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⁻¹ (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 ZnSO₄ 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 m² 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 on 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 Radhunipagal registered the shortest plant (54.43, 75.08 and 125.60 cm) at 30, 45 and 60 DAT, respectively. 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⁻¹ (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.

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

<table>
<thead>
<tr>
<th>Genotypes</th>
<th>Plant height (cm) at different DAT</th>
<th>Number of total tillers hill(^{-1}) at different DAT</th>
<th>LAI at different DAT</th>
<th>TDM (g hill(^{-1})) at different DAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
<td>45</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Kataribhog</td>
<td>68.49 b</td>
<td>87.02 b</td>
<td>127.5 d</td>
<td>4.467 b</td>
</tr>
<tr>
<td>Radhunipagol</td>
<td>54.43 d</td>
<td>75.08 d</td>
<td>125.6 d</td>
<td>3.667 d</td>
</tr>
<tr>
<td>Kalarzira</td>
<td>61.13 c</td>
<td>82.79 c</td>
<td>136.6 c</td>
<td>3.733 d</td>
</tr>
<tr>
<td>Shakorkhana</td>
<td>65.55 b</td>
<td>86.03 b</td>
<td>142.0 b</td>
<td>4.100 c</td>
</tr>
<tr>
<td>Radhunipagol</td>
<td>76.35 a</td>
<td>93.60 a</td>
<td>155.2 a</td>
<td>4.767 a</td>
</tr>
</tbody>
</table>

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), Kalarzira (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 Kataribhog 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);
found that the heaviest grain was found in Kataribhog while the lightest 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 Kalizira 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

<table>
<thead>
<tr>
<th>Genotypes</th>
<th>Number of grains panicle(^{-1})</th>
<th>Number of filled grains panicle(^{-1})</th>
<th>Number of unfilled grains panicle(^{-1})</th>
<th>Thousand–grain weight (g)</th>
<th>Grain yield (t ha(^{-1}))</th>
<th>Straw yield (t ha(^{-1}))</th>
<th>Biological yield (t ha(^{-1}))</th>
<th>Harvest index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kataribhog</td>
<td>87.20 d</td>
<td>78.53 d</td>
<td>8.667 d</td>
<td>13.36 a</td>
<td>2.463 a</td>
<td>4.280 b</td>
<td>6.743 b</td>
<td>36.51 a</td>
</tr>
<tr>
<td>Radhunipagol</td>
<td>84.63 d</td>
<td>68.57 e</td>
<td>16.07 a</td>
<td>11.19 d</td>
<td>1.950 b</td>
<td>4.010 d</td>
<td>5.960 e</td>
<td>32.72 b</td>
</tr>
<tr>
<td>Kalizira</td>
<td>108.3 c</td>
<td>94.27 e</td>
<td>14.00 b</td>
<td>12.48 b</td>
<td>2.177 b</td>
<td>4.177 bc</td>
<td>6.353 bc</td>
<td>34.26 b</td>
</tr>
<tr>
<td>Shakorkhana</td>
<td>120.6 b</td>
<td>108.3 b</td>
<td>12.33 c</td>
<td>10.06 e</td>
<td>2.610 a</td>
<td>5.337 a</td>
<td>7.947 a</td>
<td>32.84 b</td>
</tr>
<tr>
<td>Chinigura</td>
<td>126.8 a</td>
<td>119.1 a</td>
<td>7.700 e</td>
<td>10.55</td>
<td>5.8</td>
<td>1.63</td>
<td>3.2</td>
<td></td>
</tr>
</tbody>
</table>

**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.

### References


