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INFLUENCE OF DIFFERENT DOSES OF BORON AND MAGNESIUM ON THE GROWTH AND YIELD OF BORO RICE CULTIVARS

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Abstract: **The experiment conducted at the Agronomy Field Laboratory, University of Rajshahi, from January to June 2022, investigated the effects of different doses of boron and magnesium on the growth and yield of boro rice. The study included two rice varieties (BRRI dhan29 and BRRI dhan58) and three treatment levels: control (only recommended NPK), low rate of boron and magnesium (8 kg/ha and 15 kg/ha), and high rate of boron and magnesium (15 kg/ha and 24 kg/ha), arranged in a Randomized Complete Block Design. Results showed that BRRI dhan58 outperformed BRRI dhan29 across various growth parameters. BRRI dhan58 recorded the highest values for plant height (89.95 cm), total tillers per hill (17.29), effective tillers per hill (12.48), chlorophyll content (SPAD 46.08), panicle length (20.20 cm), total grains per panicle (164.11), effective grains per panicle (128.67), 1000-grains weight (23.10 g), grain yield (6.27 t/ha), straw yield (7.88 t/ha), and biological yield (14.15 t/ha).Among the treatments, the highest values for similar parameters were observed in the high rate of boron and magnesium treatment (T_3). For interaction effects, the combination of BRRI dhan58 and high rate of boron and magnesium (V_2T_3) yielded the best results, including highest plant height (93.54 cm), total tillers per hill (18.11), effective tillers per hill (13.67), chlorophyll content (SPAD 48.45), panicle length (20.65 cm), total grains per panicle (175.11), effective grains per panicle (142.45), 1000-grains weight (23.47 g), grain yield (6.56 t/ha), straw yield (8.24 t/ha), and biological yield (14.79 t/ha).The study concluded that BRRI dhan58, combined with the high rate of boron and magnesium, is the most effective for maximizing yield, recommending this combination for farmers.**

Keywords: **Boro rice, Boron and magnesium, chlorophyll content, Rice yield.**

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1. INTRODUCTION

Rice (Oryza sativa L.) is the most important food crop and a primary food source for more than one-third of world's population (Sarkar et al., 2017). Worldwide, rice provides 27% of dietary energy supply and 20% dietary protein (Kueneman, 2006). It constitutes 95% of the cereal consumed and supplies more than 80% of the calories and about 50% of the protein in the diet of the general people of Bangladesh (Yusuf, 1997). World's rice demand is projected to increase by 25% from 2001 to 2025 to keep pace with population growth (Maclean et al., 2002), and therefore, meeting this ever increasing rice demand in a sustainable way with shrinking natural resources is a great challenge. There are three distinct growing seasons of rice in Bangladesh, according to changes in seasonal conditions such as Aus, Aman and Boro. More than half of the total production (55.50 %) is obtained in Boro season occurring in December–May, second largest production in Aman season (37.90 %) occurring in July-November and little contribution from Aus season (6.60 %) occurring in April-June (APCAS, 2016). Among three growing seasons (Aus, Aman and Boro) boro rice is the most important rice crops for Bangladesh with respect to its high yield and contribution to rice production. Farmers of Bangladesh apply N, P, K and S fertilizers widely and application of micronutrients, such as, Zn, Cu, Mn and B is not a usual practice. Soils inadequate in their supply of micronutrients are alarmingly far reaching across the globe because of intensive cropping, loss of fertile topsoil and losses of nutrients through leaching (Somani, 2008). When micronutrients are in short supply, the growth and yield of crops are severely depressed (IPNI, 2014). Hence, application of nutrients particularly micronutrient are of critical importance for sustaining high productivity of rice in Bangladesh.Boron has been associated with one or more of the following processes: calcium utilization, cell division, flowering/reproductive phase, water relations, disease resistance, and nitrogen (N) metabolism (Ahmad et al. 2009). Boron deficiency in rice induces panicle sterility due to poor pollen and anther development and failed pollen germination and alters cell wall pectin in pollen tubes (Yang et al. 1999) which reduces the number of grains per panicle and, therefore, grain yield (Gowri, 2005). Moreover, B deficiency in rice not only reduces paddy yield but also damages grain quality (Rashid et al. 2007). Magnesium (Mg) is the fourth most abundant nutrient element after nitrogen (N), phosphorus (P), and potassium (K), has irreplaceable effects on the crop physiology and plays key roles in plant defense mechanisms to abiotic stress (Senbayram et al., 2015). Mg is the main component of chlorophyll and has a high impact on photosynthesis, enzyme activation, and the formation and utilization of ATP. Furthermore, Mg plays an essential role in phloem loading and transport of photoassimilates into sink organs, mainly at the grain filling stage, which is crucial for grain yields (Ruan et al., 2012). Consequently, maintaining sufficient Mg availability is important for plant growth. Mg is mainly obtained from the soil through the root system. Therefore, only sufficient soil Mg can ensure the supply of this nutrient for plant growth. Studies on Boron and Magnesium fertilizer proved that the application of B and Zn greatly influences growth, yield and quality of rice (Raimani and Singh, 2015). Keeping this in view, the present research was undertaken the following objectives: To study the effect of boron and magnesium on growth and yield of BRRI dhan29 and BRRI dhan58. To evaluate the performance of BRRI dhan29 and BRRI dhan58 using various boron and magnesium fertilizer dosages.

2. MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field Laboratory, Department of Agronomy and Agricultural Extension, University of Rajshahi, during the period from January 2020 to June 2020 to investigate the influence of different doses of boron and magnesium on growth and yield of boro rice. The materials used and the methods followed during the experimental period are described in this chapter. A brief description of the experimental site, soil, Climate, experimental design, treatments, cultural operations, data collection, and their statistical analysis are narrated under the following heads.

Location and soil: The study was conducted at the Agronomy Field Laboratory, Department of Agronomy and Agricultural Extension, Rajshahi University, spanning from December 2019 to March 2020. The experimental site featured sandy loam textured soil with a pH level of 7.6.

Climate: The experimental field was situated within a subtropical climate, distinguished by moderately high temperatures and substantial rainfall throughout the kharif season (November-March). Conversely, during the Rabi season (November to March), the region experienced sparse rainfall coupled with moderately low temperatures.

Variety and Experimental treatments: BRRI dhan29 and BRRI dhan58 were used in the present experiment. BRRI dhan29 and BRRI dhan58 were collected from Bangladesh rice research institute(BRRI), Regional Station, shyampur, Rajshahi.

Cultivation techniques: Healthy seeds were soaked for 24 hours, sprouted in darkness, and sown in a prepared seedbed in January 2022. The seedbed was maintained with weeding, irrigation, and pest protection. For transplanting, the field was initially flooded to rot weeds, then ploughed and leveled. The final preparation for transplanting occurred on 26 February

2022, with layout completed on 15 February. NPK fertilizers (urea, TSP, MP) were applied as recommended by BARI during the growth stage. Seedlings were uprooted and transplanted on 26 February using conventional methods. Intercultural operations included gap filling, manual weeding, herbicide application, flood irrigation, and pest control. Infestations by rice stem borers and green leafhoppers were managed with Furadan and Sumithion. Regular observations ensured the plants grew healthily, showing vigorous tiller growth without lodging. Data were collected from three randomly selected hills per plot at 30-day intervals until harvest. The crop was harvested on 1 June at full maturity. Post-harvest, each plot's crop was bundled, tagged, and threshed separately. The grains and straw were sun-dried, adjusted to 14% moisture, and yields were converted to tons per hectare. The field appeared healthy throughout the growing period, with no major disease incidences.

