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Performance Evaluation Of Some Selected Aromatic Rice Varieties In Dinajpur Region Of Bangladesh

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Abstract
The study was conducted during Aman season (July-December) of 2023 to observe the yield and quality attributes of ten popular aromatic rice varieties of Bangladesh. This study employed six aromatic rice genotypes designated as V1, V2, V3, V4, V5, and V6. The experiment was laid out in a randomized complete block design with four replications. All the growth and yield contributing attributes varied significantly among the rice varieties Data were recorded on plant height (cm), total tillers hill^{-1}, fertile tillers hill^{-1}, panicle length (cm), spikelets panicle^{-1}, grains panicle^{-1}, 1000-grain weight (g), grain yield (t ha^{-1}), and straw yield (t ha^{-1}). The highest grain yield was obtained from V1 (3.60 t ha^{-1}) which is statistically alike to V2 (3.27 t ha^{-1}). The yield of V1 obtained in this study is higher to that of national average (2.40 t ha^{-1}). Beside this, the V1 gave the best result among the tested varieties in respect of all the studied traits except straw yield. In most of the cases the V6 gave the worst performance except straw yield. The higher number of fertile tillers hill^{-1}, spikelets panicle^{-1}, grains panicle^{-1}, and 1000-grain weight mainly contributed to the higher grain yield of V1 and V2 varieties.

Key Words: *Aromatic Rice; Performance, Growth; Yield*

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I. Introduction

Rice (*Oryza sativa* L.) is a staple cereal grain that is crucial for ensuring food security for more than half of the global population (Liang *et al.,* 2021). It provides more than 21% of the total caloric needs of people and provide up to 76% of the caloric intake of people living in Southeast Asia (Zhao *et al.,* 2020). It is the major source of nourishment for almost two-thirds of the world's populace (Simkhada *et al.,* 2022; Asibi *et al.,* 2019). In Bangladesh rice is the staple nourishment for individuals and in the national economy play a crucial part (Al Mamun *et al.,* 2021; Faruq *et al.,* 2010). It supplies more than 80% of the calories and almost 50% of the protein needs of Bangladesh (Yusuf, 1997). About 38.143 million tons of rice was produced from 28892 thousand acres of land in Bangladesh (BBS, 2022).

Aromatic rice is renowned for its distinctive aroma upon cooking (Akter et al., 2020). It fetches higher price in market than non-aromatic ones. In fact, aromatic rice is very popular in the national and in the international markets (Yoshihashi, 2005). These varieties have a greater premium in the market compared to non-aromatic ones. Aromatic rice is extremely popular for both domestically and internationally (Yoshihashi, 2005). Production of aromatic rice in Bangladesh is becoming popular due to its high prices and export potentiality (Dutta *et al.,* 2002). It is also preferred by some consumers despite their price and yield. Farmers' net income was increased by 23% with the adoption of modern varieties (Shrestha *et al.,* 2002). The International Rice Research Institute (IRRI) gene bank acquired over 8,000 indigenous rice types from Bangladesh (Hossain *et al.,* 2013) with around 100 fragrant varieties (Khalequzzaman *et al.,* 2012). Farmers have traditionally relied on cultivating several local kinds or landraces, particularly in less-than-ideal ecosystems across the country. Local varieties, including fragrant rice genotypes, occupied around 12.16% of the rice-growing areas in Bangladesh (BBS, 2011). Many of these regional cultivars have added socioeconomic value due to unique qualities such as scent, improved taste, and improved cooking quality. Aside from that, fragrant rice is well-known in many countries for its aroma and/or superfine grain quality (Singh *et al.,* 2000). Bangladesh's natural aromatic and fine rice germplasm have short bold and medium bold grain types with a mild to strong aroma (Shahidullah *et al.,* 2009; Islam *et al.,* 2013). The Chinigura variety is the only aromatic rice variety in Bangladesh that spans more than 70% of rice farms in the northern districts of Naogaon and Dinajpur. Kalijira (mostly grown in Mymensingh) and Kataribhog (mostly grown in Dinajpur) are two more notable aromatic rice varieties (Baqui *et al.,* 1997). The majority of aromatic

