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YIELD EVALUATION OF CULTIVATED DROUGHT TOLERANT RICE VARIETIES IN BANGLADESH

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ABSTRACT

An experiment was conducted with seven drought tolerant rice varieties i.e., Binadhan-17, Binadhan-19, BRRI dhan56, BRRI dhan57, BRRI dhan66, BRRI dhan71 and BRRI dhan83 were used as plant materialism. Boro season during December 2022-May 2023 to evaluate the yield performance at the reproductive stage as well as disclose the inherent variability of the varieties for yield and yield attributing traits following a randomized complete block design with three replications. Significant variation ($p<0.01$) was observed for genotype, treatment and G (genotype) × T (treatment) interactions *viz.*, days to maturity, plant height, effective tillers/plant, filled grains/plant, unfilled grains/plant, 100-seed weight, grain yield/plant and H_2O_2. Drought stress lead to a significant decrease in grain yield/plant in all of the varieties; highest decrease was found in BRRI dhan56 (48.65%) followed by BRRI dhan57, BRRI dhan66, Binadhan-17, Binadhan-19, BRRI dhan83, and BRRI dhan71 (42.08, 39.01, 37.58, 34.54, 32.28 and 31.92%, respectively) related to control. Interestingly, the highest yield was recorded in Binadhan-17. Principle component analysis revealed that the first two components explained 76.1% of the total variations of the studied varieties, indicating total tillers/plant, effective tillers/plant, filled grains/plant, 100-seed weight and grain yield/plant are the most important characters contributing to yield. Grain yield/plant showed significant positive correlation with total tillers/plant, effective tillers/plant, filled grains/plant, 100 seed weight. From stress tolerance indices Binadhan-17 was categorized as tolerant genotype with superior yield performance and this genotype was selected for further study under different drought prone areas of Bangladesh as well as for genetic improvement against drought stress.

Keywords: Rice, Drought, Stress Tolerant Index, Yield Performance

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INTRODUCTION

Rice (*Oryza sativa* L.) is the most extensively consumed staple food for a significant percentage of the world's population, particularly in Asia (Hossain et al., 2023). Climate change poses a significant threat to agriculture, particularly in underdeveloped countries. This danger to food security, as well as the resulting economic losses, has heightened the need for the creation of abiotic stress robust rice cultivars with higher yield potential (Hoque et al., 2020). Drought is the most pressing and significant abiotic factor limiting rice output in rainfed habitats (Pandey & Shukla, 2015). Rice productivity and sustainability in Bangladesh are constantly threatened by abiotic factors such as drought, salinity, and heat or cold stress. Drought linked with high temperatures has a significant detrimental influence on agricultural productivity. Rice yield loss due to minor drought ranges from 10-30% and can reach 70-90% in severe drought (Hossain et al., 2023).

To keep up with population growth, rice production should increase by nearly 50% to 950 million tons by 2025 (Laborte et al., 2012). Drought causes about 1% of land loss in Bangladesh each year. Rice is significant in Bangladesh's agro-economy and national health. Over the previous three decades, Bangladesh has achieved significant success in maintaining a decent growth in rice output. Droughts are common in Bangladesh due to its geophysical location, fluctuating rainfall patterns, and high temperatures (Rahman, 2011). The degree and duration of drought stress during the reproductive stage in rainfed lowland rice requires the development of drought tolerant rice cultivars (Kamoshita et al., 2008), which must survive under water deficit stress during the reproductive stage, quickly recover, and grow rapidly when soil moisture is restored (De Datta et al., 1988). Drought has a negative impact on growth, yield, membrane integrity, pigment content, osmotic adjustment, water relation, and photosynthetic activities (Praba et al., 2009).

Fundamental research has offered considerable insights into the physiological, biochemical, and molecular responses of plants to drought stress, yet there is still a significant yield difference between normal and drought stress conditions. Bangladesh has created some drought-tolerant rice varieties, but yield varies among the drought-tolerant rice cultivars grown in Bangladesh. So, the experiment was carried out to determine the variety with the highest yield potential when cultivated in drought condition.