Collection of experimental data: The data recording procedure involved measuring plant height from three randomly selected plants in each plot at different stages (30, 60, 90, and 120 DAT) and at maturity. Total tillers, including both productive and unproductive, were counted from the same plants. Chlorophyll levels were measured using a SPAD-502 meter. At maturity, yield data were collected by uprooting three hills per plot, excluding border rows, and harvesting the crop from a $1m^2$ area. Yield parameters recorded included plant height, effective and non-effective tillers per hill, panicle length, number of grains per panicle, filled and unfilled grains per panicle, 1000-grain weight, grain yield, straw yield, biological yield, and harvest index. Grain and straw yields were measured, dried, and converted to tons per hectare. Biological yield was calculated by summing grain and straw yields, and the harvest index was determined as the ratio of economic yield to biological yield.

Statistical analysis: The collected data underwent analysis utilizing the "STATVIEW" statistical package. Mean differences were evaluated employing Duncan's multiple-range test.

3. RESULTS AND DISCUSSION

Plant height (cm) : There were no significant differences in plant height was observed between the two rice varieties at 30, 60, 90 and 120 days after transplanting (DAT) and BRRI dhan 58(V_2) produced comparatively taller plants than BRRI dhan 29 (V_1) (Table 1). At 30 DAT, the tallest plant (19.73 cm) was observed in V_2 and the shortest plant (19.39 cm) was observed in V_1. At 60 DAT, the highest plant height (37.60 cm) was observed in V_2 and the lowest plant height (36.39 cm) was noticed in V_1. Simmilarly at 90 and 120 DAT, the maximum plant heights (82.42 cm and 89.83 cm) were observed in V_2 and the minimum plant heights (80.08 cm and 87.95 cm) were found in V_1. A noticeable effect on the plant height of rice was observed for different boron and magnesium fertilization at all observations (30, 60, 90 and 120 DAT) **(Table 1)**. At 30 DAT, the highest plant height (20.11 cm) was found in T_3 due to the application of high rate of boron and magnesium and the lowest plant height (18.66 cm) was observed in T_1 due to the application of low rate of boron and magnesium. At 60 DAT, the maximum plant height (38.67 cm) was observed in T_3 and the minimum plant height (34.33 cm) was recorded at T_1. At 90 DAT, the tallest plant (84.16 cm) was recorded from T_3 which was statistically simillar with T_2 and the shortest plant (76.27 cm)was recorded in T_1. Finally, at 120 days after transplanting, the maximum plant height (92.00 cm) was obtained from T_3 which is statistically significant with T_1(83.81 cm). Statistically non-Significant differences in plant height were observed in case of interaction between rice varieties and different boron and magnesium fertilization at all observations except at 60 DAT **(Table 1)**. At 30 DAT, the highest value for plant height (20.23 cm) was found in combination of V_2 with T_3 which is statistically similar with all other combinations and lowest value for plant height was found in the combined effect of V_1 with T_1. At 60 DAT, the highest plant height (39.44 cm) was observed from V_2T_3 and lowest plant height (33.63 cm) was observed from V_1T_1. In case of 90 and 120 DAT, the highest plant found in the combination of V_2T_3 (85.94 and 93.54cm, respectively) and the lowest corresponding values were observed in V_1T_1 (76.05, and 83.12 cm, respectively).

Total number of tiller hill^{-1} : There were non-significant variation case of total number of tillers per hill of the varieties were observed (Table 1). The maximum number of tiller hill^{-1} (17.29) was noticed in BRRI dhan58 and the minimum no of tiller hill^{-1} (16.81) was found in BRRI dhan29. Significant differences were observed due to boron and magnesium fertilization on total no of tillers hill^{-1} of rice (Table 2). The highest number of tillers hill^{-1} (17.83) was found in T_3 which is reduced significantly by 11.22% in T_1. Interaction effects of rice varieties and different doses of boron and magnesium application showed non-significant values in case of total no of tillers hill^{-1} which is presented in **Table 1**. Interaction of V_2 with T_3 exhibit highest no of tillers hill^{-1}(18.11) and lowest no of tillers hill^{-1}(15.78) was found in V_1T_1.

