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GROWTH AND YIELD PERFORMANCE OF *AUS* RICE UNDER AGRONOMIC MANAGEMENTS

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Abstract

The experiment was conducted at the experimental field of Sher-e-Bangla Agricultural University, Dhaka during the period from March to June, 2018 to study the effects of agronomic managements on growth and yield of *Aus* rice. The experiment comprised of split –plot design where varieties in the main plots viz., i) BRRI dhan65 (V_1) and ii) Nerica (V_2) and five agronomic managements in the sub-plots viz., i) No management-M_0, ii) No weeding, but all other managements-M_1, iii) No fertilizer application, but all other managements-M_2, iv) No irrigation application, but all other managements-M_3 and v) Recommended management-M_4, respectively. Almost all the studied characters were found statistically significant due to variation in treatments. Significant variation was recorded different yield contributing characters and yield of *Aus* rice. At 30, 50, 70 DAS and harvest, the taller plant (24.61 cm, 41.27 cm, 60.23 cm and 80.28 cm, respectively), grain yield (0.96 t ha^{-1}) and straw yields (2.75 t ha^{-1}) were recorded from V_2 compared to that of V_1. Similarly, the tallest plant (27.11 cm, 49.66 cm, 71.49 cm and 91.07 cm at 30, 50, 70 DAS and harvest, respectively), grain yield (2.34 t ha^{-1}) and straw yield (5.30 t ha^{-1}) were observed from M_4. In respect of interaction, the highest grain yield (2.43 t ha^{-1}) and straw yield (5.31 t ha^{-1}) were observed from V_1M_4 (BRRI dhan65 with recommended management), while the lowest grain yield (0.12 t ha^{-1}) from V_1M_0 (BRRI dhan65 with no management) and straw yield (0.85 t ha^{-1}) from V_2M_0 (Nerica with no management). Irrespective of variety with no management reduced 94-95% grain yield of *Aus* rice that was 84-89% for no weeding and no fertilizer application.

Introduction

Rice (*Oryza sativa* L.) is the most important food in tropical and subtropical regions (Singh *et al.*, 2012). It is the staple food of more than three billion people in the world, most of who live in Asia (IRRI, 2009). It is the driving force of Bangladesh agriculture covers about two-thirds of the cultivated land and constitutes 90% of the food grain production in Bangladesh (BBS, 2020). In Bangladesh, the geographical, climatic and edaphic conditions are favorable for year-round rice cultivation. Rice yields are either decelerating/stagnating/declining in post green revolution era mainly due to imbalance in fertilizer use, soil degradation, irrigation and weeding schedule, type of cropping system practiced lack of suitable rice genotypes/variety for low moisture adaptability and disease resistance (Prakash, 2010). The average yield of rice in Bangladesh is about 3.07 t ha^{-1} (BBS, 2018).

Appropriate agronomic management practices greatly influence the growth and yield of rice. Yield loss is occurred due to improper weeds, nutrient management and irrigation schedule. Therefore, these managements are a complete package for satisfactory any crop production specially rice production in Bangladesh. Weed free condition during the critical period of competition, recommendation doses of fertilizer application and appropriate amount of water are essential for obtaining optimum rice yield. Subsistence farmers in Bangladesh spend more time and energy on control of weeds; do not give proper dose of fertilizer and optimum amount of water for rice cultivation. Thus, the appropriate agronomic management practices need to be adopted by the farmers for maximizing rice yield. The present research work was, therefore, undertaken to find out the effect of agronomic management on growth and yield of aus rice.

Materials and Methods

The experiment was conducted at experimental field of Sher-e-Bangla Agricultural University (23°77′N latitude and 90°33′E longitude) which belongs to the Agro-ecological zone of The Modhupur Tract, AEZ-28 (Anonymous, 1988). The soil of the experimental field classified as Deep Red Brown Terrace Soils in Bangladesh soil classification system (UNDP and FAO, 1988). Split -plot design with three replications was followed where variety in the main plots and agronomic managements in the sub-plots. There were 10 plots of size 5.0 m × 2.0 m in each of 3 replications. There were two rice varieties viz. Nerica (V_1) and BRRI dhan65 (V_2) and five agronomic managements viz. (No management-M_0, no weeding, but all other managements-M_1, no fertilizer application, but all other managements-M_2, no irrigation application, but all other managements-M_3, and recommended management-M_4.