MATERIALS AND METHOD

Soil and climate

The soil used for the experiment was silt loam, silt clay-loam and its belongs to the high Ganges river floodplain under the agro-ecological zone (AEZ 11, 14) which is predominantly highland and medium highland in nature. The climate here is warmly equated with warmth. Annual average temperature is 22°.24' Celsius and annual rainfall is 152.190 cm.

Location and experimental design

The experiment was conducted at the drought prone area, Jhenaidah (latitude 23.63°, and longitude 89.07°) of farmer's field during Boro season during December 2022 to May 2023. The experiment was laid out in RCBD with 3 replications.

Plant Materials

Seven drought tolerant rice varieties i.e., Binadhan-17, Binadhan-19, BRRI dhan56, BRRI dhan57, BRRI dhan66, BRRI dhan71 and BRRI dhan83 were used as plant materials. The seeds were collected from Bangladesh Rice Research Institute (BRRI) and Bangladesh Institute of Nuclear agriculture (BINA).

Seedlings growth and drought stress treatment

Thirty-eight days old seedlings were transplanted in the main field keeping 15 cm plant to plant and 20 cm row to row distance. The unit plot size was $2\times2\ m^2$. There was no replicate for control set where regular watering was followed when necessary and which was set far beside the drought treated plots. All the plants were grown with sufficient watering until the drought stress treatment was initiated. At the end of rice growth stage-4 one group of rice plants were subjected to drought stress and continued up to ripening stage.

Fertilizer application

Recommended doses of fertilizer (Urea, TSP and MP) were applied to the soil during soil preparation. Urea was applied in three times; first dose was applied after thirty days of transplanting, second dose was applied at active tillering stage, and third dose was applied at panicle initiation stage.

Intercultural operation

Intercultural operations were also done whenever necessary. The following operations also made during experimental time.

Weeding

Weed control is an important step to prevent losses in yield and to preserve good grain quality. The experimental plots were affected by some common weeds and those were removed carefully from the soil by uprooting them without bringing any injury of rice plants.

General observation of the experimental plots

Close observation was prerequisite for any kind of successful experiment. Observation was done regularly. All the stages of plants and responses of plants as per respective treatments were regularly observed.

Harvesting

Harvesting was done based upon the maturity of different genotypes. Maturity of crop was determined when about 80-90% grains of the plant became golden yellow color. The different varieties were harvested when they attained their maturity and phenotypic changes also observed.

Sampling, threshing and processing

The harvested plants for each plot were collected separately with proper tagging. The sample was sun dried and threshing was done carefully by hand.

Data on morphological traits at the reproductive stage

Observations were recorded on days to maturity, plant height (cm), total tillers/plant, effective tillers/plant, panicle length (cm), filled grains/plant, unfilled grains/plant, 100-seed weight (g), grain yield/plant (g) and hydrogen peroxide (H_2O_2).

Estimation of hydrogen peroxide (H_2O_2)

$H_2O_2$from leaf tissues at the reproductive stage and from flag leaf tissues at the reproductive stage was measured following the method of Velikova et al. (2000) and calculated by utilizing 0.28 $\mu M^{-1}cm^{-1}$ extinction coefficient.

Statistical analysis

Different parameters were compiled and tabulated in proper form for statistical analysis which was carried out in Minitab17 statistical software package. Various statistical tests were performed to assess the varietal performance of the studied varieties.

