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EFFECTS OF IRRIGATION SCHEDULING ON GROWTH AND YIELD OF BORO RICE IN BANGLADESH

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Abstract

The field experiment was conducted at the field laboratory of the Department of Soil Science, Bangladesh Agricultural University (BAU), Mymensingh during *Boro* season (January 2015-May 2015) evaluating the growth and yield of 5 *Boro* rice varieties under two irrigation approaches. The experiment was laid out in a two factors Randomized Complete Block Design (RCBD). Factor 'A' represented five varieties, viz. V_1 (BRRI dhan28), V_2 (BRRI dhan29), V_3 (Binadhan-5), V_4 (BR14) and V_5 (BR58) and factor 'B' represented two irrigation approaches, viz. I_1 (application of irrigation at 8 days intervals), I_2 (application of irrigation at physiological stages. The experimental field consists of 30 plots to apply 10 treatments with 3 replications for each treatment. Recommended doses of all fertilizers were applied in each plot. Here, growth and yields of *Boro* rice were significantly (<.001) influenced by variety. Plant height (97.45cm), number of effective tillers hill^{-1} (14.50), number of non-effective tillers hill^{-1} (1.933), straw yield (6.403 t ha^{-1}) and biological yield (12.32 t ha^{-1}) were the highest in V_3 (Binadhan-5). The panicle length (23.10 cm), grain yield (7.06 t ha^{-1}) and dry root weight (1.58 t ha^{-1}) were highest in V_2 (BRRI dhan29). Number of filled grain panicle^{-1} (154.7), unfilled grain panicle^{-1} (29.57) and harvest index (60.45 t ha^{-1}) were highest in V_5 (BRRI dhan58). Thousand grain weight, grain yield and harvest index were significantly (<.001) influenced by irrigation approaches. Thousand grain weight, grain yield and harvest index were increased significantly under I_1 (application of irrigation at 8 days intervals) over I_2 (application of irrigation at physiological stages).

Key words: Effect; Growth; Irrigation; Schedule; Yield.

Introduction

Rice is the most important cereal crop as it provides more calories than any other cereals. Rice plants need adequate moisture throughout its life cycle. The soil and climatic conditions of Bangladesh are favorable for rice cultivation throughout the year, but the yield per unit of rice area at farmers' level is much lower than the potential yield. The average yield of rice is 3.876 t ha^{-1} (BBS, 2014) which is quite lower compared to that of many other countries like China (6.23 t/ha), Japan (6.79 t/ha), Korea (6.59 t/ha) and USA (7.04 t/ha), respectively (FAO, 2014). The reasons for low yield of rice mainly associates with the lacking in use of modern varieties, judicious management of fertilizers, irrigation and others intercultural operations. Among different management practices, irrigation plays the most important role for better crop yield. So, optimum supply of water is one of the most important factors in rice production. Most of the high yielding varieties of rice are grown under submerged condition. In tropical Asia, on average a total of 1245 mm of water is required for the complete growth cycle of rice. The total water can be split into 45 mm for seedling nursery, 200 mm for land preparation and 1000 mm for satisfying the need during the whole growing period (Sattar, 2004). Three rice growing seasons are distinctly appeared in Bangladesh namely,*Aus*,*Aman* and *Boro.* Among these three seasons, *Boro* rice covers the larger area and the production (4.731 t ha^{-1}) is also higher than other seasons (BBS 2014).

In Bangladesh *Boro* rice is generally cultivated under irrigated condition during the period from December to May due to scanty rainfall in the season. Bangladesh receives about 95% of the total annual rain water (203cm) during the months from April to October. This quantity of water can support safe yield of rice crops. But the rainfall distribution pattern is such that *Boro* rice suffers from long duration drought. So, water deficit occurs both at the vegetative and reproductive stages resulting in the reduction of number of effective tillers, panicle length, number of spikelet panicle^{-1} and percentage of filled spikelet (Das *et al* 2009).