Seeds were sown in line in main plot after good tilt of land. The experimental area was fertilized with 120, 100, 80, 60 and 10 kg ha^{-1} of N, P_2O_5, K_2O, S and Zn. The entire amount of TSP, MoP, Gypsum and Zinc sulphate were applied during the final preparation of land. Half of Urea was applied during final land preparation and rest half applied two equal installments at 30 DAS and 45 DAS.

Plant height, number of tillers $hill^{-1}$ and number of leaves $hill^{-1}$ were calculated from randomly pre-selected 5 hills $plot^{-1}$. Dry matter was recorded from the mean oven dry weight of plants from 2 hills $plot^{-1}$. Filled grains $panicle^{-1}$ and unfilled grains $panicle^{-1}$ were counted from the average number of grains from ten panicles.1000-grain weight was measured at 12% moisture content. Grain yield and straw yield were determined and biological yield was calculated by summing up the grain and straw yield. Harvest index refers to the ratio of economic yield to biological yield and was computed with following formula (Gardner *et al.,* 1985). All the data collected on different parameters were statistically analyzed by technique using MSTATC computer package program and the mean differences were calculated using least significant difference (LSD) test at 5 % level of probability.

Results and Discussion

Effect of variety

Plant height, number of leaves $hill^{-1}$, dry matter weight $hill^{-1}$ and length of panicle varied significantly and number of effective tillers $hill^{-1}$ and number of non-effective tillers $hill^{-1}$ statistically identical a (Table 1). The higher plant height (80.28 cm) and panicle length (19.84

cm) was obtained from Nerica whereas, the higher value of dry matter content hill^{-1} (8.78 g), number of effective tillers hill^{-1} (5.24) and number of non-effective tillers hill^{-1} (1.72) was found from the BRRI dhan65. Due to genetic makeup of different varieties, plant height among the varieties might be varied (Murshida *et al.*, 2017). Amin *et al.* (2006) revealed that the variation of dry matter among rice varieties.

Number of filled grains panicle^{-1} and number of total grains panicle^{-1} varied significantly where number of unfilled grains panicle^{-1}, weight of 1000-grain, grain yield, straw yield and biological yield varied numerically for BRRI dhan65 and Nerica (Table 2). Rice var. Nerica produced better in all aspect of the yield and yield contributing characters viz. the number of filled grains panicle^{-1} (49.09), number of unfilled grains panicle^{-1} (27.25), weight of 1000-grain (22.51g), grain yield (0.96 t ha^{-1}), straw yield (2.75 t ha^{-1}), biological yield (3.71 t ha^{-1}) and harvest index (21.52%) compared to BRRI dhan65.

Effect of agronomic management

Different agronomic managements showed significant differences on plant height, number of leaves hill^{-1}, dry matter weight hill^{-1}, number of effective tillers hill^{-1}, and panicle length except number of non-effective tillers hill^{-1} (Table 1). Both recommended management (M_4) and no irrigation but all other managements (M_3) gave the highest plant (91.07 cm), dry matter content hill^{-1} (14.12 g) and panicle length (21.91 cm) and number of leaves hill^{-1} (61.13), number of effective tillers hill^{-1} (8.50) and non-effective tillers hill^{-1} (2.33) was found from recommended management (M_4) individually. On the other hand, no management (M_0) produced lowest in all growth parameters which are similar to no weeding.

Table 1. Effect of variety and agronomic management on growth parameters of *Aus* rice

Treatments	Plant height (cm)	Number of leaves hill^{-1}	Dry matter weight hill^{-1} (g)	Number of effective tillers hill^{-1}	Number of non-effective tillers hill^{-1}	Panicle length (cm)
V_1	71.80b	44.63a	8.78a	5.24	1.72	17.53b
V_2	80.28a	34.80b	8.31b	4.92	1.71	19.84a
SE (±)	0.99	1.98	0.99	NS	NS	0.35
CV (%)	11.43	13.63	12.11	28.63	26.15	5.13
M_0	60.31d	24.20d	4.55b	3.00c	1.00	15.41c
M_1	75.72b	38.30c	7.87b	3.50c	1.83	17.99b
M_2	66.77c	26.77d	5.39b	3.33c	1.83	17.57b
M_3	86.38a	48.17b	11.78a	7.00b	1.50	20.57a
M_4	91.07a	61.13a	14.12a	8.50a	2.33	21.91a
SE (±)	1.78	1.48	0.81	0.65	NS	0.73
CV (%)	14.52	9.14	13.21	21.55	27.83	6.72

BRRI dhan65 (V_1), Nerica (V_2), No management -M_0, No weeding but all other managements-M_1, No fertilizer application but all other managements-M_2, No irrigation but all other managements-M_3, Recommended management-M_4, Not significant –NS

Means with dissimilar letters are significantly different at $P \leq 0.05$ at LSD test.