Calculation of percent yield reduction

For comparing stressed plants with control plants, the reduction percentages for grain yield was calculated by the following formula:

$$(\%)\ \text{Reduction} = \frac{(\textbf{seed yield of stressed plants})-(\textbf{seed yield of control plants})}{\textbf{seed yield of control plants}} \times 100$$

Estimation of drought stress tolerance indices

Drought stress tolerant indices were calculated using the following formulas:

1. Stress susceptibility index (SSI) = $\frac{1-Y_s/Y_p}{1-\bar{Y}_s/\bar{Y}_p}$ (Fischer & Maurer, 1978)
2. Stress tolerance (TOL) = $Y_p - Y_s$ (Rosielle and Hamblin, 1981)
3. Mean productivity (MP) = $(Y_s + Y_p)/2$ (Rosielle and Hamblin, 1981)
4. Stress tolerance index (STI) = $\frac{(Y_s)(Y_p)}{(Y_p{}^2)}$ (Fernandez, 1992)
5. Geometric mean productivity (GMP) = $\sqrt{Y_p \times Y_s}$ (Fernandez, 1992)
6. Yield index (YI) =$\frac{Y_s}{\bar{Y}_s}$ (Gavuzzi et al., 1997)

RESULTS AND DISCUSSION

Mean performance and effect of drought stress on different yield and yield related traits of rice varieties

Days to maturity

Significant variation was observed among the varieties for days to maturity in response to drought stress. The highest days to maturity under control condition was found in BRRI dhan66 (149.78 days) whereas the lowest was in Binadhan-19 (139.78 days). Under drought condition, days to maturity was highest in BRRI dhan66 (155.15) and the lowest in Binadhan-19 (145.00) (Table 1). Drought stress lead to a significant increase in days to maturity among the varieties studied. The highest induction was observed in BRRI dhan57 (5.29%) whereas the lowest reduction was found in BRRI dhan56 (2.00%) (Table 2).

Table 1. Combined effect of varieties and treatment interaction on yield and yield related traits of rice

Varieties × Treatment		DM	PH	TT/P	ET/P	PL	FG/P	UG/P	100SW	GY/P	H_2O_2
G1	C	143.56def	92.83efg	13.00a	11.72a	22.35abc	1240.00a	666.67bc	2.07abc	25.62a	21.33gh
	D	150.82a-d	85.61hi	11.10abc	9.94abc	21.56bc	794.28e	891.44a	2.01cd	16.00e	23.40efg
G2	C	139.78f	91.83fgh	12.10ab	11.56a	23.56ab	1086.57b	251.94f	2.08ab	22.63bc	23.00fg
	D	145.00def	84.67i	10.70abc	9.72abc	22.46abc	725.33e	357.78ef	2.04bcd	14.80e	25.50e
G3	C	147.93a-e	95.22d-g	7.70cd	6.00de	23.00abc	974.78cd	436.48de	2.10ab	20.46cd	33.43c
	D	150.83a-d	89.56ghi	6.10d	5.04e	22.14abc	514.37g	755.00b	2.04bcd	10.51g	36.04b
G4	C	147.15c-f	100.05bcd	11.30abc	9.48abc	23.22abc	1026.89bcd	503.56d	2.12a	21.77bcd	31.42c
	D	154.93ab	97.00c-f	9.10a-d	7.77cd	22.48abc	615.11fg	940.11a	2.05bc	12.61fg	39.64a
G5	C	149.78a-d	105.67ab	13.00a	10.31ab	23.67a	950.11d	385.00e	2.09ab	19.89d	28.33d
	D	155.15a	101.33a-d	10.00a-d	8.89bc	22.90abc	614.00fg	641.67bc	1.98d	12.14g	36.71b
G6	C	141.33ef	107.00a	11.50abc	9.83a	22.17abc	1072.55bc	418.67de	2.12a	22.78b	21.17gh
	D	147.67b-e	101.67abc	10.00a-d	8.43ab	21.33c	773.67e	621.67c	2.00cd	15.51e	23.80ef
G7	C	147.37cde	98.89cde	10.00a-d	10.00abc	23.11abc	1001.74bcd	698.93bc	2.12a	21.24bcd	20.17h
	D	152.48abc	95.00d-g	8.30bcd	6.78bc	22.19abc	694.81ef	935.89a	2.07abc	14.38ef	22.83fg
Max.	C	149.78	107.00	13.00	11.72	23.67	1240.00	698.93	2.13	25.62	34.12
	D	155.15	101.67	11.10	9.94	22.90	794.28	940.11	2.07	16.00	40.12
Min.	C	139.78	91.83	7.67	6.00	22.17	950.11	251.94	2.07	19.89	19.50
	D	145.00	84.67	6.11	5.04	21.33	514.37	357.78	1.98	10.51	22.00
CV (%)		3.34	7.16	9.27	8.71	4.21	14.62	16.3	2.36	15.94	9.57

