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AGROMORPHOLOGICAL CHARACTERIZATION, GROWTH, AND YIELD PERFORMANCE OF LOCAL RICE CULTIVARS IN SYLHET REGION OF BANGLADESH

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Abstract

Rice is one of the most crucial staple foods that feed a significant portion of the global population and has an impact on the well-being and economies of billions of people in the world. The experiment was conducted in pot culture during the *aman* season of 2022 in the Agronomy research field of Sylhet Agricultural University, Bangladesh to observe the agromorphological traits, growth, and yield performance of 18 local rice cultivars. The cultivars included Binni, Naizershail (Brahmonbaria), Biruy, Begunbichi, Modonga, Meghraj, Biruin, Dumai, Kalojira, Maloti, Moinasail, Naizershail (Sylhet), Madhumadab, Tulsimala, Gandi, Nagrasail, Bontosh, and Chinigura. Each pot contained three hills, and the pots were replicated four times using a completely randomized design (CRD). Dumai required a period of 78 days to reach maturity. In turn, Nagrasail and Bontosh took a long time of 158 days to reach their full maturity. Kalojira, Moinasail, and Chinigura exhibited lodging resistance. The experiment revealed a positive correlation between grain yield and factors contributing to yield, including the number of effective tillers, length of panicles, number of grains panicle^{-1}, and weight of 1000 grains. Conversely, there was a negative relationship between grain yield and plant height and the presence of unfilled grains panicle^{-1}. Binni exhibited the highest grain yield (107.70 g pot^{-1}). The findings of Dumai, Kalojira, Moinasail, Chinigura, and Binni showed a number of desirable characteristics which are very useful for future breeding purposes. Preserving not only the mentioned cultivars but also all other cultivars studied is of utmost importance for future breeding needs.

Keywords: Agromorphological traits; Lodging resistance; Growth characters; Effective tillers; Grain yields

Introduction

Rice, scientifically designated as *Oryza sativa L.*, serves a vital role as a primary staple food for a substantial portion of the world's population. More than half of the global populace depends on rice as a crucial food source (Jahan *et al.,* 2018). Worldwide rice production has significantly increased during the past century. Around 524 million metric tons of rice needs to be produced worldwide in 2023–2024 to feed billions of people (IGC, 2023). Bangladesh's climatological and ecological conditions are excellent for the production of rice. In Bangladesh, the majority of the population, around 99%, consumes approximately 367 grams of rice per person every day. Rice plays a significant role in providing nutrition to the population, with approximately 75% of the total calorie intake and 55% of the protein intake being derived from rice on an average day (Rahman *et al.*, 2020). At present Bangladesh is successful to produce a sufficient amount of rice by high-yielding rice varieties (HYV). On an average 75% of the entire cultivated land covering about 11.68 million hectares produces approximately 37.60 million tons of rice every year in Bangladesh (BBS, 2022), which makes up around 85% (BER, 2023) of all cereal production.

Rice holds significant importance as a primary source of essential trace elements such as Selenium (Se), Zinc (Zn), and other micronutrients. These trace elements are essential for human health. Kashin-Beck disease, a chronic and endemic type of bone disease known as osteochondropathy, can occur due to a deficiency of Selenium (Se) in the diet, where the intake falls below 10 µg Se per day (Zwolak, 2020). Zinc (Zn) is a micronutrient vital for human health, supporting the functioning of over 300 enzymes and playing a crucial role in maintaining a healthy immune system. Recent studies have highlighted the presence of zinc deficiency in the population of Bangladesh. But the quality of rice is decreasing day by day. Nowadays worldwide climate change is a big challenge for hybrid rice production. Climate change is causing an increase in salinity levels in coastal regions, leading to heightened flooding in low-lying areas, while drought-prone regions are experiencing a growing scarcity of water over time. Bangladesh has different types of local cultivars of rice. The cultivars possess unique characteristics that are not present in our high-yielding or hybrid varieties. These traits include attributes like delicacy, aroma, drought tolerance, the ability to absorb phosphorus through the PISTOL gene, high concentrations of zinc and selenium, as well as stickiness to effectively deal with adversities.