Different agronomic managements showed significant differences on yield and yield contributing characters (Table 2). Recommended management (M_4) gave highest value in attributes of yield and yield contributing characters, whereas no irrigation but all other managements (M_3)

performed highest in number of unfilled grains panicle^{-1}, and harvest index. Lowest performance was obtained from no management (M_0) and no weeding but all other managements (M_1) in all parameters except in number of unfilled grains panicle^{-1} and weight of 1000- grains for M_1. No management reduced 94% grain yield of *aus* rice that followed by 87% for no weeding and 86% for no fertilizer application. Without irrigation reduced 32% yield that might be due to the contribution of rainfall during the growing period. Singh *et al.* (1999) reported that no weed management until maturity removed significantly higher amount of nitrogen through weeds (12.97 kg ha^{-1}) and reduced the grain yield of rice by 49% compared to that of weed free crop up to 60 DAT.

Table 2. Effect of variety and agronomic management on yield and yield contributing characters of *Aus* rice

Treatments	Number of filled grains panicle^{-1}	Number of unfilled grains panicle^{-1}	Weight of 1000-grains (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Variety							
V_1	36.58b	23.71	22.02	0.95	2.67	3.63	19.45
V_2	49.09a	27.25	22.51	0.96	2.75	3.71	21.52
SE (±)	2.26	NS	NS	NS	NS	NS	NS
CV (%)	14.46	13.73	6.71	24.59	3.21	5.11	24.70
Agronomic Management							
M_0	26.33c	19.33b	20.36c	0.14c	0.94c	1.08c	12.97c
M_1	27.83c	29.67a	21.96b	0.31c	1.45c	1.77c	12.90c
M_2	33.33c	19.67b	22.31b	0.33c	1.98c	2.29c	17.51b
M_3	55.33b	29.17a	23.11ab	1.62b	3.87b	5.48b	28.53a
M_4	71.67a	29.67a	23.56a	2.39a	5.30a	7.70a	30.51a
SE (±)	6.20	3.10	0.51	0.24	0.37	0.58	1.37
CV (%)	25.03	21.28	3.99	22. 08	18.32	17.24	11.61

BRRI dhan65 (V_1), Nerica (V_2), No management -M_0, No weeding but all other managements-M_1, No fertilizer application but all other managements-M_2, No irrigation but all other managements-M_3, Recommended management-M_4,

Means with dissimilar letters are significantly different at $P \leq 0.05$ at LSD test.

Interaction effect

Interaction effect of variety and agronomic managements showed significant differences on all growth characters (Table 3). The tallest plant (94.48 cm) and panicle length (22.61 cm) were observed from the Nerica with recommended management which are 50.61% and 37.44% higher than no management of same variety. The highest number of leaves hill^{-1} (70.40), dry matter content hill^{-1} (14.48 g), number of effective tillers hill^{-1} (9.33) and number of non-effective tillers hill^{-1} (2.67) showed 60.41, 71.75, 71.38 50.19 and 65.72%, respectively lower performance observed from BRRI dhan65 with recommended management than no management.No weeding, but all management also reduced 41.66, 55.73, 64.31, 37.45 and 57.16%, respectively lower performance of same parameters. Suresh kumar *et al.* (2016) reviewed that weed flora under transplanted condition is very much diverse and consists of grasses, sedges and broad-leaved weeds causing yield reduction of rice crop up to 76 %.