Note: C indicate control condition and D indicate drought condition.

Here, DM= Days to maturity, PH= Plant height (cm), TT/P= Total tillers/plant, ET/P= Effective tillers/plant, PL= Plant length (cm), FG/P= Filled grains/plant, UG/P= Unfilled grains/plant, 100SW= 100-seed weight (g), GY/P= Grain yield/plant (g). G1=Binadhan-17, G2=Binadhan-19, G3=BRRI dhan56, G4=BRRI dhan57, G5=BRRI dhan66, G6=BRRI dhan71 and G7=BRRI dhan83.

Table 2. Percent induction/reduction in yield and related traits due to the effect of drought stress among seven rice varieties

Varieties	DM	PH	TT/P	ET/P	PL	FG/P	UG/P	100SW	GY/P	H_2O_2
	+++	---	---	---	---	---	+++	---	---	+++
Binadhan-17	5.05	7.78	14.61	15.15	3.55	35.94	33.91	2.54	37.58	9.72
Binadhan-19	3.74	7.80	11.92	15.90	4.67	33.15	41.99	2.08	34.54	10.98
BRRI dhan56	2.00	5.95	19.91	16.25	3.75	47.25	73.00	2.65	48.65	7.88
BRRI dhan57	5.29	3.03	19.39	17.80	3.20	40.10	86.64	3.30	42.08	26.18
BRRI dhan66	3.59	4.09	22.64	13.83	3.25	35.43	67.01	5.57	39.01	29.62
BRRI dhan71	4.51	4.98	13.00	11.80	3.76	27.86	48.65	5.66	31.92	12.62
BRRI dhan83	3.47	3.94	16.38	12.08	3.99	30.64	33.88	2.36	32.28	13.42

Note: +++ indicate induction and --- indicate reduction.

Here, DM= Days to maturity, PH= Plant height, TT/P= Total tillers/plant, ET/P= Effective tillers/plant, PL= Plant length, FG/P= Filled grains/plant, UG/P= Unfilled grains/plant, 100SW= 100-seed weight, GY/P= Grain yield/plant.

Plant height (cm)

The study found a considerable variation in plant height. Plant height was the highest in BRRI dhan71 (107.00 cm) and the lowest in Binadhan-19 (91.83 cm) under control. Besides, the highest plant height was found in BRRI dhan71 (101.67 cm) and the lowest in Binadhan-19 (84.67 cm) under drought (Table 1). Exposure to drought stress resulted in a remarkable decrease in plant height and the highest decrease was observed in binadhan-19 (7.80%) whereas the lowest in BRRI dhan57 (3.03%) (Table 2).

T**otal tillers/plant**

The treatment effect showed significant variation in total tillers/plant among the varieties studied. number of total tillers/plant was noted maximum in BRRI dhan66 (13.00) and minimum in BRRI dhan56 (7.67) under control condition. Under drought, the highest total tillers/plant was exhibited in Binadhan-17 (11.10) and the lowest in BRRI dhan56 (6.11) (Table 1). Drought stress found to a significant decrease in total tillers/plant in all varieties; highest decrease was found in BRRI dhan66 (22.64%) and the lowest in Binadhan-19 (11.92%) (Table 2).