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Native cultivar like "Kasaloth" possesses the gene called PISTOL that promotes root growth to survive phosphorus-deficient, drought-prone soil. Another local Aus cultivar like FR13A contains the Sub1 gene, which is important for survival in the submerged state (Kamrujjaman *et al*, 2017). Besides, the native rice cultivar in Bangladesh contains more Se and Zn than the modern variety. These traits are valuable for the present and future sustainability of rice cultivation in Bangladesh considering the climate change impacts. Many wide ranges of rice cultivars with valuable genes can be found in Sylhet. It also reported that the local rice cultivar of Sylhet contains higher of Zinc and Manganese (Al-Rmalli *et al.*, 2012). But these regional cultivars have received little attention. Increased local cultivar cultivation is necessary for the aforementioned reasons. These genetically altered grains of rice might fare well in a harsh climate. To enhance breeding programs and identify noteworthy genes that have yet to be discovered, it is crucial to thoroughly characterize and evaluate these particular cultivars. This experiment was conducted to assess the growth and yield capabilities of 18 indigenous rice cultivars and elucidate their agromorphological characteristics, aiming to provide high-quality cultivars for future breeding endeavors. This experiment was conducted to characterize the agro morphological traits of some native rice cultivars, evaluate the yield potential of these cultivars and to evaluate key characteristics of these indigenous cultivars, considering their potential incorporation into upcoming breeding programs.

Materials and Methods

Experimental site description

The experiment was conducted at the agronomy research area of the Sylhet Agricultural University in Sylhet, Bangladesh, which is located at 24.89°N latitude and 91.88°E longitude. The experimental soil was sandy loam, exhibiting a fertility level ranging from low to medium. This soil type falls under the classification of the Agro-Ecological Zone of the Eastern Surma-Kushiyara Floodplain (AEZ 20) (BARC, 2018). Throughout the experiment, the highest recorded temperature occurred in August, reaching 29.5°C, while the lowest temperature was observed in December at 20.9°C. July experienced the highest rainfall, with a cumulative precipitation of 778 mm, accompanied by a relative humidity of 82% (Table 1).

Table 1: Weather report of the 2022

Month	Temperature (°C)	Rainfall (mm)	Relative Humidity (%)
January	19.1	16	74
February	19.5	24	68
March	26.2	79	66
April	26.8	287	79
May	26.8	902	82
June	26.6	1485	89
July	29.3	778	82
August	29.5	461	80
September	28.6	744	84
October	27	334	82
November	24.4	0	73
December	20.9	8	76

Source: Sylhet Meteorological Station, Sylhet

Experimental material and seedling raising method

Eighteen (18) local rice cultivars including Binni, Naizershail (Brahmonbaria), Biruy, Begunbichi, Modonga, Meghraj, Biruin, Dumai, Kalojira, Maloti, Moynasail, Naizershail (Sylhet), Madhumadab, Bontosh, Tulsimala, Gandi, Nagrasail, and Chinigura, were individually considered as treatment. The seedlings were raised in seedbeds on July 3, 2022. On July 30, 2022, at the age of 27 days, the seedlings were transplanted into containers.

Layout and design of experiment

The experiment was done following completely randomized design (CRD) with four replications. Each pot occupied an area of 20 cm × 30 cm. So the area of one pot is 0.014 $m^{3.}$ Two seedlings were transplanted in each hill, and a total of three hills were transplanted within each pot.

Fertilizer dose and application method

About 5-6 days before the seedlings were transplanted, the soil in the pots was thoroughly mixed with cow dung. In accordance with the recommendations from the BARC fertilizer guide (2018), a foundational fertilizer application was carried out during the last soil preparation stage. This involved utilizing 40-10-46 kg ha^{-1} of N-P-K nutrients in the form of Urea, Triple Super Phosphate (TSP), and Muriate of Potash (MoP) respectively. The distribution of Urea occurred in three stages: an initial application during the last pot preparation, with the remaining quantity divided into two equal parts at the maximum tillering phase and before the initiation of panicles.

Cultural operations

Several intercultural practices, including irrigation, weed control, pest management, and fertilizer application, were implemented to support and maintain the optimal growth of the cultivars.

Procedure of data collection

Agromorphological traits, growth characters, and yield-attributing data were collected from this experiment.

Agromorphological traits

The evaluation of agromorphological traits of the local rice cultivars followed the IBPGR-Descriptor (IRRI, 1980) guidelines. The traits included basal leaf characteristics such as sheath color, anthocyanin coloration in leaves, the color of the leaf blade, presence of leaf auricles, presence of leaf ligules, anthocyanin coloration in nodes and internodes, lodging resistance indicated by culm strength, the timing of 50% plant heading, the attitude of the flag leaf (early and late), and presence of awns on spikelets.

