Journal of Agroforestry and Environment

Volume 16, Issue 2, 2023

Journal DOI: https://doi.org/10.55706/jae

Journal homepage: www.jagroforenviron.com

Yield Performance of Binadhan-24 Over Two Selected Locations in Bangladesh

Md. Elius Hossain[1]*, Shamima Begum[1], Md. Muzammal Hoque[1], Md. Mohimenul Islam[1], Mohammad Ferdous Ikbal[2], S. M. Abdul Alim[2] and Md. Shahed Hossain[3]

[1]Adaptive Research and Extension Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh
[2]Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh
[3]Agronomy Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh

*Correspondence: eliusbina09@gmail.com; Phone: +8801616131689.

Received: 19/10/2023

Accepted: 12/12/2023

Available online: 30/12/2023

Abstract: Boro is the most important cereal crops in terms of production to the farmers in Bangladesh. An experiment was conducted to examine the suitability and productivity of two rice varieties cultivating in Boro season. The experiment was consisted of Binadhan-24 and BRRI dhan58 and it was conducted at the farmer's field of Mymensingh and Kishoreganj districts from December, 2022 to May, 2023. The experiment was performed in Randomized Complete Block Design (RCBD) with three replications. Higher yield (7.03 tha^{-1}) was recorded in Binadhan-24 compared to the variety BRRI dhan58 (6.53 tha^{-1}). A higher day to maturity was found in BRRI dhan58 (152.50 days) compared to the varieties Binadhan-24. The highest effective tiller $hill^{-1}$ (24.90) and number of filled grain $panicle^{-1}$ (142) were recorded in Binadhan-24 where in BRRI dhan58, effective tiller $hill^{-1}$ and number of filled grain $panicle^{-1}$ were 22.19 and 136.80 respectively. Higher 1000 seed wt. (24.38 g) was found in Binadhan-24 compared to another variety. And the maximum yield potential (7.03 tha^{-1}) was recorded in Binadhan-24. This experiment will be useful to select Boro genotypes with high yield potential and future breeding stock in area specific suitable locations and all over the world.

Keywords: Boro; Effective tiller; Panicle length; Rice yield.

INTRODUCTION

One of the main foods that people eat to satisfy their hunger is rice (*Oryza sativa* L.). With an annual production of 37.61 million tons from 11.71 million ha of land, rice is grown on about 85% of Bangladesh's cultivable land. Bangladesh has an extremely low average rice yield of 2.92 t/ha (BBS 2015). Bangladesh's agroclimatic conditions are perfect for rice cultivation. Maclean *et al.* (2002) predicted that as the population grew, so would the demand for rice, with a 25% increase. There are currently about 169.4 million people living in Bangladesh, a small country with a substantial population, and its population is growing at a rate of 1.16% (BBS, 2021). The rising population and rising demand for food will soon cause Bangladesh's land resources to yield more rice. Higher yielding cultivars require more fertilizer, with nitrogen being the most important ingredient (Chang *et al.*, 1964). It will be necessary for future technologies to use high-yielding cultivars that make effective use of various manures and fertilizers. Bangladesh experiences three distinct rice-growing seasons: Aus, Aman, and Boro. Winter rice is the usual term for Boro rice. Lal, (2013) states that irrigated conditions are used to grow Boro rice varieties from November through May. The Department of Agriculture Extension states that a total of 48.59 lac hectares were used for Boro rice production in 2017–2018, which was 8.55% more than in 2016–2017. The amount produced was 195.78 lac tons, which was 8.66 percent more than in 2016–2017 (Rakib, 2019). According to Mainuddin (2021), farmers in Bangladesh cultivate Boro rice on 48.59 lakh hectares of land. This has led us to conduct our experiment in order to ascertain whether Binadhan-24 is appropriate for these particular locations during the Boro season.

MATERIALS AND METHODS

Study location

The experiments were conducted at the farmer's field of Mymensingh (24.76° N, 90.43° E) and Kishoreganj (24.43° N, 90.78° E) districts during the period from December, 2022 to May, 2023 to study the suitability and productivity of Binadhan-24 and BRRI dhan58 rice varieties cultivating in Boro season.

Experimental design and data collection

Binadhan-24 and BRRI Dhan58 were tested at farmers' field in two locations namely, Mymensingh (Sadar) and Kishoreganj (Sadar). The field experiments were laid out in Randomized Complete Block Design (RCBD) with three replications (Gomez, 1984).

Intercultural operations and data collections

The size of each unit plot was 5m × 6m (30 m^2). Forty days aged single seedling transplanted in each hill maintaining 20 cm distance between row to row and 20 cm distance between hill to hill. Nitrogen, Phosphorus, Potassium, Zinc, and Sulphur were used as Urea, TSP, MoP, Zinc Sulphate, and Gypsum maintaining the doses as 210 kg ha^{-1}, 105 kg ha^{-1}, 135 kg ha^{-1}, 5 kg ha^{-1} and 80 kg ha^{-1} respectively. The total TPS, MoP, Zinc Sulphate, Gypsum were applied as basal doses. After transplanting for seven days, one-third of the urea was applied. After transplanting, the urea was applied at top-dress at two equal slips at 30 and 45 days. Using pesticides and herbicides allowed soil pests and pre-emergence weeds to be controlled. Following recommended dosages, Virtako 40WG was used to control the infestation of yellow stem borer, and Nativo 75WG was used to control the infection of blast and sheath blight. When necessary, irrigations were carried out multiple times. Plant height (cm), panicle length (cm), number of effective tillers/hill, number of grains/panicle, number of filled grains/panicle, number of unfilled grains/panicle, yield (t/ha), and days to maturity were all recorded.