It is necessary to apply irrigation for maximizing water use efficiency in a way to achieve economic yields thereby controlling excess leaching of nutrients from the soil root zone. In this situation, selection of suitable high yielding rice variety (HYV) and proper irrigation scheduling is necessary to minimize the production cost. With the above views in mind, the research work was conducted to achieve the following objectives:

1. To evaluate the yield performances of five *Boro* rice varieties (BRRI dhan28, BRRI dhan29. Binadhan-5, BR14 and BRRI dhan58).

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2. To assess the effects of irrigation scheduling suitable for growth and yield of different *Boro* rice varieties.
3. To observe the interaction effects of irrigation scheduling and varieties

Materials and methods

Experimental site and soil

The research was conducted at the field laboratory of the Department of Soil Science, Bangladesh Agricultural University (BAU), Mymensingh, with five selected *Boro* rice varieties viz. V_1 (BRRI dhan28), V_2 (BRRI dhan29), V_3 (Binadhan-5), V_4 (BR14) and V_5 (BRRI dhan58) under two irrigation approaches viz. I_1 (Application of irrigation on the basis of field data), I_2 (application of irrigation at physiological stages, i.e., early tillering, flowering, panicle initiation, milk and dough stages during the period from January to June, 2015). The experimental field was located at 24^0 N latitude and $90^0$150' E longitude at a height of 18 m above the mean sea level. The land was medium high in topography, belongs to the Sonatala Soil Series of Non-Calcareous Dark Grey Floodplain Soil under the Agro-ecological Zone 9; namely Old Brahmaputra Floodplain (UNDP and FAO, 1988). The climate of the experimental area was sub-tropical which was characterized by high temperature, high humidity and heavy rainfall with occasional gusty wind in the *Aman* season (July-December) and scanty of rainfall associated with moderately low temperature during the Rabi season (October-March).

The texture of the soil was silt loam with P^H value of 6.57. The organic matter content, total N, available P, exchangeable K and available S were, respectively, 1.29%, 0.11%, 11 ppm, 0.14 meq./100g of soil, and 10.41 ppm.

Experimental Treatments

- Treatment 1: Application of irrigation on the basis of field data (application of irrigation at 8 days intervals), I_1.
- Treatment 2: Application of irrigation at physiological stages, I_2.

Design and layout of the experiment

The experimental plot was laid out in a two factor Randomized Complete Block Design (RCBD). Factor 'A' represented variety, viz., V_1 (BRRI dhan28), V_2 (BRRI dhan29), V_3 (Binadhan-5), V_4 (BR14), V_5 (BRRI dhan58), and factor 'B' represents irrigation approaches i.e., I_1 (application of irrigation to rice field at 8 days intervals) and I_2 (application of irrigation at physiological stages). The experimental field was divided into 3 blocks. Each block was sub-divided into 10 unit plot. The total numbers of unit plot of the experiment were 30. The size of the unit plot was 4.0 m x 2.5 m = 10 m^2. Drains of 0.5 m width and 10 cm depth were made in blocks, keeping 0.5 m width between plots and 0.5 m width between blocks.

Application of fertilizers

Fertilizers such as Urea, TSP, MoP, Gypsum and Zinc Sulphate were used for sources of N, P, K, S and Zn, respectively. The full recommend doses of all fertilizers except urea were applied as basal dose to the individual plot during final land preparation. Urea was top dressed in three (3) equal splits at 15, 30 and 45 days after transplanting (DAT). The doses of Urea, TSP, MoP, Gypsum, and Zinc Sulphat were 75, 15, 45, 10 and 1.5, respectively.