Growth characters

i. Plant height: Plant height measurements were taken from the ground level to the tip of the longest stem, and the average value was calculated. These measurements were recorded at specific intervals of 15 days after transplanting (DAT), 30 DAT, 45 DAT, 60 DAT, and at the time of harvest.

ii. Tiller numbers: Throughout the growth period until harvest, the number of tillers per hill was assessed by counting the tillers from two specifically chosen hills at 15-day intervals. The average value of these counts was then considered as the total number of tillers per hill.

Yield and yield contributing parameters

Quantitative data were collected from the following yield and yield attributing traits-

i. Effective tiller $hill^{-1}$
ii. Panicle length (cm)
iii. Filled grains $panicle^{-1}$
iv. Unfilled grains $panicle^{-1}$
v. Weight of 1000-grain (g)
vi. Grain yield (g pot^{-1})
vii. Grain yield (t ha^{-1})

Statistical Analysis

Statistical analysis was done to observe whether there is any significant difference among the treatments by using R software (4.1.1, 2022). Treatments were compared through LSD.

Results and Discussion

Agromorphological traits

For the majority of agro-morphological traits, the cultivars showed a high degree of similarity (Table 2). However, there were noticeable distinctions in certain traits. Biruin and Maloti exhibited a purple color in their basal leaf sheaths, whereas the other cultivars had green coloration. Bontosh, on the other hand, only had awns in its panicles. This finding was consistent with the results of Rabara *et al.* (2014), who found that among 307 rice cultivars, only 5% had awns. The flag leaf showed an erect both in early and late observations. These results agree with the study of Pachauri *et al.* (2017), who reported significant variations among various rice genotypes in flag leaf.

Table 2: Agromorphological traits of different cultivars

Cultivar	BLSC	LAC	LBC	LA	LL	NIAC	CSLR	TH	PA
Binni	Green	Absent	Green	Present	Present	Present	Strong	Early	Absent
Naizershail (Brahmonbaria)	Green	Absent	Green	Present	Present	Absent	Strong	Late	Absent
Biruy	Purple	Present	Green	Present	Present	Absent	Moderately strong	Early	Absent
Begunbichi	Green	Absent	Green	Present	Present	Absent	Moderately strong	Very early	Absent
Modonga	Green	Absent	Green	Present	Present	Absent	Moderately strong	Early	Absent
Meghraj	Green	Absent	Green	Present	Present	Absent	Intermediate	Early	Absent
Biruin	Purple	Absent	Green	Present	Present	Absent	Intermediate	Early	Absent
Dumai	Green	Absent	Green	Present	Present	Absent	Intermediate	Very early	Absent
Kalojira	Green	Absent	Green	Present	Present	Absent	Strong	Late	Absent
Maloti	Purple	Present	Green	Present	Present	Present	Moderately strong	Late	Absent
Moynasail	Green	Absent	Green	Present	Present	Absent	Strong	Very early	Absent
Naizershail (Sylhet)	Green	Absent	Green	Present	Present	Absent	Strong	Late	Absent
Madhumadab	Green	Absent	Green	Present	Present	Absent	Moderately strong	Early	Absent
Tulsimala	Green	Absent	Green	Present	Present	Absent	Moderately strong	Early	Absent
Gandi	Green	Absent	Green	Present	Present	Absent	Intermediate	Very early	Absent
Nagrasail	Green	Absent	Green	Present	Present	Absent	Strong	Very early	Absent
Bontosh	Green	Absent	Green	Present	Present	Absent	Strong	Very early	Present
Chinigura	Green	Absent	Green	Present	Present	Absent	Strong	Very early	Absent

BLS= Basal leaf: sheath color, LAC= Leaf: Anthocyanin coloration, LBC= Leaf blade color, LA= Leaf auricles, LL= Leaf ligules, NIAC= Node and internode: Anthocyanin coloration, CSLR= Culm strength: lodging resistance, TH= Time of heading (50% plants with panicles), PA= Panicle: awns

