05) and TDM (19.92 g $hill^{-1}$) at vegetative stage (60 DAT). Similarly, no. of effective and non-effective tillers per hill (10.53 and 2.13), total and filled grains $panicle^{-1}$ (126.80 and 119.10), minimum unfilled grains panicle (7.70), grain, straw and biological yield also higher (2.61, 5.34 and 7.95 t ha^{-1}, respectively) in *Chinigura* at harvest. So, *Chinigura* was the most productive genotype among the studied aromatic genotypes under the southern region.
Key words: Aromatic genotypes, growth, yield.

Introduction

In Bangladesh, rice covered an area of 28.5 thousand acres with a production of 33.5 million metric tons while the average yield of rice is around 1.2 thousand tons per acres. But a steady growth in agriculture as well as in food production, Bangladesh has been facing persistent challenges in achieving food security. This is mainly due to natural disasters and fluctuations in food prices. Farmer's want reasonable price of his produced products. But production of usual rice variety can not get reasonable price. So, alternatively production of aromatic rice will give fair price to farmer's because of aromatic rice have more demand both in internal and external trade markets. Moreover, the price of 1 kg aromatic fine milled rice is Tk. 75–90 whereas, 1 kg modern rice is Tk. 30–40 (Islam, 2008). Aromatic rice constitutes a small but special group of rice which is considered best in quality. They have long been popular in the orient, and are now becoming more popular in Middle–east, Europe and the United States. Aromatic fine rice such as *Kalizira, Katharibhog, Chinigura* are the most high valued rice commodity in Bangladesh Agricultural Trade Market, having small grain and pleasant aroma. Aromatic fine rice is generally used to prepare many dishes such as polau, paish, firny, birany, jarda etc. which are served on special occasions. So, therefore, the production of aromatic rice in our country is becoming popular due to its high prices and export potentiality. Considering the above facts, the present research has been carried out to find out the most potential genotype among the selected *T. Aman* aromatic genotypes for cultivation in the southern region.

Materials and Methods

The experimental field belongs to the Research Farm of Patuakhali Science and Technology University, Dumki, Patuakhali and covered by the Ganges Tidal Flood Plains under the AEZ–13. The experimental field was medium high in nature and silty clay loam soil having pH value of 6.8. Five local *T. aman* aromatic rice genotypes *viz. Kataribhog, Radhunipagal, Kalizira, Shakhorkhana* and *Chinigura* as planting material were used and laid out in Randomized Complete Block Design (RCBD) with three replications. The plot size was 4.0 × 2.5 m where block to block and plot to plot distance was 1.0 and 0.5 m. Fertilizer such as Gypsum, MOP, TSP, urea and $ZnSO_4$ at the rate of 65, 75, 130, 190 and 10 kg per hactare were applied at the time of final land preparation and different vegetative growth stages. The seedlings were transplanted maintaining 20cm X 20cm and different intercultural operations were done properly. Randomly selected five plants in each plot were taken to measure plant height and number of leaves. To get leaf area index (LAI), randomly collected six leaves per hill five hills of each plot were taken and leaf area was measured by an automatic leaf area meter and finally LAI was calculated with the formula as follows- LA/P. To get effective and non effective tillers per hill, tillers were counted from each sample and average of five hills of each plot was recorded. Number of total grains per panicle were recorded through sum of number of filled grains and number of unfilled grains. One thousand cleaned dried seeds were counted randomly from each sample and weighed in gram as 12% moisture basis. The grain and straw yield harvest of the kg per 1 m^2 per plot and converted to ton per ha. The biological yield and harvest index were calculated also. Collected data were statistically analyzed and evaluated with the help of Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Performance of growth characters at vegetative stage

Plant height: At vegetative stage, plant height was recorded at 30, 45 and 60 DAT in this study whereas all the data recording stages were influenced significantly due to studied Aromatic local genotypes (Table 1). Among the aromatic local genotypes, the genotype *Chinigura* exhibited the tallest plant (76.35, 93.60 and 155.20 cm) at 30, 45 and 60 DAT, respectively followed by *Kataribhog* at 30 and 45 DAT (68.49 and 87.02 cm, respectively) and *Shakorkhana* at 60 DAT (142.0 cm). Among other Aromatic genotypes, the genotype *Radhunipagol* registered the shortest plant (54.43, 75.08 and 125.60 cm) at those stages, respectively. Islam *et al*. (2013); Mannan *et al*. (2012) and Uddin *et al*. (2011) evaluated some local aromatic rice genotypes where all of them found significant variation in plant height due to genotypes.