Effective tillers/plant

The treatment recorded significant variation in number of effective tillers/plant among the varieties. The highest effective tillers/plant was noted in Binadhan-17 (11.72) and the lowest was recorded in BRRI dhan56 (6.00) under control. In contrary, the highest effective tillers/plant was recorded in Binadhan-17 (9.94) and the lowest was in BRRI dhan56 (5.04) under stress (Table 1). Drought stress lead to significant reduction in effective tillers/plant among all of the varieties; the highest reduction was found in BRRI dhan57 (17.80%) and minimum in BRRI dhan71 (11.80%) (Table 2).

Panicle length

The treatment effect showed considerable variation in panicle length. The highest panicle length was found in BRRI dhan66 (23.67 cm) and the lowest in BRRI dhan71 (22.17 cm) under control. Besides, the maximum panicle length was observed in BRRI dhan66 (22.90 cm) and minimum was in BRRI dhan71 (21.33 cm) under drought (Table 1). Drought stress resulted in decrease in panicle length among all varieties; the highest reduction was found in Binadhan-19 (4.67%) and the lowest was in BRRI dhan57 (3.20%) (Table 2).

Filled grains /plant

In this study, the effect of treatment showed a significant variation in filled grains/plant among the varieties. The highest filled grains/plant were noted in Binadhan-17 (1200.00) and the lowest was in BRRI dhan66 (950.11) under control. In contrary, the highest filled grains/plant were recorded in Binadhan-17 (794.28) and the lowest was in BRRI dhan56 (514.37) under stress (Table 1). Drought stress lead to significant reduction in filled grains/plant among the varieties; the highest reduction was found in BRRI dhan56 (47.25%) followed minimum in BRRI dhan71 (27.86%) (Table 2).

Unfilled grains /plant

Drought treatment displayed significant impacts on unfilled grains/plant as compared to their control. The maximum unfilled grains/plant were observed in BRRI dhan83 (698.93) and the minimum in Binadhan-19 (251.94) under control. Under drought, the highest unfilled grains/plant were noted in BRRI dhan57 (940.11) whereas the lowest was in Binadhan-19 (357.18) (Table 1). Drought stress resulted in a significant increase in unfilled grains/plant, maximum decrease was recorded in BRRI dhan57 (86.64%) and minimum in BRRI dhan83 (33.88%) (Table 2).

100-seed weight

100-seed weight showed a remarkable variation in drought treatment. The highest 100-seed weight was recorded in BRRI dhan83 (2.13 g) and the lowest in Binadhan-17 (2.07 g) under control. The maximum 100-seed weight was found in BRRI dhan83 (2.07 g) and the minimum was in BRRI dhan66 (1.98 g) under drought (Table 1). Drought stress exhibited a significant decrease in 100-seed weight among the varieties studied compared to control. The highest reduction was observed in BRRI dhan71 (5.66%) and lowest in Binadhan-19 (2.08%) (Table 2).

Grain yield/plant

The effect of treatment exhibited significant variation in grain yield/plant among the varieties studied. Grain yield/plant was noted maximum in Binadhan-17 (25.62 g) and minimum in BRRI dhan66 (19.89 g) under control. Under drought, the highest grain yield/plant was exhibited in Binadhan-17 (16.00 g) and the lowest in BRRI dhan56 (10.51 g) (Table 1). Drought stress lead to a significant decrease in grain yield/plant in all varieties; highest decrease was found in BRRI dhan56 (48.65%) and the lowest in BRRI dhan71 (31.92%) (Table 2).

Hydrogen peroxide (H_2O_2)

H_2O_2 found a significant variation under drought. The highest H_2O_2 was recorded in BRRI dhan56 (34.12 nmol/g) and the lowest in BRRI dhan83 (19.50 nmol/g) under control. The maximum H_2O_2 was found in BRRI dhan57 (40.12 nmol/g) and the minimum was in BRRI dhan83 (22.00 nmol/g) under drought stress (Table 1). Drought stress lead to a significant decrease in H_2O_2 among the varieties studied in comparison with control. The highest induction was observed in BRRI dhan66 (29.62%) and minimum in BRRI dhan56 (7.88%) (Table 2).