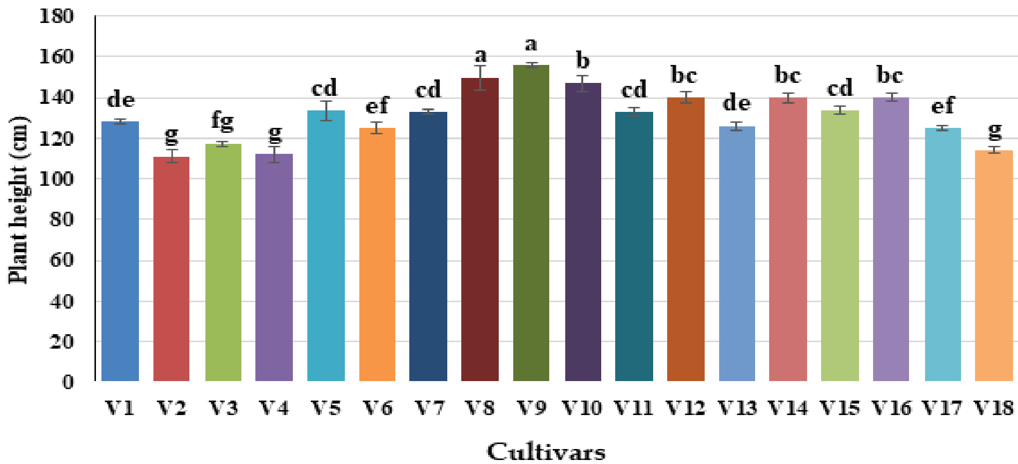
Growth characters

Plant height

Plant height progressively increased until it peaked at 60 days after transplanting (DAT). Within the range of different cultivars, Kalojira exhibited the tallest plants at 156.75 cm, in contrast to Naizershail from Brahmonbaria, which displayed the shortest plant at 111 cm (Table 3.). Among the cultivars Dumai (V8) and Kalojira (V9) showed maximum plant height, on the other hand Naizershail (V2) produced lowest height (Figure 1). Discrepancies in plant height can be attributed to the divergences in rice varieties and genetic influences. Foysal et al. (2023), Islam et al. (2013), and Satyanarayan et al. (2005) also observed individually in their experiments. They mention that variations in plant height occurred due to varietal differences.

Table 3: Plant height of different cultivars at different DAT

DAT / Cultivar	15 DAT	30 DAT	45 DAT	60 DAT	Harvesting
Binni	51.25 gh	87.5 g	107 e	128.25 fg	128.22 de
Nazirsail (Brahmonbaria)	48.88 h	91.5 efg	92.25 f	109 k	111 g
Biruy	59.00 d-g	89.25 fg	106.75 e	118.25 hij	117.25 fg
Begunbichi	55.50 e-h	97.75 c-g	123.5 cd	115 ijk	112 g
Modonga	53.63 fgh	99.5 b-f	109.75 e	131 def	133.5 cd
Meghraj	58.25 d-g	100.25 b-f	113.5de	129 efg	125 ef
Biruin	64.75 bcd	104.00 bcd	124.25 cd	140.75 bc	133 cd
Dumai	49.13 h	98.75 b-g	147.5 a	155 a	150 a
Kalojira	72.63 ab	110.00 ab	138 ab	156.75 a	156 a
Maloti	71.88 ab	115.50 a	128 bc	145.5 bc	147 b
Moynasail	65.00 bcd	102.50 b-e	127.25 bc	137.5 cde	133 cd
Nazirsail (Sylhet)	75.13 a	106.75 abc	123 cd	142.25 bc	140 bc
Madhumadab	62.00 cde	94.00 d-g	109.75 e	121.75 ghi	126 de
Tulsimala	62.75 cde	102.75 b-e	110.5 e	144 bc	140 bc
Gandhi	71.63 ab	116.75 a	133.5 bc	138.25 cd	133.75 cd
Nagrasail	71.75 ab	116.00 a	128.75 bc	148.75 ab	140 bc
Bontosh	70.00 abc	102.75 b-e	115 de	126.25 fgh	125 ef
Chinigura	60.75 def	97.25 c-g	110 e	110.5 jk	114 g
CV	9.2	7.9	6.85	4.57	4.25
LSD	8.15	11.42	11.61	8.65	7.95