Chlorophyll Content (ChN_{SPAD}): Leaf chlorophyll content of rice varieties were measured on 30 and 60 DAT and presented in Table 1. There were no significant differences within the rice varieties at all observations (30 and 60 DAT). At 30 DAT, maximum chlorophyll content (46.08) was found in V_2 and minimum value (44.55) for chlorophyll content was observed in V_1. At 60 DAT, chlorophyll content was highest (44.54) in V_2 and lowest (41.89) in V_1. Chlorophyll content of rice showed statistically significant result due to different boron and magnesium fertilizations **(Table 1)**. At 30 DAT, highest chlorophyll content (47.40) was observed in T_3 which reduced slightly by 1.52% in T_2 but significantly by 11.50% for T_1. At 60 DAT, highest chlorophyll content (46.27) was observed in T_3 which is statistically similar with T_2 and reduced significantly by 16.90 in T_1. Significant interaction was found between varieties and boron and magnesium fertilization in chlorophyll content of rice **(Table 1)**. At 30 DAT maximum chlorophyll content (48.45) was found in the combination of V_2 with T_3 and the minimum (41.42) was observed in V_1 with T_1. At 60 DAT maximum chlorophyll content (48.44) was found in the combination of V_2 with T_3 and the minimum (38.81) was observed in V_1 with T_1.

Effective tiller hill^{-1}: Statistically non-significant differences were observed in no of effective tiller hill^{-1} of rice presented in **Table 1**. The highest number of effective tiller hill^{-1} (12.48) was observed in V_2 and the lowest (11.74) was in V_1. Number of effective tiller hill^{-1} was significantly affected due to different doses of boron and magnesium fertilizers **(Table 1).** The highest number of effective tiller hill^{-1} (13.22) was recorded in T_3 and the lowest (10.44) was in T_1. The interaction effect between rice varieties and different boron and magnesium fertilization on effective tiller hill^{-1} showed significant results **(Table 1)**. Numerically the highest number of effective tiller hill^{-1} (13.67) was found in the combination of V_2T_3 and the lowest number of effective tiller hill^{-1} (10.22) was found in the combination of V_1T_1.

Non-Effective tiller hill^{-1}: Number of non-effective tiller hill^{-1} was non-significant in case of rice varieties **(Table 1)**. The highest number of non-effective tiller hill^{-1} (5.07) was observed in V_1 and the lowest (5.87) was in V_2. Number of non-effective tiller hill^{-1} was not significantly affected due to different boron and magnesium fertilizer rates **(Table 1)**. The highest number of non-effective tiller hill^{-1} (5.39) was recorded in T_1 and the lowest (4.61) was in T_3. The interaction effect between rice varieties and different phosphorus fertilization on non-effective tiller hill^{-1} was non-significant **(Table 1)**. The highest number of non-effective tiller hill^{-1} (5.55) was found in the combination of V_1T_3 and the lowest number of non-effective tiller hill^{-1} (4.44) was found in the combination of V_2T_3.

Panicle Length (cm): No remarkable difference in the length of the panicle was observed between the two rice varieties (**Table 2**). V_2 produced a comparatively higher value (20.23 cm) than that of V_1 (19.51 cm). Boron and magnesium fertilization had a remarkable effect on the rice panicle length (**Table 2**). In this case, the highest value (20.53 cm) was recorded in T_3, which significantly reduced by 0.97% and 5.94% in T_2 and T_1, respectively. Statistically significant effect was observed in the length of panicle due to the interaction between rice varieties and boron and magnesium fertilization (**Table 2**). The highest length of the panicle (20.65 cm) was obtained from the treatment combination of V_2T_3 and the lowest length of panicle (19.21cm) was found in treatment combination of V_1T_1.