Number of total tillers per hill: The data on number of total tillers $hill^{-1}$ was recorded at 15 days interval from 30 DAT to 60 DAT at vegetative stage where those stages were significantly affected due to studied Aromatic rice

genotypes (Table 1). The maximum total tillers hill^{-1} (4.77, 7.67 and 12.03) was found from the genotype *Chinigura* followed by *Kataribhog* (4.47, 7.10 and 10.47) at 30, 45 and 60 DAT, respectively. Similarly, the genotype *Radhunipagal* observed the minimum total tillers hill^{-1} (3.67, 4.33 and 8.80) at 30, 45 and 60 DAT respectively. Uddin *et al*. (2011); Islam (2011) and Kabir *et al*. (2010) also evaluated some local aromatic rice varieties where all of them found significant variation in tiller production.

Table 1. Effect of aromatic rice genotypes on plant height, No. of total tillers per hill, LAI and TDM at different DAT

Genotypes	Plant height (cm) at different DAT			Number of total tillers hill^{-1} at different DAT			LAI at different DAT			TDM (g hill^{-1}) at different DAT		
	30	45	60	30	45	60	30	45	60	30	45	60
Kataribhog	68.49 b	87.02 b	127.5 d	4.467 b	7.100 b	10.47 b	0.7033 ab	1.583 b	2.027 a	5.563a	10.33ab	18.87 b
Radhunipagal	54.43 d	75.08 d	125.6 d	3.667 d	4.333 e	8.800 c	0.5833 c	1.443 c	1.757 b	4.627 d	9.173 c	17.09 d
Kalizira	61.13 c	82.79 c	136.6 c	3.733 d	5.033 d	9.267 c	0.5933 c	1.460 c	1.820 b	4.913 c	9.513 c	17.38cd
Shakorkhana	65.55 b	86.03 b	142.0 b	4.100 c	6.067 c	10.40 b	0.6400bc	1.500 c	2.023 a	5.260 b	10.13 b	18.13bc
Chinigura	76.35 a	93.60 a	155.2 a	4.767 a	7.667 a	12.03 a	0.7500 a	1.677 a	2.047 a	5.680 a	10.57 a	19.92 a
CV (%)	3.15	1.47	1.39	2.37	3.28	4.01	8.11	1.94	4.92	2.14	1.82	2.77

In a column, the means having same letter (s) do not differ significantly as per DMRT 5% level of significance.

Leaf area index (LAI): Leaf area index (LAI) over time in rice plants was significantly affected due to rice genotypes during the data recording stage (Table 1). The highest LAI (0.750, 1.677 and 2.047) was observed in *Chinigura* at 30, 45 and 60 DAT, respectively which was statistically similar at per with the genotypes *Kataribhog* (2.027) and *Shakorkhana* (2.023) at 60 DAT and *Kataribhog* was statistically close (0.703) at 30 DAT. Similarly, *Radhunipagol* exhibited the lowest LAI (0.583, 1.443 and 1.757) at 30, 45 and 60 DAT which was also statistically similar at per with the genotypes *Kalizira* (0.593, 1.460 and 1.820) at 30, 45 and 60 DAT, respectively and *Shakorkhana* at 45 DAT (1.500) while *Shakorkhana* showed statistically lower LAI (0.640) at 30 DAT.