V1= Binni, V2= Naizershail (Brahmonbaria), V3= Biruy, V4= Begunbichi, V5= Modonga, V6=Meghraj, V7=Biruin, V8= Dumai, V9= Kalojira, V10= Maloti, V11= Moinasail, V12= Naizershail (Sylhet), V13= Madhumadab, V14= Tulsimala, V15= Gandi, V16= Nagrasail, V17= Bontosh, V18= Chinigura

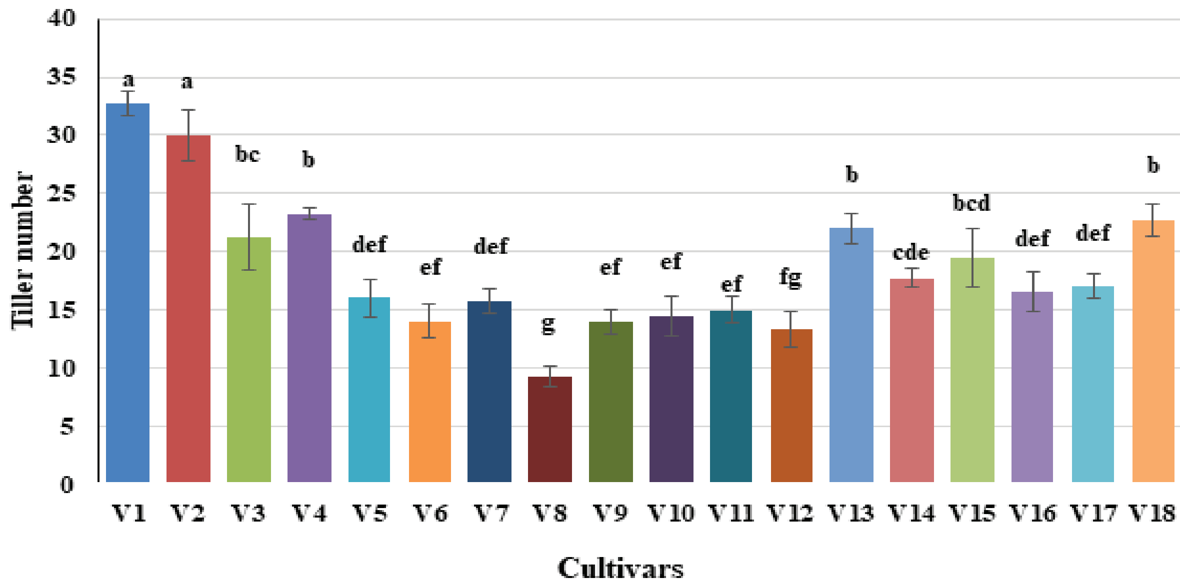
Figure 1. Plant height of different rice cultivars at harvesting

Tiller numbers hill

During the observation at 15 DAT, the Biruy cultivar displayed the highest tiller number (11.63), which was statistically similar to Chinigura (10.88), whereas Dumai had the lowest tiller number (2.38) (Table 4). At both 30 DAT and 45 DAT, Chinigura exhibited a higher tiller number compared to Dumai. The tiller number gradually increased over time, reaching a maximum of 23.3 tillers at harvest in the Nazirsail cultivar collected from Brahmonbaria (Figure 2). Other cultivars demonstrated varying trends in tiller response from 30 DAT until harvest, with Dumai exhibiting the lowest tiller number. Tiller numbers were found to significantly vary at different growth stages, as reported by Badshah *et al.* (2014). According to Xiu-mei *et al.* (2015), tillering plays a vital role in rice cultivation as it significantly affects plant growth and grain yield.

Table 4: Tiller numbers of different cultivars at different DAT.