Grains Panicle^{-1}: There was non significant differences in no of grains panicle^{-1} was observed between the two rice varieties and V_2 produced a maximum (164.11) grains panicle^{-1} and which was 2.76% higher than V_1 (**Table 2**). Boron and magnesium fertilization significantly influenced no of grains panicle^{-1}(**Table 2**). The highest grains panicle^{-1} (171.33) was recorded from T_3 and the lowest no of grains panicle^{-1} (148.11) was recorded from T_1. Statistically significant effect was observed in no of grains panicle^{-1} due to the interaction between variety and different doses of boron and magnesium fertilizer (**Table 2**). The highest grains panicle^{-1} (175.11) was acquired from V_2T_3 and the lowest grains panicle^{-1} (147.67) was achieved from V_1T_1.

Number of effective grains panicle^{-1}: There was non significant differences in no of effective grains panicle^{-1} was observed between the two rice varieties where V_2 produced a maximum (128.67) no of effective grains panicle^{-1} and which was 4.72% higher than V_1 (**Table 2**). Boron and magnesium fertilization significantly influenced no of effective grains panicle^{-1} (**Table 2**). The highest value for effective grains panicle^{-1} (137.00) was recorded from T_3 and the lowest no of effective grains panicle^{-1} (108.66) was recorded from T_1. Statistically non-significant effect was observed in no of effective grains panicle^{-1} due to the interaction between variety and different doses of boron and magnesium fertilizer (**Table 2**). The highest effective grains panicle^{-1} (142.85) was recorded from V_2T_3 and the lowest no of effective grains panicle^{-1} (107.89) was observed from V_1T_1.

Number of non-effective grains panicle^{-1}: Non significant differences in no of non-effective grains panicle^{-1} was observed between the two rice varieties. In this case, V_1 produced a maximum (37.07) non –effective grains panicle^{-1} and which was 4.60 % higher than V_2 (**Table 2**). Influence of Boron and magnesium fertilization on of non-effective grains panicle^{-1} was no significant(**Table 2**). The highest no of non-effective grains panicle^{-1} (39.44) was recorded from T_1 and the lowest no of non-effective grains panicle^{-1} (34.33) was recorded from T_3. Statistically non-significant effect was observed in no of non-effective grains panicle^{-1} due to the interaction between variety and different doses of boron and magnesium fertilizer (**Table 2**). The highest no of non-efective grains panicle^{-1} (39.78) was observed from V_1T_1 and the lowest no of non-effective grains panicle^{-1} (32.66) was recorded from V_2T_3.

1000 grain weight (g): No remarkable difference in 1000 grain weight (g) was found between two rice varieties and maximum 1000 grain weight (23.10g) was found in V_2 and minimum was found in V_1 (22.80g) (**Table 2**). Different boron and magnesium fertilization significantly influence 1000 grain weight (g) of rice varieties (**Table 2**). The highest 1000 grain weight (23.29g) was found in T_3 and the lowest 1000 grain weight (22.40g)was recorded from T_1. No remarkable effect was observed in 1000 grain weight (g) due to the interaction between variety and different boron and magnesium fertilization(**Table 2**). The highest 1000 grain weight (23.47 g) was recorded from V_2T_3 and the lowest 1000 grain weight (22.34 g) was obtained from $V_1T_{1.}$

Grain yield (t ha^{-1}): Rice varieties did not differ significantly in case of grain yield. Numerically, V_2 showed the highest value (6.27 t ha^{-1}) than V_1(6.14 t ha^{-1}). In this case, V_2 exceeded V_1 by 2.07% (**Table 2**). Grain yield is significantly influenced by different boron and magnesium fertilizer doses(**Table 2**). The highest grain yield (6.49 t ha^{-1}) was obtained from T_3 which reduced slightly by 1.38% in T_2 and significantly by 11.71% in T_1. The interaction between variety and boron and magnesium fertilization had a statistically significant effect on grain yield of rice varieties (**Table 2**). Interaction of V_2 with T_3 produced the highest grain yield (6.56 t ha^{-1}), while V_1T_1 produced the lowest grain yield (5.62 t ha^{-1}).