rice cultivars in Bangladesh are cultivated during the Aman season in a rainfed lowland ecology, and they are photoperiod-sensitive and regionally adapted. Aromatic and fine rice is cheaper in manufacturing cost than coarse rice. As a result, the earning potential of fragrant fine rice production is higher, as it does not typically necessitate additional fertilizer, pesticide, or irrigation expenditures. Although high-producing rainfed lowland rice has a higher average yield (3.4 t ha^{-1}) than aromatic rice, the market price of aromatic rice is nearly double that of coarse rice. Bangladesh provides various excellent aromatic rice varieties with outstanding consuming quality for normal use as steamed rice and special occasion preparations such as polao, biriani, jarda, and firni (Hussain, 2008). Rice yield varies depending on the growing conditions, such as genetics, location, seasonal fluctuations, planting dates, and so on (Sarker, 2020). Aside from these, rice yield is influenced by a variety of growth characteristics, such as leaf area index, dry matter production, and partitioning, tillering, and so on (Shams, 2002). Many essential nutrients have a significant impact on growth and development, tiller production, grain formation, and other yield-related characteristics (Khatun *et al*., 2021). Besides, the most crucial component in maximizing rice yield is choosing the proper variety (Hussain, 2008). As a result, a plant breeder must have knowledge of yield contributing features to generate improved rice varieties or lines with higher yield potential. With these considerations in mind, the current study was designed to characterize and evaluate the fine rice genotypes for growth and yield potential in Bangladesh.

II. Materials And Methods

This study employed six aromatic rice variety designated as V1, V2, V3, V4, V5, and V6. The seeds of the varieties were obtained from the BRRI (Bangladesh Rice Research Institute) regional center, Rangpur, Bangladesh. In the Aman season of 2023 (June-December), the experiment was conducted in the farmer's research field in Dinajpur Sadar Upazilla. The experimental plots were set up in a three-replication in a randomized complete block design. There were 150 hills of each cultivar in each replication, with a 20 cm x 20 cm spacing between them. 63.3 m^2 was the size of the unit plot. In this experiment, the standard protocol of Bangladesh Agricultural Research Council, 2005 was followed to produce rice verities. Urea, TSP (Triple Super Phosphate), MOP (Muriate of Potash), and Gypsum were applied at rates of 210 kg, 185 kg, 100 kg, and 20 kg ha^{-1}, respectively, were applied in the experimental plots. At the final land preparation, full doses of TSP and MOP, as well as gypsum with one-half dose of urea, were applied. The remaining urea was split into two applications, one at the tillering stage and the other at the booting stage. A 50-cm drainage trench was made between two seedbeds to drain excess water as needed. For fast germination, the seeds were soaked in water for 24 hours and then germinated in a damp jute sack for 48 hours. The seed beds were irrigated to a depth of 2-3 cm after root establishment. Excess water was drained out to achieve a water depth of 5 cm, which partially controlled weeds, and the remaining weeds were eradicated to establish healthy and vigorous seedlings. Intercultural activities such as weeding and plant protection were carried out as needed. Harvesting was done when 90% of the grains had turned a golden yellow tint. Plant height (cm), total tillers $hill^{-1}$, fertile tillers $hill^{-1}$, panicle length (cm), spikelets $panicle^{-1}$, grains $panicle^{-1}$, 1000-grain weight (g), grain yield (t ha^{-1}), and straw yield (t ha^{-1}) were all taken accordingly. Following the emergence of fertile panicles and grain growth, the number of tillers was counted. The plant's height was measured from the ground to the longest panicle's tip. Panicles were collected separately and stored in individual envelopes when they reached maturity. The recorded data were analyzed by using the statistical program STAR (Statistical Tool for Agricultural Research) version 2.0.1. 5.1 developed by IRRI (International Rice Research Institute), Los Baños, Philippine.