Total dry matter (TDM): From the Table 1, it was found that dry matter production increased with age of rice plant. Among the cultivars, *Chinigura* showed the highest TDM hill^{-1} (5.68, 10.57 and 19.92 g) at 30, 45 and 60 DAT, respectively while *Kataribhog* was statistically identical at 30 DAT (5.56 g) and at 45 DAT 10.33 g). Correspondingly, the genotype *Radhunipagol* produced significantly the lowest TDM hill^{-1} (4.63, 9.17 and 17.09 g); while it was statistically identical at 45 DAT (9.51 g) and at 60 DAT (17.38 g) it was close to *Kalizira*. Baset Mia and Shamsuddin (2011) in their research also found significant variation in TDM by local aromatic rice genotypes.

Performance of yield and yield contributing characters at harvest

Number of effective tillers per hill: The maximum number of effective tillers hill^{-1} (10.50) was recorded in *Chinigura* and minimum (5.23) in *Radhunipagol* (Fig. 1). Similarly, significant variation among the rice varieties regarding tillers hill^{-1} were also found by Islam *et al*. (2013); Mannan *et al*. (2012); Uddin *et al*. (2011); Islam (2011) and Kabir *et al*. (2010).

Number of non–effective tillers per hill: Among the studied Aromatic rice genotypes, the genotype *Radhunipagol* produced significantly the more non–effective tillers hill^{-1} (3.70) than *Shakorkhana* (3.23), *Kalizira* (3.03), *Kataribhog* (2.43) in sequence while *Chinigura* observed the less non–effective tillers hill^{-1} (2.13) during reproductive or harvest stage (Fig. 2). The variation in production of non effective tillers was found due to its genetic variation and also the different types of tiller mortality possibility at harvest.

Number of total grains per panicle: From the Table 2, it was appeared that the variety *Chinigura* had more significant than other varieties as well as produced more grains panicle^{-1} (126.80) than *Shakorkhana* (120.60), *Kalizira* (108.30), *Kataribhog* (87.20) and *Radhunipagol* (84.63) whereas the genotypes *Radhunipagol* and *Kataribhog* observed the minimum grains panicle^{-1} (*Kataribhog* > *Radhunipagol*).

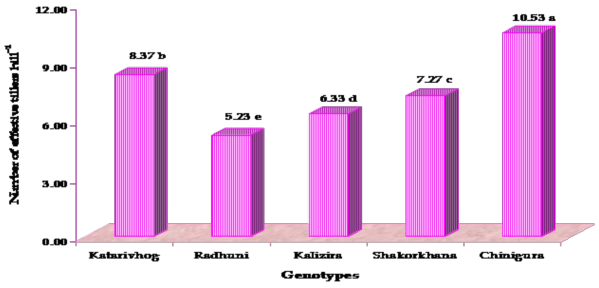

Fig. 1. Effect of aromatic rice genotypes on number of effective tillers hill^{-1} at harvest

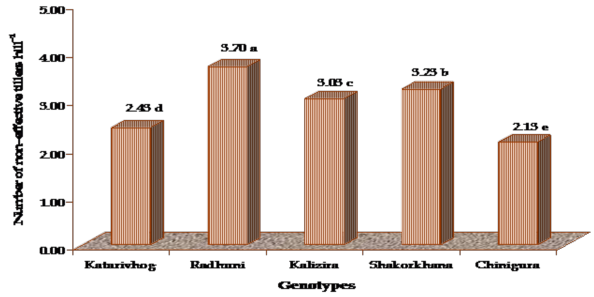

Fig. 2. Effect of aromatic rice genotypes on number of non-effective tillers hill^{-1} at harvest

Number of filled grains per panicle: Among the genotypes, the maximum number of filled grains panicle^{-1} (119.10) was found from *Chinigura* followed by *Shakorkhana* (108.30); while *Radhunipagol* observed the minimum filled grains panicle^{-1} (68.57) (Table 2). Among other genotypes, *Kalizira* and *Katarivhog* produced an average of 94.27 and 78.53 grains panicle^{-1}. Variation in filled grains panicle^{-1} due to genotypic differences of varieties were also reported by Islam *et al*. (2013);

Mannan *et al*. (2012); Islam (2011) and Uddin *et al*. (2011).

