



## Glutinous Rice (*Oryza sativa* L.) Cultivars Grown on Coastal Soils of Bangladesh

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### Abstract

The experiment describes the patterns of plant height, days required for booting, heading and flowering, sterility (%), grain yield, straw yield and harvest index of three glutinous rice (*Oryza sativa* L.) cultivars namely, Pushbiruine, Kathalibiruine and Pakbiruine grown in the coastal saline soils of South West Bangladesh. The experiment was carried out in a Randomize Complete Block Design (RCBD) during aman season, 2003 at the experimental land of Khulna University, Khulna. The obtained results suggest that Kathalibiruine had better plant growth, considerable booting, heading and flowering periods, higher grain yield and harvest index than Pushbiruine and Pakbiruine. Thus Kathalibiruine may be considered as a potential candidate for cultivation in South-West Coastal Region of Bangladesh.

**Keywords:** Coastal Bangladesh, glutinous rice and urea

### 1. Introduction

Glutinous rice (*Oryza sativa* L.) has some special quality in terms of fineness, aroma, taste and protein contents (Kaul *et al.*, 1982). In Bangladesh, over 30 % of the net cultivable area is in the coast (Brammer, 1971) and glutinous rice can be well cultivated in South West Coastal Region (SWCR). Some of the important glutinous rice cultivars are Pakbiruine, Pushbiruine and Kathalibiruine (Paul, 2004). The demand for glutinous rice is also increasing in the country and in the European Union (Bocchi *et al.* 1995). Further, with social and cultural significance, glutinous rice has its historical traditions too (Golomb, 1976). However, the broader and extensive cultivation of this glutinous rice necessitates selection of suitable varieties that may perform well in the coastal regions, where the cropping intensity is rather low. Although rice (*Oryza sativa* L.) is the

principal food of Bangladesh and commendable development in non-glutinous rice has been made, scarce research so far has been conducted on glutinous rice. This experiment was therefore, initiated to evaluate the growth and yield performance of three glutinous rice cultivars namely Pushbiruine, Kathalibiruine and Pakbiruine in the saline soil of South West Coastal Region of Bangladesh (SWCRB).

### 2. Materials and Methods

The study was conducted at the Khulna University high land field during July to December, 2003. The field is situated in the Agroecological Zone (AEZ) of Gangetic Tidal Floodplain. The soil of the field was loamy to clay loam having a of pH 7.9 to 8.3 with low fertility status and salinity range of 0.85 to 2.24 dSm<sup>-1</sup>. The land was opened with a tractor and was ploughed and cross ploughed followed by

laddering to bring under good puddled conditions for transplanting rice seedlings. Full doses TSP ( $50 \text{ kg ha}^{-1}$ ) and MP ( $35 \text{ kg ha}^{-1}$ ) were applied as basal at final land preparation. Urea ( $88 \text{ kg ha}^{-1}$ ) was applied in four splits namely, at transplanting and 10, 25 and 45 DAT (days after transplanting), respectively. The prepared block with the 0.5 m border pathway, consisted of 15 plots with a unit plot size of  $5 \times 3 \text{ m}^2$ . Three uncontaminated and homogenous transplanted seedlings of the varieties- Pushbiruine, Kathalibiruine and Pakbiruine were transplanted in each hill with spacing of  $20 \text{ cm} \times 20 \text{ cm}$  between rows and hills. Gap filling when needed was done within one week of transplanting.

Data on seed germination, plant height, booting, heading and flowering periods, sterility encompassing grain weight, straw yield and harvest index were collected from eight randomly selected plants coupled with the avoidance of before and after harvesting border effect. The experiment was laid out in randomized complete block design (RCBD) with five replications and statistical analyses were carried out with a statistical package MSTAT-C.

### 3. Results and Discussion

#### 3.1. Seed Germination

The three rice cultivars showed a significant ( $p \leq 0.01$ ) variation in seed germination (Figure 1). Before sowing seed germination ranged from 68 to 74%, while after sowing that ranged from 80 to 82%, respectively. Kathalibiruine attained the highest germination (82%) and the lowest was recorded in Pakbiruine (68%). The finding suggested that the seed germination performance of the three rice cultivars used for the experiment lied in the acceptable range for cultivation.