The study revealed that the imposition of drought stress significantly reduced yield and yield related characters (Table 2). Tiwari et al. (2019) observed significant variation among varieties for days to maturity, effective tillers/plant, panicle length, and grain yield/plant. These results suggest that all the varieties under study had significant variation with each other, which is very much desirable to breeder for identification of high yielding varieties and also in crop improvement program to enhance the grain yield. The reduction in yield and yield contributing parameters due to drought stress was also found by Mau et al. 2019. The results also showed that drought stress increased H_2O_2 content in all the varieties tested, but the accumulations of H_2O_2 was lower in highly drought tolerant variety having high yield (Table 1). The lower accumulation of H_2O_2 in the drought tolerant varieties implies greater protection against Reactive oxygen species (ROS) and thus perform their signaling function perfectly (Shafiq et al., 2014). The yield contributing traits like filled grains/plant, panicle length, plant height, 100-seed weight, and grain yield/plant were significantly reduced by the imposition of drought stress whereas unfilled grains/plant were increased (Table 2). The reduction of yield attributing traits and yield due to drought were also mentioned by Gupta et al. (2020).

Estimation of correlation coefficient

The results indicated that grain yield/plant showed highly significant ($p<0.001$) positive correlation with total tillers/plant, effective tillers/plant, filled grains/plant and 100-seed weight. Besides, grain yield/plant was found strong negative correlated with days to maturity and unfilled grains/plant (Table 3). Days to maturity exhibited significant ($p<0.001$) positive correlation with H_2O_2 and unfilled grains/plant but strong negative correlation ($p<0.001$) with total tillers/plant, effective tillers/plant, filled grains/plant, 100-seed weight and grain yield/plant. Total tillers/plant showed highly positive significant ($p<0.001$) correlation with effective tillers/plant, filled grains/plant and grain yield/plant and showed significantly negative relationship with days to maturity ($p<0.01$) and unfilled grains/plant ($p<0.05$). Besides, filled grains/plant and grain yield/plant but showed highly negative association with days to maturity and H_2O_2.The results found that total tillers/plant, effective tillers/plant, filled grains/plant and 100-seed weight were the most important positive characters for yield of rice (Table 3). A similar positive correlation with grain yield/plant was reported by Gupta et al. (2017). The increased number of filled grains/plant contributes to higher grain yield. Furthermore, positive correlation of 100-seed weight with grain yield indicates the importance of individual grain weight for increased yields. However, unfilled grains/plant showed a significant positive correlation with H_2O_2, indicating ROS and H_2O_2 levels are the most important biochemical determinants of spikelet sterility (Sohag et al., 2020). Increased level of ROS and H_2O_2 might be responsible for grain fertility. A similar negative correlation with ROS and rice grain yield were reported by Verma et al. (2017).

Table 3. Phenotypic correlation coefficient among different yield and yield related traits of rice varieties

Traits	DM	PH	TT/P	ET/P	PL	FG/P	UG/P	100SW	GY/P
PH	-0.017								
TT/P	-0.419**	0.234							
ET/P	-0.523***	0.241	0.852***						
PL	-0.056	0.194	-0.013	-0.050					
FG/P	-0.707***	0.235	0.599***	0.604***	0.238				
UG/P	0.648***	-0.194	-0.353*	-0.288	-0.420*	-0.509***			
100SW	-0.465**	0.325*	0.150	0.127	0.303*	0.599***	-0.326**		
GY/P	-0.709***	0.257	0.579***	0.583***	0.253	0.997***	-0.512***	0.655***	
H_2O_2	0.601***	0.031	-0.424*	-0.685***	0.124	-0.585***	-0.179	-0.267	-0.573***

Note: *, ** and *** indicates significant at 5%, 1% and 0.1% level of probability, respectively.