Straw yield (t ha^{-1}): There was no significant difference in straw yield was viewed between two rice varieties of which V_2 produced the highest value (7.88 t ha^{-1}) (**Table 2**). This value was 3.27% higher than that in V_1**.** The application of different boron and magnesium fertilizer significantly influences straw yield of rice vareities (**Table 2**). The highest straw yield (8.10 t ha^{-1}) was recorded from T_3 which reduced slightly by 1.23% in T_2 and significantly by 11.23% in T_1. Statistically non-significant effect was observed in straw yield due to the interaction between variety and boron and magnesium fertilization (**Table 2**). The highest straw yield (8.24 t ha^{-1}) was achieved from V_2T_3 and the lowest straw yield (7.10 t ha^{-1}) was obtained from V_1T_1.

Biological yield (t ha^{-1}): There was no remarkable difference in biological yield was noticed between the two rice varieties in which V_2 produced the highest value (14.15 t ha^{-1}). This value was 2.76% higher than that in V_1(**Table 2**). Biological yield is significantly influenced by different doses of boron and magnesium fertilizers **(Table 2**). The highest biological yield (14.57 t ha^{-1}) was obtained from $T_{3,}$ which reduced only by 1.24% in T_2, but significantly by 11.32% in T_1. Statistically non-significant effect was observed in biological yield due to the interaction effect of variety and boron and magnesium fertilization (**Table 2**). The highest biological yield (14.79 t ha^{-1}) was obtained from V_2T_3 and the lowest biological yield (12.72 t ha^{-1}) was recorded from $V_1T_{1.}$

Harvest index (%): Statistically non sifnificant difference in harvest index was found between two rice varieties (**Table 2**). The highest value for harvest index(44.56) was found in V_1 which is only reduced by 0.49% in V_2. Significant differences were observed due to boron and magnesium fertilization in case of harvest index of rice (**Table 2**). The highest harvest index (44.56) was rocorded from $T_{3,}$ and lowest (44.32) was found in T_1. The harvest index showed a statistically non-significant effect due to the interaction between variety and boron and magnesium fertilization. The highest harvest index(44.79) was achieved from V_1T_3 and the lowest harvest index (44.17) was obtained from V_1T_1 (**Table2**).

Table 1: Varietal difference , Effect of different doses of boron and magnesium and Interaction effectss in plant height, total number of tiller hill^{-1}, No of effective tiller hill^{-1} No of non-effective tiller hill^{-1} and Chlorophyll Content (ChNSPAD) of boro rice.

Variety	Plant Height (cm)				Total no of tiller hill^{-1}	No of effective tiller hill^{-1}	No of non-effective tiller hill^{-1}	Chlorophyll Content (ChNSPAD)	
	30DAT	60 DAT	90DAT	120DAT				60DAT	90DAT
V_1	19.39±0.35	36.39±0.99	80.08±1.81	87.95±2.03	16.81±0.44	11.74±0.60	5.07±0.17	44.55±1.29	41.89±2.10
V_2	19.73±0.40	37.60±1.1	82.42±2.07	89.83±2.10	17.29±0.50	12.48±0.70	4.81±0.24	46.08±1.33	44.54±2.12
LS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	5.31	7.37	6.28	6.31	7.13	14.14	12.32	7.61	13.62