Seedling transplanting, harvesting and data collection

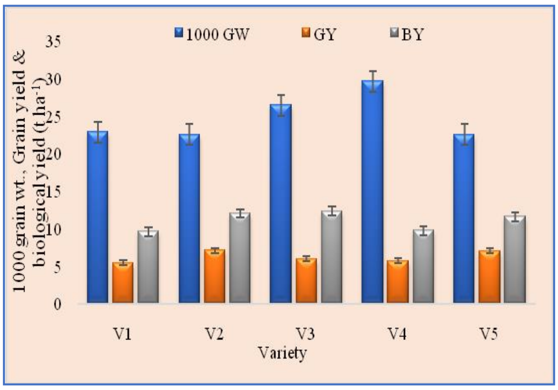
Thirty-seven day-old seedlings were transplanted on January 29, 2015.The spacing was 20 cm x 20 cm and three seedlings were transplanted in each hill. BRRI dhan28 and BR14 were harvested on May 4, 2015; BRRI dhan29 was harvested on May 12, 2015 and BRRI dhan58 and Binadhan-5 were harvested on May18, 2015. From each plot, 100g grain and straw samples were kept for taking dry weight. The grain (14% moisture basis) and straw (sun-dried basis) yields were converted to ton ha^{-1}.The yield and other parameters like plant height (cm),number of effective tillers $hill^{-1}$, non-effective tillers $hill^{-1}$, filled grains $panicle^{-1}$, Panicle length (cm), number of unfilled grains $panicle^{-1}$, thousand (1000) grain weight (g), grain yield (t ha^{-1}), straw yield (t ha^{-1}), biological yield (t ha^{-1}),dry root weight (t ha^{-1}), root-shoot ratio and harvest index (%) were recorded and analyzed. All the components were collected and recorded from five representative hills per plot.

Statistical analysis

The collected data were compiled and analyzed statistically using analysis of variance (ANOVA) technique with the help of a computer software, MSTAT and mean differences were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results

It was observed that growth and yields of *Boro* rice were significantly (<.001) influenced by variety. Plant height (97.45cm), number of effective tillers $hill^{-1}$ (14.50), number of non-effective tillers $hill^{-1}$ (1.933), straw yield (6.403 t ha^{-1}) and biological yield (12.32 t ha^{-1}) were highest in V_3 (Binadhan-5) (Figure 1, 2; Table 1). Panicle length (23.10 cm), grain yield (7.06 t ha^{-1}) and dry root weight (1.58 t ha^{-1}) were highest in V_2 (BRRI dhan29)(Table 1). Number of filled grain $panicle^{-1}$ (154.7), number of unfilled grain $panicle^{-1}$ (29.57) and harvest index (60.45 t ha^{-1}) were highest in V_5 (BRRI dhan58) (Table 1). On the other hand, plant height (78.77 cm), number of effective tillers $hill^{-1}$ (11.50) and straw yield (4.04 t ha^{-1}) were lowest in V_5 (BRRI dhan58)(Table 1).Number of non-effective tillers hill^{-1} (1.4), number of filled grain panicle^{-1}(124.1) and number of unfilled grain panicle^{-1}(14.27) were lowest in V_4 (BR14) whereas, the biological yield (9.57 t ha^{-1}) and grain yield (5.34 t ha^{-1}) were lowest in V_1 (BRRI dhan28)(Table 1). Variety performance considering overall physiological attributes may be arranged in the order of V_5 or $V_2>V_3>V_4>V_1$. Thousand grain weight, grain yield and harvest index were significantly (<.001) influenced by irrigation approaches. Thousand grain weight, grain yield and harvest index were increased significantly under I_1 (application of irrigation at 8 days intervals) over I_2 (application of irrigation at physiological stages)(Table 2). All the physiological attributes were also statistically influenced (<.005) by interaction effects of variety and irrigation approaches. The interaction between Binadhan-5 and Irrigation$_1$ showed the highest plant height (97.83 cm), number of effective tillers (15.47) hill^{-1} and biological yield (13.30 t ha^{-1}). Maximum number of filled grains panicle-1 was found for (BR 58*Irrigation$_2$). The highest panicle length (23.43cm) was found in (BRRI dhan29*Irrigation$_1$); and the highest grain yield (7.67 t ha^{-1}) and harvest index (63.11%) were recorded for (BR 58*Irrigation$_1$) (Table3). The tables and bar diagrams represent the descriptive statistics about the experimented results.