III. Results And Discussion

Table 1. Yield and yield contributing attributes of the selected six aromatic rice varieties

Variety	Plant height (cm)	Total tillers $hill^{-1}$	Fertile tillers $hill^{-1}$	Panicle length (cm)	Spikelets $Panicle^{-1}$	Grains $Panicle^{-1}$	1000-grain weight(g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
V1	166.50a	13.10a	10.73a	25.700a	152.73a	133.17a	15.467a	3.60a	7.50c
V2	158.23b	12.36b	10.16a	24.233b	145.13b	122.50b	13.467b	3.27ab	6.53d
V3	153.83bc	11.80b	9.40b	23.100c	143.97b	121.70b	12.767c	3.07bc	6.17d
V4	151.10cd	10.20c	9.10b	22.367d	135.20c	117.33b	11.267d	2.90cd	8.37ab
V5	147.43d	9.20d	8.06c	22.233d	117.08d	111.57c	11.233d	2.57de	8.17b
V6	142.17e	8.23e	7.50c	21.467e	99.70e	93.37d	10.233e	2.30e	8.77a
Standard Error	2.094	0.281	0.260	0.2737	3.3518	2.5657	0.2117	0.521	0.2254
Critical Value	4.666	0.627	0.580	0.6097	7.4682	5.7167	0.4717	4.9120	4.9120

The growth and yield contributing characteristics of the selected aromatic rice varieties was significantly different among them (Table 1). Among the varieties, V1 had the tallest plant height (166.50 cm) followed by V2 (158.23 cm) while V6 had the dwarf type plant (142.17 cm). Because of the increased plant height, aromatic rice varieties lodged at maturity. This could be owing to the variety' genetic traits (Hong et al., 2023; Liu *et al.,* 2017). Kabir *et al.,* (2004) also observed variation in plant height due to varietal differences.

The total number of tillers hill^{-1} ranged from 8.233 to 13.100, according to the findings. The V1 variety had the maximum number of number of tillers hill^{-1} (10.733) and fertile tiller (10.73) subsequently V2 (12.36) and V2 (10.16). In the V6 variety, had the fewer number of total tillers hill^{-1} (8.23) and fertile tiller hill^{-1} (7.50). Variation in the number of tillers hill^{-1} could be attributable to varietal characteristics (Sarker, 2020). V1 had the longest panicle (25.700 cm), which was statistically different from the other varieties evaluated. V6 gave the shortest panicle (21.467 cm). This variance could be attributed to heredity, which is linked to genetic traits of different varieties. Islam et al., 2016 observed significant variance in panicle length in fine rice varieties. V1 had the highest number of spikelets panicle^{-1} (152.73), followed by V2 (145.13) and V3 (143.97), with V6 having the lowest number (99.70). Similarly, V1, which is statistically different from other varieties, has the maximum number of grains panicle^{-1} (133.17). However, in terms of the quantity of grains panicle^{-1}, the varieties V2, V3, and V4 gave statistically alike result. On the other hand, V6 had the lowest number of grains panicle^{-1} (93.37). Short bold type (small) grains were found to be more tightly clustered in a panicle. In rice varieties, the quantity of grains per panicle is the most significant criterion for high production (Loitongbam *et al.,* 2020). V1 had the highest 1000-grain weight (15.467 g), followed by V2 (13.46 g) while V6 had a minimum 1000-grain weight (10.233 g), which was statistically distinct from the other varieties. Pokhrel et al. (2020) reported the differences in thousand grain weights owing to morphological and varietal differences. Kataribhog (Deshi) had the greatest 1000 grain weight (15.18g) while Zirabhog and Chiniatab had the lowest (10.2g), according to Hossain *et al.*, 2008. For grain yield, V1 had the top most value (3.60 t ha^{-1}) which was statistically identical to V2 (3.27 t ha^{-1}). It may be due to the presence of higher number of fertile tillers per hill and a higher individual grain weight, the V1 produced a higher grain yield. The V6 cultivar produced the lowest grain yield (2.30 t ha^{-1}). V6 and V4 had the largest straw yield (8.77 t ha^{-1}) may be due to the thickest plants (Table 1). Sao (2002) reported varietal differences in grain yield. Rice grain yield was higher in genotypes that produced a higher number of effective tillers hill^{-1} and a higher number of grains panicle^{-1}. Variable grain yield among varieties was observed by Islam et al. 2014, who observed yield changes owing to variety.

IV. Conclusion

Based on the data on the present research, it may be concluded that V1 displayed the most desirable growth and yield contributing traits among the selected rice varieties followed by V2 variety. The V6 showed the worst performance among them. So, cultivation of V2 aromatic rice variety could be recommended in the study area.

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