Treatments

Treatments	Plant Height (cm)				Total no of tiller hill^{-1}	No of effective tiller hill^{-1}	No of non-effective tiller hill^{-1}	Chlorophyll Content (ChNSPAD)	
	30DAT	60 DAT	90DAT	120DAT				60DAT	90DAT
T_1	18.66±0.23b	34.33±0.89b	76.27±1.59b	83.81±1.92b	15.83±0.43b	10.44±0.46b	5.39±0.10	41.95±1.22b	38.45±2.20b
T_2	19.91±0.42ab	37.98±1.01a	83.33±1.10a	90.85±2.17ab	17.50±0.53a	12.67±0.71a	4.83±0.19	46.69±1.27a	44.92±2.33ab
T_3	20.11±0.47a	38.67±1.19a	84.16±2.24a	92.00±2.19a	17.83±0.42a	13.22±0.74a	4.61±0.34	47.40±1.43a	46.27±2.26a
LS	0.05	0.05	0.05	0.05	0.05	0.05	NS	0.05	0.05
CV%	5.31	7.37	6.28	6.31	7.13	14.14	12.32	7.61	13.62

Interaction

Interaction	Plant Height (cm)				Total no of tiller hill^{-1}	No of effective tiller hill^{-1}	No of non-effective tiller hill^{-1}	Chlorophyll Content (ChNSPAD)	
	30DAT	60 DAT	90DAT	120DAT				60DAT	90DAT
V_1T_1	8.50±0.25	33.63±1.26b	76.05±2.56	83.12±3.16	15.78±0.62	10.22±0.73b	5.55±0.11	41.42±1.96	38.31±3.51
V_1T_2	19.69±0.52	37.63±1.41ab	81.82±3.23	90.25±3.38	17.11±0.78	12.22±1.06ab	4.89±0.30	45.89±2.15	43.25±3.78
V_1T_3	19.99±0.72	37.91±1.54ab	82.38±3.23	90.46±3.29	17.56±0.68	12.78±0.97ab	4.78±0.29	46.35±2.05	44.11±4.05
V_2T_1	18.83±0.41	35.03±1.33ab	76.45±2.46	84.49±2.84	15.89±0.73	10.67±0.69ab	5.22±0.11	42.48±1.81	38.59±3.43
V_2T_2	20.14±0.76	38.33±1.73ab	84.83±2.69	91.45±3.44	17.89±0.80	13.11±1.10ab	4.77±0.29	47.29±1.73	46.59.3.17
V_2T_3	20.23±0.74	39.44±2.03a	85.94±3.38	93.54±3.30	18.11±0.59	13.67±1.26a	4.44±0.68	48.45±2.20	48.44±2.12
LS	NS	0.05	NS	NS	NS	0.05	NS	0.05	0.05
CV%	5.31	7.37	6.28	6.31	7.13	14.14	12.32	7.61	13.62

Mean values in a column having the same letters or without letter do not differ significantly as per DMRT, CV= Co-efficient of variation, LS= Level of significant, DAT= Days After Transplanting, V_1=BRRI dhan29, V_2= BRRI dhan58,T_1=Control (Only Recommended NPK), T_2 = Low rate of boron and magnesium, T_3 = High rate of boron and magnesium

Table 2: Varietal difference, Effect of different doses of boron and magnesium and Interaction effects at yield and yield component of boro rice.

Variety	Panicle Length (cm)	Number of Grain panicle^{-1}	Eff. of Grain panicle^{-1}	Non Eff. of Grain panicle^{-1}	1000 Grain Weight (g)	Grain Yield (tha^{-1})	Straw Yield (tha-1)	Biological Yield (tha^{-1})	Harvest Index (%)
V_1	19.91±0.31	159.70±5.23	122.63±6.46	37.07±1.34	22.80±0.19	6.14±0.19	7.63±0.23	13.77±0.41	44.56±0.26
V_2	20.20±0.30	164.11±5.50	128.67±6.93	35.44±1.49	23.10±0.25	6.27±0.17	7.88±0.24	14.15±0.40	44.34±0.18
LS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	4.02	8.59	13.97	10.97	2.59	7.35	8.3	7.76	1.64