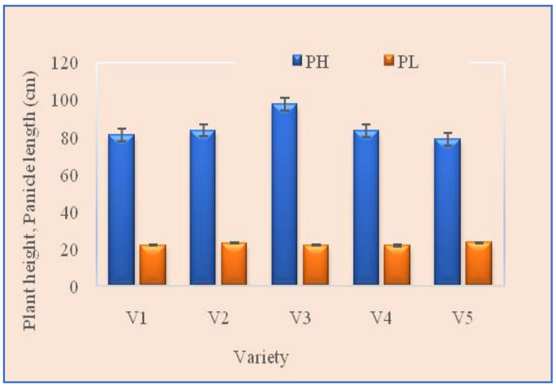


Figure 1: Effect of varieties on plant height (cm) and panicle length (cm)

Figure 2: Effect of varieties on 1000 grain weight (g), grain yield (t ha^{-1}) and biological yield (t ha^{-1})

Table 1: Effects of different *Boro* rice varieties on grain yield and yield attributing different morphological traits

Variety	PH (cm)	ETH	NETH	PL (cm)	FG	UFG	1000 GW (gm)	GY (t ha^{-1})	SY (t ha^{-1})	BY (t ha^{-1})	DRW (t ha^{-1})	RSR	HI (%)
V_1	80.97bc	11.63b	1.700ab	22.00c	130.3c	14.41b	22.81c	5.390d	4.188bc	9.578b	0.7717c	5.450a	56.48a
V_2	83.51b	12.57b	1.833a	23.10ab	142.3b	15.47b	22.48d	7.067a	4.923b	11.99a	1.585a	3.120c	58.97a
V_3	97.45a	14.50a	1.933a	22.05bc	127.5c	15.55b	26.38b	5.920b	6.403a	12.32a	1.215b	5.282a	48.02b
V_4	83.33b	10.83b	1.400c	21.82c	124.1c	14.27b	29.57a	5.672c	4.048c	9.720b	0.9967bc	4.178b	58.455a
V_5	78.77c	11.50b	1.533bc	23.32a	154.7a	18.15a	22.50d	6.997a	4.398bc	11.56a	1.028bc	4.648ab	60.45a
Maximum	97.45	14.50	1.933	23.32	154.7	18.15	29.57	7.067	6.403	12.32	1.585	5.450	60.45
Minimum	78.77	11.50	1.400	21.82	124.1	14.27	22.48	5.3390	4.048	9.578	0.7717	3.120	48.02
Mean	84.806	12.206	1.6798	22.158	135.78	15.57	24.748	6.2092	4.792	11.0336	1.11928	4.5356	56.474
Lsd (0.05)	2.565	1.759	0.2426	21.82	9.542	1.943	0.2870	0.1918	0.7268	0.7972	0.2544	0.7767	3.981
SE	0.8631	0.5922	0.08165	0.3695	3.212	0.6538	0.09661	0.06455	0.2446	0.2683	0.08563	0.2614	1.340
CV (%)	2.49	11.88	11.93	4.03	5.79	10.29	0.95	2.53	12.50	.95	18.80	14.12	5.81
$LSD_{(0.05)}$	**	**	**	**	**	**	**	**	**	**	**	**	**

Discussions

The different varieties showed variable results on different physiological attributes. For different parameters, such as plant height, the effects of varieties were found statistically significant at 1% level of probability. From this experiment, it was observed that variety, V_3 (Binadhan-5) was the tallest variety (97.45cm) and V_5 (BRRI dhan58) was the shortest variety (78.77 cm) among the selected five varieties (Figure 1). The effects of variety on plant height could be arranged in the order of $V_3>V_2>V_4>V_1>V_5$ (Table1). Variation in plant height of the varieties also indicated different genetic make-up of the varieties. The results of the experiment are in agreement with Hossain (2001).