Number of unfilled grains per panicle: Number of unfilled grains panicle^{-1} varied significantly from 7.70 to 16.07 due to aromatic rice genotypes where number of unfilled grains panicle^{-1} had maximum in *Radhunipagol* and minimum in *Chinigura* (Table 2). The maximum unfilled grains decreased the final yield as well as minimum unfilled grains increase the grain yield.

Thousand–grain weight: From the Table 2, Genotype *Kataribhog* showed the highest 1000–grains weight (13.36 g) due to heavier grain followed by *Shakorkhana* (12.48 g) whereas *Radhunipagol* showed the lowest 1000–grains weight (11.19 g) due to lighter grain. Mannan *et al*. (2012) found that the heaviest grain was found in *Kataribhog* while the light grain was observed in *Badshavog* due to their genetic variation.

Grain yield: Among the varieties, *Chinigura* produced significantly the highest grain yield (2.61 t ha^{-1}) (Table 2) while statistically similar higher yield of grain (2.46 t ha^{-1}) was also obtained by *Kataribhog*. The genotypes *Shakorkhana* (2.17 t ha^{-1}), *Kalizira* 1.98 t ha^{-1}) and *Radhunipagol* (1.95 t ha^{-1}) were also statistically identical similar lower grain yield while *Radhunipagol* was the least among them. Mannan *et al*. (2012) reported that the grain yield of *Chinigura* and Kalijira was almost highest and identical while it was lowest in *Kataribhog* which may be attributed to lower number of panicles and grain panicle^{-1}.

Table 2. Effect of aromatic rice genotypes on various yield and yield contributing characters at harvest

Genotypes	Number of grains panicle^{-1}	Number of filled grains panicle^{-1}	Number of unfilled grains panicle^{-1}	Thousand–grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Kataribhog	87.20 d	78.53 d	8.667 d	13.36 a	2.463 a	4.280 b	6.743 b	36.51 a
Radhunipagal	84.63 d	68.57 e	16.07 a	11.19 d	1.950 b	4.010 d	5.960 c	32.72 b
Kalizira	108.3 c	94.27 c	14.00 b	11.98 c	1.980 b	4.063 cd	6.043 c	32.76 b
Shakorkhana	120.6 b	108.3 b	12.33 c	12.48 b	2.177 b	4.177 bc	6.353 bc	34.26 b
Chinigura	126.8 a	119.1 a	7.700 e	10.06 e	2.610 a	5.337 a	7.947 a	32.84 b
CV (%)	2.33	2.08	2.16	1.55	5.8	1.63	3.2	2.3

Straw yield: The variety *Chinigura* recorded the highest straw yield (5.33 t ha^{-1}) while *Kataribhog*, *Shakorkhana*, *Kalizira* and *Radhunipagol* produced the grain yield of 4.28, 4.17, 4.06 and 4.01 t ha^{-1}, respectively (Table 2) while *Radhunipagol* was the least straw yield productive genotype. Baset Mia and Shamsuddin (2011); also found significant variation in straw yield due to the variation in genetic make up of their studied genotypes.

Biological yield: Among the cultivars, *Chinigura* produced significantly the higher biological yield (7.94 t ha^{-1}) followed by *Kataribhog* (6.74 t ha^{-1}) while *Radhunipagol* and *Kalizira* showed statistically identical lowest biological yield (5.96 and 6.04 t ha^{-1}, respectively) followed by *Shakorkhana* (6.35 t ha^{-1}). Similarly, Islam *et al*. (2013); Mannan *et al*. (2012) and Kabir *et al*. (2010) also found significant variation regarding biological yield among the studied particular genotypes.

Harvest index (HI): The genotype *Kataribhog* showed significantly the higher HI (36.51%) but all other aromatic rice such as *Shakorkhana* (34.26%), *Chinigura* (32.84%), *Kalizira* (32.76) and *Radhunipagol* (32.72%) produced statistically similar lower HI in sequence where *Radhunipagol* was the least. Such variation in genetic make up of the varieties regarding HI was also found Baset Mia and Shamsuddin (2011).

From the above results it was concluded that the genotype *Chinigura* would be the most productive among the studied aromatic local genotypes under the southern region.

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