Statistical analysis

Using the analysis of variance technique, the mean value of the collected data was statistically analyzed using the MSTAT computer package. The mean differences were then adjusted using Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Days to maturity

Days to maturity among the varieties showed noteworthy results. (Table 1) shows that Binadhan-24 (147 days) required less days to maturity than BRRI dhan58 (152.50 days). Mymensingh recorded the lowest maturity period (146 days) and the highest (153 days). Ghosh *et al.* (2015) supports the idea that genotypic variations may contribute to differences in maturity.

Plant height (cm)

Regarding plant height, there was a notable variation between these genotypes. Binadhan-24 (86.84 cm) had the lowest plant height, while BRRI dhan58 (93.10 cm) had the highest (Table 1). Similar to Sarkar (2014), who suggested that varietal differences account for variable plant height, the variation in plant height could arise from distinct genotypes having different genetic potentials.

Panicle length (cm)

The length of the panicles varied significantly among the varieties. In comparison to BRRI dhan58 (12.63 cm), Binadhan-24 had a longer panicle (13.88 cm) (Table 1). For Binadhan-24, the longest panicle length was measured at Mymensingh (15.23 cm), while for BRRI dhan58, the shortest panicle length was measured in Kishoreganj (11.62 cm). Sarkar, (2014) suggests that genetic characteristics could be the cause of the plant's variation.

Table 1. Variation in yield and yield contributing characters of the selected rice genotypes

Locations	Genotypes	Days to maturity	Plant height (cm)	Panicle length (cm)	No. of effective tiller $hill^{-1}$	No. of filled grains $panicle^{-1}$	No. of unfilled grains $panicle^{-1}$	1000 seed weight (g)	Grain yield (tha^{-1})
Mymensingh	Binadhan-24	146a	88.15b	15.23a	24.65a	142.65a	32.33b	24.64a	7.10a
	BRRI dhan58	153b	92.73a	13.64b	23.45b	135.27b	41.25a	21.23b	6.63 b
Kishoreganj	Binadhan-24	148a	85.52b	12.53a	25.15a	141.35b	29.63b	24.12a	6.92a
	BRRI dhan58	152ab	93.46a	11.62b	20.93c	138.32a	38.45a	21.43b	6.43b
Combined	Binadhan-24	147.00b	86.84b	13.88a	24.90a	142.00a	30.98b	24.38a	7.03a
	BRRI dhan58	152.50a	93.10a	12.63b	22.19b	136.80b	39.85a	21.33b	6.53b
	F test	**	**	*	**	**	**	*	**
	CV (%)	4.68	3.75	6.65	5.23	10.52	8.35	5.12	6.73

Figures in the column having the same letters (s) do not differ significantly; *= significant at 5% level of probability; **= significant at 1%
Values in a column that share the same letter (s) do not significantly differ at the 5% level using LSD.

DOI: https://doi.org/10.55706/jae1640

No. of effective tillers per hill

Binadhan-24 recorded the highest number of tillers per hill (24.90), while the BRRI dhan58 recorded the lowest number of tillers per hill (22.19), both of which were statistically significant. (Table 1) shows that the highest number of productive tillers/hill for Binadhan-24 (25.15) was found at Kishoreganj, while the lowest number was found in BRRI dhan58 (20.93). Jisan *et al.* (2014) previously reported that varietal characteristics are the cause of variations in the number of tillers per hill.

No. of filled grains per panicle

A statistically significant difference in the number of filled grains between Binadhan-24 (142) and BRRI dhan58 (136.80) was observed. Table 1 shows that the highest number of filled grains was recorded in Mymensingh for Binadhan-24 (142.65) and the lowest number in BRRI dhan58 (135.27).

No. of unfilled grains per panicle

The quantity of unfilled grains per panicle varied significantly between these genotypes. Comparing BRRI dhan58 (39.85) to Binadhan-24 (30.98), a greater quantity of unfilled grains was discovered. (Table 1) shows the maximum number of unfilled grains for BRRI dhan58 (41.25) in Mymensingh and the minimum number for Binadhan-24 (29.63) in Kishoreganj. According to Chowhan (2017), cultural management practices, environmental factors, or genetics may have contributed to variations in grain filling.

1000 seed weight (g)

Regarding thousand seed weight, there was a notable variation between the two varieties; Binadhan-24 had the highest weight (24.38 g) and BRRI dhan58 had the lowest weight (21.33 g). Binadhan-24 (24.64 g) had the highest thousand seed recorded in Mymensingh, and BRRI dhan58 (21.23) had the lowest (Table 1). Pawar *et al.* (2014) found that the genetic patterns of 43 distinct rice genotypes resulted in significant differences in their 1000 seed weight.