Statistically, variation was also found in number of effective tillers hill^{-1} among different varieties. The effects of variety on number of effective tillers hill^{-1}could be arranged in the order of $V_3>V_2>V_1>V_5>V_4$. The highest number of non-effective tillers hill^{-1}were found in V_3 (1.933) and V_2 (1.83) and were statistically similar and sequence for rest of the treatments were in the order of $V_1>V_5>V_4$(Table1).

Effects of variety on panicle length were also significant at 1% level of probability. Highest panicle length was found in V_2 (BRRI dhan29) and lowest in V_4 (BR14). The results were also similar with BINA (1993) and Uddin (2004) which reported that panicle length was significantly influenced by variety (Figure 1). Sequence of the number of filled grains panicle^{-1}could be arranged in descending order as $V_5>V_2>V_1>$

V_3> V_4(Table1). BRRI (1994) reported that number of filled grains panicle^{-1}was found to vary among the cultivars due to varietal effects.

Effects of varieties on unfilled grain panicle^{-1}, 1000-grain weight, grain yields, straw yields, biological yields, dry root weight, root-shoot ratio and harvest index were statistically significant (1% level of probability) i.e. different varieties showed variation among the parameters due to variation in their genetic make-up. Varieties could be arranged in descending order considering the numbers of unfilled grains panicle^{-1} as$V_5>V_3>V_2>V_1>V_4$, 1000-grains weight as $V_4>V_3>V_1>V_5>V_2$, grain yields as $V_2>V_5>V_3>V_4>V_1$, straw yields as $V^3>V^2>V_5>V_1>V_4$, biological yields as $V_3>V_2>V_5>V_4>V_1$, dry root weight as $V_2>V_3>V_5>V_4>V_1$, root-shoot ratio as $V_1>V_3>V_5>V_4>V_2$ and harvest index as $V_5>V_2>V_4>V_1>V_3$ (Table1).

Considering all the parameters, it may be concluded that variety, V_5 (BRRI dhan58) showed better performance considering physiological attributes compared to other varieties. Variety, V_1(BRRI dhan28) showed inferior performance that could be arranged in the order of $V_5>V_2>V_3>V_4>V_1$(Table 1).

Statistical variation (5% level of probability) was found in grain yield obtained under two different irrigation approaches. Grain yield significantly increased under irrigation approaches, I_1(application of irrigation at 8 days intervals) and I_2 (application of irrigation at physiological stages) (Figure 3, Table2).

Table 2: Effects of irrigation approaches on grain yield and yield attributing different morphological traits of rice plants

Variety	PH (cm)	ETH	NETH	PL (cm)	FG	UFG	1000 GW (gm)	GY (t ha^{-1})	SY (t ha^{-1})	BY (t ha^{-1})	DRW (t ha^{-1})	RSR	HI (%)
I_1	84.73	12.31	1.747	22.56	134.7	15.45	25.10a	6.693a	4.809a	11.50a	1.105	4.537	58.57a
I_2	84.88	12.11	1.613	22.35	136.8	15.69	24.39b	5.725b	4.775a	10.57b	1.134	4.535	54.38b
Maximum	84.88	12.31	1.747	22.56	136.8	15.69	25.10	6.693	4.809	11.50	1.134	4.537	58.57
Minimum	84.73	12.11	1.613	22.35	134.7	15.45	24.39	5.725	4.775	10.57	1.105	4.535	54.38
Mean	84.805	12.21	1.68	22.455	135.75	15.57	24.745	6.209	4.792	11.035	1.1195	4.536	56.475
Lsd (0.05)	1.622	1.113	0.1534	0.6943	6.035	1.229	0.1815	0.1213	0.4596	0.5042	0.1609	0.4912	2.518
SE	0.5459	0.3745	0.05164	0.2337	2.031	0.4135	0.06110	0.04082	0.1547	0.1697	0.05416	0.1653	0.8475
CV (%)	2.49	11.88	11.93	4.03	5.79	10.29	0.95	2.53	12.50	.95	18.80	14.12	5.81
$LSD_{(0.05)}$	NS	NS	NS	NS	NS	NS	**	**	NS	**	NS	NS	**

Similar findings were observed by Spanu, *el al.* (2004) who indicated that grain yields were satisfactory both in quantity and quality under irrigated condition.