Table 3. Interaction effect of variety and agronomic management on growth parameters of Aus rice at harvest

Treatments	Plant height (cm)	Number of leaves hill^{-1}	Dry matter weight hill^{-1}	Number of effective tillers hill^{-1}	Number of non-effective tillers hill^{-1}	Panicle length (cm)
V_1M_0	57.88f	27.87e	4.09e	2.67d	1.33bc	14.36e
V_1M_1	70.37d	41.07c	6.41cd	3.33d	1.67a-c	16.50d
V_1M_2	61.11ef	30.40e	4.41de	3.00d	2.00ab	16.31d
V_1M_3	82.03c	53.40b	11.46ab	7.67b	1.00bc	19.29c
V_1M_4	87.66b	70.40a	14.48a	9.33a	2.67a	21.20b
V_2M_0	62.73e	20.53f	5.02de	3.33d	0.67c	16.45d
V_2M_1	81.07c	35.53d	7.33c	3.67d	2.00ab	19.47c
V_2M_2	72.42d	23.13f	6.39cd	3.67d	1.67a-c	18.83c
V_2M_3	90.73ab	42.93c	10.81b	6.33c	2.00ab	21.84ab
V_2M_4	94.48a	51.87b	13.76ab	7.67b	2.00ab	22.61a
SE (±)	2.543	2.09	1.14	0.63	0.57	0.73
CV (%)	5.79	9.14	25.64	21.55	57.83	6.72

BRRI dhan65 (V_1), Nerica (V_2), No management -M_0, No weeding but all other managements-M_1, No fertilizer application but all other managements-M_2, No irrigation but all other managements-M_3, Recommended management-M_4, Means with dissimilar letters are significantly different at $P \leq 0.05$ at LSD test.

Interaction effect of variety and agronomic managements showed significant differences on yield and yield contributing characters (Table 4). The highest number of filled grains panicle^{-1}, weight of 1000- grain, grain yield, straw yield, biological yield and harvest index were observed from the recommended management both the varieties except in number of unfilled grains panicle^{-1} for Nerica and weight of 1000 - grain for BRRI dhan65. The lowest performance gave BRRI dhan65 with no management combination. Nerica with no management reduced number of filled grains panicle^{-1} (56.25%), grain yield (93.64%), straw yield (83.75%) and biological yield (86.81%) and no weeding, but all management also reduced 58.93, 32.80, 83.90, 54.50 and 63.84%, respectively from recommended management. Jayadeva *et al.* (2009) and Subha and Ramana (2009) found that hand weeding at 20 and 40 DAT recorded highest plant height, dry matter production, tillers m^{-2}, nutrient uptake by crop and highest grain and straw yield of rice crop.

Table 4. Interaction effect of variety and agronomic management on yield and yield contributing characters of *Aus* rice

Treatments	Number of filled grains panicle^{-1}	Number of unfilled grains panicle^{-1}	Weight of 1000-grains (g)	Grain yield (tha^{-1})	Straw yield (tha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
V_1M_0	20.00e	17.00ef	20.78e	0.12c	1.03de	1.15d	10.74f
V_1M_1	25.00de	22.33de	21.62d	0.23c	1.58d	1.82cd	12.28ef
V_1M_2	22.00de	16.33f	22.19cd	0.27c	1.32de	1.59d	15.82d
V_1M_3	47.67c	29.67bc	22.59c	1.70b	4.12b	5.82b	28.06b
V_1M_4	68.67ab	33.33ab	22.89bc	2.43a	5.31a	7.74a	30.38ab
V_2M_0	32.67d	21.67d-f	19.95e	0.15c	0.85e	1.01d	15.19d
V_2M_1	30.67de	37.00a	22.30cd	0.38c	2.38c	2.77c	13.53de
V_2M_2	44.67c	23.00d	22.42cd	0.38c	1.58d	1.96d	19.20c
V_2M_3	63.00b	28.67bc	23.63ab	1.53b	3.62b	5.15b	29.01ab
V_2M_4	74.67a	26.00cd	24.22a	2.36a	5.23a	7.66a	30.65a
SE (±)	4.20	3.13	0.51	0.237	0.365	0.576	1.373
CV (%)	20.03	16.28	3.99	22. 08	18.32	17.24	11.61

BRRI dhan65 (V_1), Nerica (V_2), No management -M_0, No weeding but all other managements-M_1, No fertilizer application but all other managements-M_2, No irrigation but all other managements-M_3, Recommended management-M_4, Means with dissimilar letters are significantly different at $P \leq 0.05$ at LSD test.

Conclusion

Considering the above results, it may be concluded that agronomic management had significant role in the grain yield of rice. Among the treatments, variety with recommended agronomic management (Var. BRRI dhan66 with recommended practices) gave comparable higher grain yield closely followed by var. Nerica with same management. However, further experimentation will need to be executed in different agro-ecological zones with more varieties of aus rice under agronomic management to reach a specific conclusion and recommendation.

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