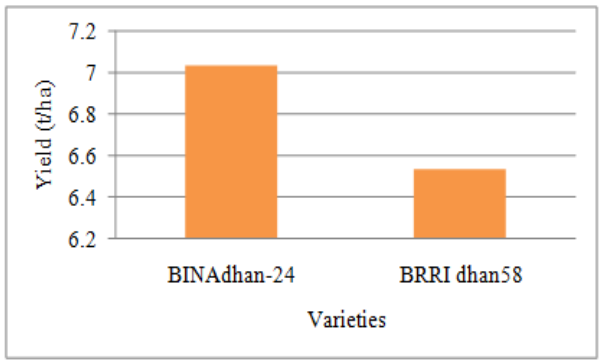

Figure 1. Average yield performance of the selected varieties

Grain yield (tha^{-1})

The yield performance of the two types differed significantly from one another. According to (Table 1), higher grain yield was observed in Binadhan-24 (7.03 tha^{-1}) compared to BRRI dhan58 (6.53 tha^{-1}). Highest yield was found in Mymensingh for Binadhan-24 (7.10 tha-^{1}) and minimum in Kishoreganj for BRRI dhan58 (6.43 tha^{-1}) (Figure 1). This result was similar to Dutta *et al.* (2002), who observed that yield was affected by the filled grains/panicle.

CONCLUSION

This study revealed that Binadhan-24 had a high yield potential of 7.10 tha-^{1} with a lower day to maturity of 147 days compared to BRRI dhan58 over two selected areas in Bangladesh. Based on the yield performance, Binadhan-24 could be selected for cultivation as a promising rice variety in Boro season through all over the world specially in South East Asia.

Conflict of Interest

There are no conflicts of interest declared by the authors.

REFERENCES

BBS (Bangladesh Bureau of Statistics). 2021. Summary crop statistics and crop indices (2019-20). Bangladesh Bureau of Statistics Division, Govt. of the People's Republic of Bangladesh:31-32.

BBS (Bangladesh Bureau of Statistics). 2015. Summary crop statistics and crop indices (2013-14). Bangladesh Bureau of Statistics Division, Govt. of the People's Republic of Bangladesh:35-37.

Chowhan, Sushan, M. Raisul Haider, A. F. M. F. Hasan, Md Imdadul Hoque, Md Kamruzzaman, and Rigyan Gupta. 2017. "Comparative on farm performance of five modern rice varieties with two local cultivars." *Journal of Bioscience and Agriculture Research* 13, no. 01: 1074-1086.

Dutta RK, Baset M, Khanam S. 2002. Plant architecture and growth characteristics of fine grain and aromatic rices and their relation with grain yield. International Rice Commission Newsletter (FAO)

Ghosh, U. K., A. R. Khan, and M. A. Karim. 2015. "Growth performance of aus rice varieties under rainfed condition." *International Journal of Advanced Multidisciplinary Research* 2, no. 11: 29-35.

Gomez, Kwanchai A., and Arturo A. Gomez. 1984. *Statistical procedures for agricultural research*. John wiley & sons

Islam, M. M., Haque, M. S., Khanam, S.,Begum, S. and Hoque, M. M.. 2023. "Yield Performance of Two Drought Tolerant Rice Mutants in Boro Season at Two Semi Drought Prone Areas of Bangladesh." *Asian Journal of Research in Crop Science* 8, no. 4: 323-329.

Jisan, M. T., S. K. Paul, and M. Salim. 2014. "Yield

performance of some transplant aman rice varieties as influenced by different levels of nitrogen." *Journal of the Bangladesh agricultural university* 12, no. 452-2016-35815: 321-324.

Lal, B., Priyanka Gautam, B. B. Panda, and R. Raja. 2013. "Boro rice: a way to crop intensification in Eastern India." *Popular kheti* 1, no. 1: 5-9.

Mainuddin, M., Alam, M. M., Maniruzzaman, M., Kabir, M. J., Mojid, M. A., Hasan, M. M., Schmidt, E. J. and Islam, M. T., 2021. Yield, profitability, and prospects of irrigated Boro rice cultivation in the North-West region of Bangladesh. *PloS one*, *16*(4), p.e0250897.Pawar GS, Padma V, Subrahmanyam D, Kumar SS, Bhave MH. 2014. Assessment of genotypic variability in rice (Oryza sativa L.) for growth and yield characteristics. Journal of Research PJTSAU.;42(4):1-6.

Rakib, Abdur, K. T. Akhter, M. S. Khanam, Md Sefaur Rahman, and ABM Shafiul Alam. "Performance of Binadhan-17 compare to BRRIdhan-28, BRRIdhan-29, BRRIdhan-81 and BRRIdhan-89."

Zhao, Hua, Zhaowen Mo, Qingshan Lin, Shenggang Pan, Meiyang Duan, Hua Tian, Shuli Wang, and Xiangru Tang. "Relationships between grain yield and agronomic traits of rice in southern China." *Chilean journal of agricultural research* 80, no. 1 (2020): 72-79.

DOI: https://doi.org/10.55706/jae1640