DAT / Cultivar	15 DAT	30 DAT	45 DAT	60 DAT
Binni	6.00 ef	32 b	32.5 b	32.75 a
Naizershail (Brahmonbaria)	7.13 c-f	22.5 cde	38.5 a	30 a
Biruy	11.63 a	15 f-i	27.5 cd	21.25 bc
Begunbichi	9.00 a-e	17.5 d-i	32 bc	23.25 b
Modonga	4.50 fg	7 jk	15.25 h	16 def
Meghraj	9.88 a-d	13.25 hij	19.25 fgh	14 ef
Biruin	9.25 a-d	14.5 ghi	20.75 efg	15.75 def
Dumai	2.38 g	5.25 k	9.25 i	9.25 g
Kalojira	6.75 def	12.5 hij	16.25 gh	14 ef
Maloti	9.00 a-e	16.25 e-i	15.25 h	14.5 ef
Moynasail	9.88 a-d	18.5 c-i	21.5 ef	15 ef
Naizershail (Sylhet)	8.25 b-e	20.5 c-h	18 fgh	13.25 fg
Madhumadab	9.38 a-d	24.5 cd	25.25 de	22 b
Tulsimala	4.63 fg	12 ijk	18.75 fgh	17.75 cde
Gandi	8.88 a-e	21.75 c-f	19 fgh	19.5 bcd
Nagrasail	10.25 abc	21.75 c-f	15.75 h	16.5 def
Bontosh	8.63 a-e	25 bc	22.5 ef	17 def
Chinigura	10.88 ab	42 a	28.25 bcd	22.75 b
CV	27.58	26.33	14.87	15.52
LSD	3.18	7.05	4.64	4.09



V1= Binni, V2= Naizershail (Brahmonbaria), V3= Biruy, V4= Begunbichi, V5= Modonga, V6=Meghraj, V7=Biruin, V8= Dumai, V9= Kalojira, V10= Maloti, V11= Moinasail, V12= Naizershail (Sylhet), V13= Madhumadab, V14= Tulsimala, V15= Gandi, V16= Nagrasail, V17= Bontosh, V18= Chinigura

Figure 2. Effective tiller number of different rice cultivars at harvesting

Yield and Yield attributes

Yield and yield-related traits are key factors that influence the productivity of various rice cultivars. Traits such as the number of tillers hill^{-1}, number of panicles hill^{-1}, weight of 1000 grains, and other factors are important determinants of yield in rice. These characteristics are presented in Table 5 and subsequently subjected to detailed analysis and discussion.

Effective tillers hill^{-}: The highest number of effective tillers hill^{-1} was observed in Naizershail (23.13), which was collected from Brahmonbaria. The lowest effective tillers number was recorded in the cultivar Dumai (5.0). The variation in the number of effective tillers among different cultivars can be attributed to their genetic composition as well as environmental factors. Insufficient tillers result in a lower number of panicles, while excessive tillers can lead to a higher occurrence of tiller abortions, smaller panicles, insufficient grain filling, and consequently, reduced grain yield (Oladosu, 2014).

Panicle length: The Kalojira cultivar exhibited the longest panicle length (30.03 cm). Dumai (16.75 cm) cultivar exhibited the shortest panicle length. Environmental conditions, as mentioned by Seyoum *et al.* (2012), have an influence on panicle length

Filled grain panicle^{-1}: Among the cultivars evaluated, the Kalojira demonstrated the highest number of filled grains panicle^{-1} (223.25). In contrast, the Dumai cultivar exhibited the lowest number, with only 29.0 filled grains per panicle. The genetic makeup of the cultivar is a significant factor influencing the number of filled grains panicle^{-1}. Khatun *et al.* (2020) also found that variation in grain filling may have occurred due to genetic, environmental or cultural management practices adopted.