Interaction effects of varieties and irrigation approaches also showed significant effects on grain yield. Varieties interacted with irrigation approaches, I_1 (application of irrigation at 8 days intervals) obtain more grain yields over the varieties interacted with the irrigation approaches, I_2 (application of irrigation at physiological stages).

Statistically variations (5% level of probability) were found in straw yield, biological yield, dry root weight, root-shoot ratio and harvest index with respect to the two irrigation approaches (Table2). All these parameters increased significantly under I_1 (application of irrigation at 8 days intervals) over I_2 (application of irrigation at physiological stages).

Interactions of varieties with I_1 (application of irrigation at 8 days intervals) produced more root-shoot over those with I_2 (application of irrigation at physiological stages). Straw yield, biological yield, dry root weight and harvest index also showed statistical variations (5% level of probability) off the interactions between variety and irrigation approaches (Table 2).However, there was also statistical variation (5% level of probability) of the effects of irrigation approaches on plant height, numbers of effective tillers hill^{-1}, numbers of non-effective tillers hill^{-1}, panicle length, number of filled grains panicle^{-1}, number of unfilled grains panicle^{-1}, straw yield, dry root weight and root-shoot ratio. Interaction effects of variety and irrigation approaches showed similar results.

The highest plant height (97.83cm), No. of effective tillers (15.47) hill^{-1}& Biological yield(13.30 t ha^{-1}) were found in V3*I1; maximum panicle length (23.43cm), 1000 grains wt.(30.36g), grain yield (7.67 t ha^{-1}) and harvest index (63.11%) were found in V3*I1, V2*I1, V4*I1 and v5*I1, respectively (Figure 3).

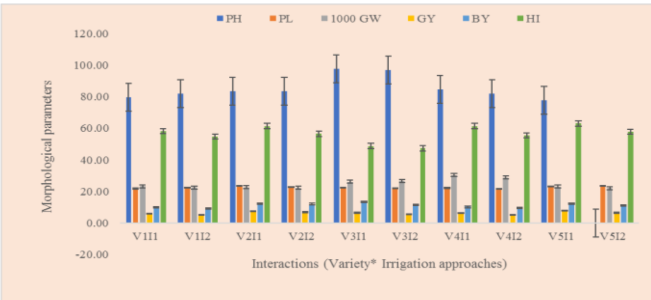


Figure 3: Effect of interactions between varieties and irrigation approaches on grain yield (t ha^{-1}) and yield attributing characters of rice plants

Finally, it may be concluded that, V_5 (BR 58) and V_2 (BRRI dhan 29) were more suitable among the selected 5 varieties of the study. As per the objective, maximizing crop yield with minimizing irrigation cost, the 'application of irrigation at 8 days intervals' was found more suitable than 'stage wise irrigation' for *Boro* rice cultivation.

Table 3: Effects interactions between rice varieties and irrigation approaches on grain yield and yield attributed traits of rice