Treatments

Treatments	Panicle Length (cm)	Number of Grain panicle^{-1}	Eff. of Grain panicle^{-1}	Non Eff. of Grain panicle^{-1}	1000 Grain Weight (g)	Grain Yield (tha^{-1})	Straw Yield (tha-1)	Biological Yield (tha^{-1})	Harvest Index (%)
T_1	19.31±0.18b	148.11±3.79b	108.66±5.12b	39.44±1.44	22.40±0.12b	5.73±0.21b	7.19±0.24b	12.92±0.44b	44.32±0.38
T_2	20.33±0.34a	166.28±5.84a	131.28±7.22a	35.00±1.52	23.17±0.25a	6.40±0.13a	8.00±0.24ab	14.39±0.37a	44.48±0.24
T_3	20.53±0.35a	171.33±5.73a	137.00±7.25a	34.33±1.60	23.29±0.28a	6.49±0.16a	8.10±0.25a	14.57±0.40a	44.56±0.19
LS	0.05	0.05	0.05	NS	0.05	0.05	0.05	0.05	NS
CV%	4.02	8.59	13.97	10.97	2.59	7.35	8.3	7.76	1.64

Interaction

Interaction	Panicle Length (cm)	Number of Grain panicle^{-1}	Eff. of Grain panicle^{-1}	Non Eff. of Grain panicle^{-1}	1000 Grain Weight (g)	Grain Yield (tha^{-1})	Straw Yield (tha-1)	Biological Yield (tha^{-1})	Harvest Index (%)
V_1T_1	19.21±0.32	147.67±6.17b	107.89±8.36	39.78±2.40	22.34±0.21	5.62±0.36b	7.10±0.41	12.72±0.75	44.17±0.67
V_1T_2	20.18±0.55	163.89±9.60ab	128.44±11.31	35.44±1.96	22.98±0.33	6.36±0.20ab	7.87±0.37	14.23±0.57	44.74±0.38
V_1T_3	20.41±0.60	167.55±9.25ab	131.55±11.73	36.00±2.50	23.10±0.34	6.42±0.22ab	7.92±0.36	14.34±0.58	44.79±0.28
V_2T_1	19.41±0.22	148.55±5.79ab	109.44±7.79	39.11±2.11	22.46±0.15	5.83±0.29ab	7.28±0.33	13.11±0.60	44.47±0.51
V_2T_2	20.53±0.49	168.67±8.53ab	134.11±11.17	34.56±2.74	23.36±0.41	6.43±0.21ab	8.12±0.36	14.56±0.58	44.22±0.28
V_2T_3	20.65±0.51	175.11±8.04a	142.45±9.80	32.66±1.95	23.47±0.45	6.56±0.26a	8.24±0.40	14.79±0.66	44.34±0.22
LS	NS	0.05	NS	NS	NS	0.05	NS	NS	NS
CV%	4.02	8.59	13.97	10.97	2.59	7.35	8.3	7.76	1.64

Mean values in a column having the same letters or without letter do not differ significantly as per DMRT, CV= Co-efficient of variation, LS= Level of significant, DAT= Days After Transplanting, V_1=BRRI dhan29, V_2= BRRI dhan58,T_1=Control (Only Recommended NPK), T_2 = Low rate of boron and magnesium, T_3 = High rate of boron and magnesium

4. CONCLUSION

The experiment conducted at the University of Rajshahi investigated the effects of varying doses of boron and magnesium on the growth and yield of boro rice, specifically BRRI dhan29 and BRRI dhan58. Conducted from January to June 2022, the study utilized a Randomized Complete Block Design on High Ganges River Floodplain soil. Key growth parameters and yields were measured at multiple intervals and statistically analyzed. Results indicated that BRRI dhan58 generally outperformed BRRI dhan29 in most growth and yield parameters, such as plant height, tiller count, chlorophyll content, and grain yield. The high dose of boron and magnesium (15 kg/ha and 24 kg/ha, respectively) significantly enhanced these parameters, with the combination of BRRI dhan58 and the high dose treatment (T_3) yielding the best results overall. The findings suggest that BRRI dhan58, in combination with higher doses of boron and magnesium, is optimal for increasing rice yield, recommending this combination to farmers for better productivity.

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