Table 5: Yield and yield contributing data of different rice cultivars

Treatment	Effective tillers at harvest	Panicle length (cm)	Filled grains panicle^{-1}	Unfilled grains panicle^{-1}	1000 grains weight pot^{-1} (g)	Grain yield pot^{-1}(g)	Crop duration (Days)
Binni	22.75 a	25.04 bcd	112.38 j	24.00 de	24.55 a	100.70 a	150
Naizershail (B.Baria)	23.13 a	26.15 bc	114.13 ij	15.63 ghi	16.80 f	91.57 b	156
Biruy	19.13 bc	19.98 e	99.25 k	13.00 hi	17.80 ef	34.59 f	155
Begunbichi	12.38 f	24.19 bcd	149.50 cd	11.38 ij	16.40 f	50.29 e	149
Modonga	12.25 f	25.94 bc	144.75 cde	10.38 ij	24.35 ab	59.33 d	149
Meghraj	13 f	22.54 de	139.63 def	21.38 ef	23.60 ab	59.30 d	145
Biruin	17 cde	24.59 bcd	127.63 gh	12.88 hi	12.88 g	80.12 c	144
Dumai	5 g	16.75 f	29.00 l	5.75 j	22.82 abc	19.44 g	78
Kalojira	14.63 def	30.03 a	223.25 a	33.00 c	9.90 h	47.14 e	156
Maloti	16.5 cde	25.34 bcd	150.38 c	46.63 b	16.50 f	50.23 e	156
Moynasail	13.88 def	24.96 bcd	131.63 fgh	18.25 fgh	20.75 cd	49.31 e	153
Naizershail (Sylhet)	14.88 def	25.08 bcd	135.63 efg	16.00 f-i	19.05 de	62.71 d	153
Madhumadab	19 bc	24.94 bcd	162.38 b	55.38 a	11.45 gh	59.31 d	157
Tulsimala	19.13 bc	25.33 bcd	138.50 ef	46.25 b	10.15 h	19.35 g	157
Gandi	20.88 ab	24.73 bcd	137.50 efg	32.75 c	18.15 ef	59.16 d	153
Nagrasail	17.25 ef	24.75 bcd	123.63 hi	20.63 efg	22.35 bc	48.13 e	158
Bontosh	13.75 ef	26.59 b	130.63 fgh	21.50 ef	19.15 de	40.26 f	158
Chinigura	20.75 ab	23.21 cd	130.25 fgh	28.38 cd	10.50 h	39.81 f	157
CV	14.84	8.61	5.32	16.59	8.37	7.46	-
LSD	3.46	2.99	9.99	5.67	2.09	5.71	-

Unfilled grain panicle^{-1}: The Madhumadab cultivar had the highest number (55.38) of unfilled grains, while the Dumai cultivar had the lowest (5.75). The experiment indicated that minimizing the occurrence of unfilled grains is beneficial for achieving a good grain yield. Cultural practices can play a role in controlling the presence of unfilled grains. Alam et al. (2009) also found that genetic makeup and cultural practices is responsible for producing unfilled grain of different cultivars.

1000-grain weight: The Binni cultivar exhibited the highest (24.55 g) 1000-grain weight, indicating that the weight of 1000 grains from this cultivar was greater compared to others. Comparatively lower 1000-grain weights were recorded in Kalojira (9.90) and Chinigura (10.50) cultivars. The observed differences in 1000-grain weight could be attributed to both genotypic (genetic) and phenotypic (environmental) factors. This finding is consistent with the studies conducted by Bello et al. (2018) and Kumar et al. (2018).

Grain yield: Differences in grain yield among various rice cultivars were calculated. Binni exhibited the highest yield at 100.70 g pot^{-1} followed by Naizershail from Brahmonbaria at 91.57 g. However, when Naizershail from Sylhet was considered, its yield dropped to 62.71 g, akin to Modonga, Meghraj, Madhumadhab, and Gandi, all at around 59.30 g. The lowest yields of 19.40 g pot^{-1} was seen in Dumai and Tulsimala, with Biruy slightly better at 34.59 g. Positive contributors to yield included effective tillers, panicle length, filled grains, and 1000-grain weight. Additionally, shorter plant height and fewer unfilled grains led to higher yields. These results align with the findings of Odjo et al. (2017). Overall, the combination of these favorable traits makes the Binni cultivar well-suited for achieving substantial grain yield.

Correlation of grain yield with plant height across different cultivars at varying time intervals

Table 6 displayed the relationship between plant heights on different DAT and grain yield of various rice cultivars. It was observed that grain yield exhibited a negative correlation with all plant heights at different DATs. This finding is in line with the studies conducted by Hairmansis et al. (2010) and Oladosu et al. (2014), which supported the findings that taller plants tend to have lower grain yields. However, it is important to note that not all studies have found a negative correlation. Bhadru et al. (2011) and Islam et al. (2021) reported in their studies that plant height actually has a positive.

Table 6: Correlation between grain yield and plant height of different cultivars at different DAT

DAT / DAT	15 DAT	30 DAT	45 DAT	60 DAT	Harvesting	Grain yield (g pot^{-1})
15 DAT	1.00					
30 DAT	0.80**	1.00				
45 DAT	0.41	0.65**	1.00			
60 DAT	0.47*	0.67**	0.79**	1.00		
Harvesting	0.46	0.63**	0.73**	0.97**	1.00	
Grain yield (g pot^{-1})	-0.19	-0.23	-0.40	-0.30	-0.29	1.00

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level.

correlation with grain yield. These conflicting results suggest that the relationship between plant height and grain yield may vary depending on the specific cultivar and environmental conditions. Again, there was a strong positive correlation between plant heights at 60 DAT and those at different DAT values. Furthermore, plant heights at 30 DAT showed a significant positive correlation with those at 15 DAT (r =0.80).