Interaction	PH (cm)	ETH	NETH	PL (cm)	FG	UFG	1000 GW (gm)	GY (t ha^{-1})	SY (t ha^{-1})	BY (t ha^{-1})	DRW (t ha^{-1})	RSR	HI (%)
V_1I_1	79.83cd	11.73bc	1.800ab	21.73ab	127.83d	14.63b	23.28e	5.743f	4.173cd	9.917cd	0.7300d	5.730a	58.20abc
V_1I_2	82.10bc	11.53bc	1.600bc	22.27ab	132.7cde	14.19b	22.34gh	5.037h	4.203cd	9.240d	0.8133cd	5.170a	54.76c
V_2I_1	83.55bc	12.60bc	2.000a	23.43a	144.5bc	15.73b	22.68fg	7.390b	4.647cd	12.04b	1.480ab	3.143c	61.42ab
V_2I_2	83.47bc	12.53bc	1.667abc	22.77ab	140.0bcd	15.20b	22.28gh	6.743c	5.200bc	11.94b	1.690a	3.097c	56.51bc
V_3I_1	97.83a	15.47a	2.000a	22.27ab	124.9e	15.60b	26.14d	6.480cd	6.823a	13.30a	1.257b	5.430a	48.72d
V_3I_2	97.07a	13.53ab	1.867ab	21.83ab	130.0cde	15.50b	26.63c	5.360g	5.983ab	11.34b	1.173bc	5.133a	47.32d
V_4I_1	84.70b	9.800c	1.400c	22.13ab	127.7de	14.10b	30.36a	6.180e	3.910d	10.09cd	0.8433cd	4.630ab	61.40ab
V_4I_2	81.97bc	11.87bc	1.400c	21.50b	120.5e	14.43b	28.77b	5.163gh	4.187cd	9.350d	1.150bc	3.727bc	55.50bc
V_5I_1	77.73d	11.93bc	1.533bc	23.23ab	148.5ab	17.20ab	23.03ef	7.670a	4.493cd	12.16b	1.213bc	3.750bc	63.11a
V_5I_2	79.80cd	11.07bc	1.533bc	23.40a	160.9a	19.10a	21.96h	6.323de	4.303cd	10.96bc	0.8433cd	5.54a	57.79abc
Maximum	97.83	15.47	2.000	23.43	160.9	19.10	30.36	7.670	6.823	13.30	1.690	5.730	63.11
Minimum	79.83	9.800	1.400	21.50	120.5	14.10	21.96	5.037	3.910	9.24	0.7300	3.097	47.32
Mean	84.805	12.206	1.68	22.456	135.753	15.568	24.747	6.2089	4.7922	11.03	1.11929	4.535	56.473
Lsd (0.05)	3.627	2.488	0.3431	1.552	13.49	2.747	0.4059	0.2712	1.028	1.127	0.3598	1.098	5.631
SE	1.221	0.8375	0.1155	0.5225	4.542	0.9247	0.1366	0.09129	0.3459	0.3795	0.1211	0.3697	1.895
CV (%)	2.49	11.88	11.93	4.03	5.79	10.29	0.95	2.53	12.50	.95	18.80	14.12	5.81
$LSD_{(0.05)}$	**	*	*	*	**	*	**	**	*	**	*	*	**

N.B. V_1= BRRI dhan 28, V_2= BRRI dhan 29, V_3= Binadhan-5, V_4= BR 14), V_5= BR 58, I_1= Application of irrigation at 8 days intervals, I_2= Application of irrigation at physiological stage, PH= Plant height, ETH= No. of effective tillers $hill^{-1}$, NETH= No. of non-effective tillers $hill^{-1}$, PL= Panicle length, FG= No. of filled grains, UFG= No. of unfilled grains, 1000 GW= 1000 grains wt., GY= Grain yield(t/ha), SY= Straw yield, BY= Biological yield(t/ha), DRW= Dry root wt., RSR=Root-shoot ratio, HI= Harvest Index

**= Significant at 1% level of probability, * = Significant at 5% level of probability, NS= Non-significant, CV= Co-efficient of variation, SE = Standard Error

The figures in a column with common letters do not differ significantly but dissimilar letters differ significantly by 5% level DMRT level.

Conclusions

From the results and discussion, it may be concluded that-

1. Growth and yield of different of Boro rice varied significantly among the varieties studied. Considering the yield performance, BRRI dhan28 and BRRI dhan58 appeared to be superior varieties and BRRI dhan28, inferior variety.
2. Growth and yields of different varieties of Boro rice increased significantly with application of irrigation at 8 days intervals.
3. Some yield contributing attributes, specially, grain yield was significantly influenced by interaction effects of variety and irrigation approaches. Variety performed better when interacted with irrigation approaches based on field data (application of irrigation at 8 days intervals).

Conflict of Interests

All the authors have no conflict of interests about the results of this research works.

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