Here, DM= Days to maturity, PH= Plant height (cm), TT/P= Total tillers/plant, ET/P= Effective tillers/plant, PL= Plant length (cm), FG/P= Filled grains/plant, UG/P= Unfilled grains/plant, 100SW= 100-seed weight (g), GY/P= Grain yield/plant (g).

Estimation of drought tolerance indices for yields in seven rice varieties obtained from yield/plant in a control and drought stress conditions

Different stress tolerance characteristics of rice varieties that were estimated from yields in normal and drought stress conditions are presented in Table 4. The highest stress susceptibility index (SSI) was recorded for the variety BRRI dhan56 (1.51) and the lowest in BRRI dhan71 (0.99). The highest stress tolerance (TOL) was observed in the variety BRRI dhan56 (9.95) whereas the lowest in BRRI dhan83 (6.85). The highest mean productivity (MP) was recorded in the variety Binadhan-17 (20.81) and the minimum in BRRI dhan56 (15.48). Maximum stress tolerance index (STI) was obtained in Binadhan-17 (0.91) whereas minimum in BRRI dhan56 (0.48). The geometric mean productivity (GMP) was the highest in Binadhan-17 (20.24) and the lowest in BRRI dhan66 (15.54). The highest yield index (YI) was obtained in Binadhan-17 (1.11) and the minimum in BRRI dhan56 (0.73). STI estimated from grain yield/plant were found to be effective in separating the susceptibility varieties in terms of yield. The results of this study are in good agreement with the earlier findings (Adhikari et al., 2019). From the stress tolerance indices, it is proved that Binadhan-19 and BRRI dhan83 was the superior drought tolerant varieties having high yield potential.

Table 4. Drought tolerance indices in rice varieties, estimated from yields obtained in a control and drought conditions

Varieties	SSI	TOL	MP	STI	GMP	YI
Binadhan-17	1.16	9.63	20.81	0.91	20.24	1.11
Binadhan-19	1.07	7.83	18.71	0.74	18.30	1.03
BRRI dhan56	1.51	9.95	15.48	0.48	14.66	0.73
BRRI dhan57	1.30	9.16	17.19	0.61	16.57	0.88
BRRI dhan66	1.21	7.75	16.01	0.54	15.54	0.84
BRRI dhan71	0.99	7.27	19.14	0.78	18.80	1.08
BRRI dhan83	1.00	6.85	17.81	0.68	17.48	1.00

Here, SSI=Stress Susceptibility Index, TOL= Stress Tolerance, MP=Mean Productivity, STI= Stress Tolerance Index, GMP= Geometric Mean Productivity and YI= Yield Index.

CONCLUSION

Drought in the field of agriculture is a major obstacle which detrimentally affects rice in terms of growth and productivity leading to low yield potential and food insecurity. The main focus of the study was to evaluate the best drought tolerant rice variety having high yield potential. The results revealed that variety Binadhan-17 was found the best performance in terms of yield under control and drought stress (25.62 g/plant, 16.00 g/plant, respectively). The results of stress tolerance indices (STI) stated that Binadhan-17 showed the best performance. Ranking of the studied drought tolerant rice varieties based on yield performance at the reproductive stage under stress were chronology sequenced as from higher to lower Binadhan-17 (16.00 g/plant) > BRRI dhan71 (15.51 g/plant) > Binadhan19 (14.80 g/plant) > BRRI dhan83 (14.38 g/plant) > BRRI dhan57 (12.61 g/plant) > BRRI dhan66 (12.14 g/plant) > BRRI dhan56 (10.51 g/plant) related to yield. In a nutshell, it could be disseminated as the best drought tolerant rice variety among the cultivated drought tolerant rice varieties in Bangladesh in terms of yield. However, further research under different drought prone areas is necessary to confirm these findings and may be tested in the drought areas of Bangladesh for evaluating their yield performance and getting higher production as well as more profit.

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