#### 3.2. Plant height

No significant effect of the rice cultivars on plant height at 28, 50 and 73 DAT was observed though the plant height was significantly ( $p \leq 0.01$ ) influenced by the cultivars at maturity (Table 1). At harvesting stage, Pakbiruine ( $V_3$ ) attained the lowest plant height (151.12 cm) with the intermediate (153.40 cm) by Pushbiruine ( $V_1$ ) and the highest (162.00 cm) by Kathalibiruine ( $V_2$ ). Characteristically rice varieties differ in their heights (BRRRI, 1991; Sawant *et al.* 1986).

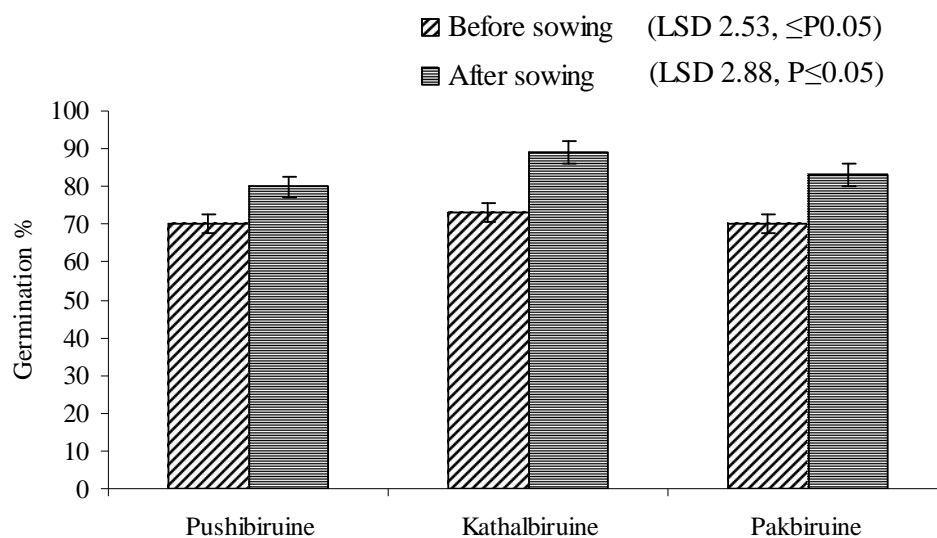


Fig. 1. Effect of varieties on seed germination

Table 1: Differences in plant height in three glutinous rice cultivars during growing period

Variety	Plant height (cm)			
	28 DAT	50 DAT	73 DAT	Harvesting time
Pushibiruine	47.08	76.64	117.36	153.40
Kathalbiruine	48.44	82.88	123.60	162.00
Pakbiruine	46.80	75.56	109.52	151.12
CV%	8.60	6.61	7.50	1.69
LSD	--	--	--	7.18
Level of significance	NS	NS	NS	**

N. B.: CV = Coefficient of Variation, LSD = Least Significant Difference, NS = Non significant, \*\* = Significant at 1% level, DAT= Days After Transplanting

### 3.3. Booting, heading and flowering

As shown in Table 2, the three cultivars did not show any variation in days required to booting, heading and flowering. However, Kathalibiruine ( $V_2$ ) required the maximum number of days for booting, while minimum days was required for Pakbiruine ( $V_3$ ). In general, glutinous rice varieties grown in the SWCR showed no remarkable differences in days required for booting (Paul, 2004) and thus, the booting period requirement for the three cultivars were similar to those reported by Paul (2004). The highest number of days (87 and 90) required for heading and flowering was found in Kathalibiruine ( $V_2$ ) and those of the lowest (85 and 89) in Pakbiruine ( $V_3$ ). Variety may have differential effect on plant characters of rice as reported by Shamsuddin *et al.* (1988) and BIRRI (1990). It has been reported that variable heading and flowering periods in rice is a common feature (BIRRI, 1988). In the current investigation, different varieties needed different number of days for their heading and flowering. So, variability in the number of days required for heading and flowering in our findings are supported by those of Shamsuddin *et al.* (1988) and BIRRI (1988 and 1990). Insignificant difference with regards of booting, heading and flowering periods among three cultivars studied

reflects the varietal uniqueness on the expression of rice plant characters. Thus the varieties characterized by differential booting, heading and flowering periods demonstrated their persistent adaptation in locale of SWCRB. Further, longer booting, heading and flowering periods in Kathalibiruine ( $V_2$ ) revealed that Kathalibiruine could be cultivated in flash flood or heavy rainfall hit parts of SWCRB where water stagnation caused delayed transplanting of aman rice prevails.