Correlation between tiller numbers at different time intervals with grain yield across various Cultivars

Table 7 displayed the correlation between grain yield and tiller numbers at various DATs for different rice cultivars. The findings indicated that grain yield had a significant positive relationship with the most DAT values, except for 15 DAT where the relationship was positive but not statistically significant. Notably, at 45 DAT, there was a significant positive correlation between tiller numbers and grain yield (r=0.52). A non-significant negative association exists between harvesting and grain yield, as indicated by the correlation coefficient of -0.089. The findings of the study demonstrated a positive correlation between grain yield and effective tillers, which is consistent with the results reported by Pandey and Kar (2017).

Table 7: Correlation between tiller numbers at DAT with grain yield of different cultivars

DAT / DAT	15 DAT	30 DAT	45 DAT	60 DAT	Harvesting	Grain yield (g pot^{-1})
15 DAT	1.00					
30 DAT	0.11	1.00				
45 DAT	0.078	0.60**	1.00			
60 DAT	-0.006	0.62	0.91**	1.00		
Harvesting	0.29	0.27	0.44	0.52*	1.00	
Grain yield (g pot^{-1})	-0.19	0.31	0.52*	0.59*	-0.089	1.00

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Correlation between yield and yield contributing parameters

Table 8 presented the correlation between grain yield and various yield parameters for 18 rice cultivars. The analysis found the significant positive correlations between effective tillers at harvest and grain yield pot^{-1} (r = 0.50), panicle length and filled grains $panicle^{-1}$ (r = 0.85), and unfilled grains per panicle and filled grains $panicle^{-1}$ (r = 0.51). A positive correlation was also observed between panicle length and effective tillers at harvest, although it was not statistically significant (r = 0.35). These findings align with the research conducted by Srijan et al. (2016), suggesting that longer panicle length positively influences grain yield. This is attributed to the increased capacity of longer panicles to accommodate more grains, resulting in higher grain yield. Similarly, effective tillers at harvest displayed a positive but non-significant correlation with filled grains panicle^{-1} (r = 0.23). On the other hand, 1000-grain weight pot^{-1} exhibited negative but non-significant correlations with all yield attributes, except for a significant negative correlation with unfilled grains panicle^{-1} (r = -0.56). Grain yield pot^{-1} demonstrated a negative but non-significant correlation with unfilled grains panicle^{-1} (r = -0.11). There was a non-significant positive correlation between grain yield per pot and 1000-grain weight pot^{-1} (r = 0.21).

Table 8: Correlation between yield and yield attributes

Trait / Trait	Effective tillers at harvest	Panicle length (cm)	Filled grains panicle^{-1}	Unfilled grains panicle^{-1}	1000-grains wt. (g)	Grain yield pot^{-1} (g)
Effective tillers at harvest	1.00					
Panicle length (cm)	0.35	1.00				
Filled grains panicle^{-1}	0.23	0.85**	1.00			
Unfilled grains panicle^{-1}	0.42	0.38	0.51	1.00		
1000-grains wt. (g)	-0.34	-0.33	-0.49*	-0.56*	1.00	
Grain yield pot^{-1} (g)	0.49*	0.37	0.15	-0.11	0.21	1.00

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Conclusion

In order to achieve the objectives of the experiment and based on the analysis of agro-morphological traits, growth characteristics, and yield performances, it was observed that all local cultivars exhibited distinct characteristics. Dumai stood out with its exceptionally early maturation period of 129 days. Kalojira, Moynasail, and Chinigura demonstrated lodging resistance at harvest, making them promising candidates for breeding purposes. Binni displayed the highest yield, followed by Biruin and Naizershail (Brahmonbaria), which had the highest grain yield among the local cultivars. Notably, the Kalojira cultivar showcased the highest number of filled grains per panicle. Additionally, the performance of the Naizershail cultivar, collected from both Brahmonbaria and Sylhet, yielded satisfactory results in Brahmonbaria. Therefore, it is crucial to identify the origin of the Naizershail cultivar. Correlation studies investigating the relationship between grain yield and yield-contributing traits also support similar results.

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