### 3.4. Sterility, grain yield, straw yield and harvest index

#### 3.4.1. Sterility

Spikelet sterility varied significantly ( $p \leq 0.5$ ) among the rice cultivars (Table 3). The highest spikelet sterility (23%) was observed in Pushibiruine and that of the lowest was in Kathalibiruine (18%). For aromatic rice, spikelet sterility potential differs among rice varieties (Mannan *et al.*, 2008). In the current study, spikelet sterility was considerable in all the cultivars used. These results indicated that glutinous rice varieties possessed significantly different sterility potential which agreed with those reported by Paul (2004).

Table 2: Differences in days required for booting, heading and flowering of three glutinous rice cultivars

Variety	Days		
	Booting	Heading	Flowering
Pushibiruine	82.20	86.00	89.00
Kathakbiruine	83.00	87.00	90.00
Pakbiruine	81.00	85.00	89.00
CV%	1.75	1.26	1.58
LSD	--	-	-
Level of significance	NS	NS	NS

N.B.: CV= Coefficient of Variation, LSD= Least Significant Difference, NS = Non significant

Table 3: Differences in sterility, grain yield, straw yield and harvest index of three glutinous rice cultivars

Variety	Sterility (%)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	Harvest index (%)
Pushibiruine	23.00	1.69	7.62	18.2
Kathalbiruine	18.50	2.01	7.24	21.7
Pakbiruine	20.00	1.70	9.19	15.6
CV%	6.25	12.35	15.25	6.19
LSD	3.5	0.21	1.65	0.13
Level of significance	*	**	**	**

N. B.: CV= Coefficient of Variation, LSD= Least Significant Difference, \*\* = Significant at 1% level, \* = Significant at 5% level

### 3.4.2. Grain yield

The grain yield among the test cultivars showed a significant ( $p \leq 0.01$ ) variation (Table 3). Kathalbiruine produced the highest grain yield (2.01 t ha<sup>-1</sup>) and the lowest (1.691 t ha<sup>-1</sup>) was recorded in Pushibiruine. However, the grain yield of Pakbiruine and Pushibiruine was statistically identical (Table 3). These findings suggested that spikelet sterility were the major factors for such yield variation among the varieties tested as for glutinous rice, almost similar findings were reported by Mannan *et al.* (2008).

### 3.4.3. Straw yield

With respect to straw yield, the test cultivars showed significant ( $p \leq 0.01$ ) variation (Table 3). The highest straw yield (9.19 t ha<sup>-1</sup>) was found in Pakbiruine and the lowest (7.24 t ha<sup>-1</sup>) was recorded in Kathakbiruine. These sorts of variability in straw yields of rice was also reported by Singh and Sharma (1987) as these authors experimentally reported that rice varieties lead to differential production of straw yields. Additionally, for glutinous rice, antagonistic grain and straw yields are also

reported by Mannan *et al.* (2008). However, generalized agreement is that both grain and straw production are highly correlated with the amount of N use and in the current investigation, all the varieties tested were treated with the recommended dose of urea (88 t ha<sup>-1</sup>). The test varieties therefore, need further test with various N levels.

#### 3.4.4. Harvest index

Harvest index was significantly ( $p \leq 0.01$ ) different among the rice varieties. The highest harvest index (21.73) was obtained in Kathalbiruine and the lowest (15.61) was found in Pakbiruine (Table 3). For rice varieties, the relationship between harvest index and yield are directly proportional; and thus higher the harvest index and the greater is the yield (Dutta *et al.* (1997). The results related to the harvest index variation among the rice cultivars of the current investigation is similar to those referred by Yoshida (1981).

#### 4. Conclusions

This work demonstrated that glutinous rice cultivars when experimented with recommended dose of urea in the SWCB showed differential plant height, booting, heading, flowering periods, grain and straw yields etc. which are genetic characters. Among the three cultivars, Kathalbiruine showed better performance related to those characters compared to other two cultivars. However, it is suggested to carry out further experiments on coastal saline soil of South West Coastal Bangladesh for selecting a suitable cultivar and developing appropriate management practices to adapt and cultivate glutinous rice in that region.

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