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Response of Boro Rice (Brri Dhan29) to the Different Doses of Fertilizers in Bangladesh

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Abstract
A field experiment was conducted at the experimental field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during December, 2014 to May, 2015 to study the response of boro rice (BRRI Dhad29) to the different doses of fertilizers in Bangladesh. The experiment consists of four different levels of fertilizer management. The experiment was laid out in randomized complete block design (RCBD) with five replications. The result indicated significant variations in total number of tiller hill^{-1}, number of effective tiller hill^{-1}, number of ineffective tiller hill^{-1}, dry matter content, number of grains panicle^{-1}, number of filled grains panicle^{-1}, number of unfilled grains panicle^{-1}, grain weight hill^{-1}, straw weight hill^{-1}, grain yield and harvest index due to fertilizer management. Among the treatment on maximum number of effective tiller hill^{-1} and dry matter content recorded of plant in T_3 irrespective of growing period. This treatment also exhibited maximum panicle length, number of filled grains panicle^{-1}, height grain yield and harvest index. When ensure the optimum fertilizer then boro rice ensure maximum grain yield.

Keywords: Responds, Boro Rice, Fertilizer, BRRI Dhan29.

1. Introduction
Rice (*Oryza sativa* L.) belongs to the family Gramineae and is dominant over all other crops in respect of economic and social significance in Bangladesh. It is the most extensively cultivated crop and the staple food of the country. The acreage and production of boro rice in Bangladesh are about 15.32 lac hectares and 75.94 lac metric tons, respectively with an average yield of only 5.64 t ha^{-1} (BBS, 2014) [3]. Among the rice producing countries, Bangladesh ranks fourth to China, India and Indonesia both in acreage and production (FAO, 2013) [6].
Rice is the principal food crop of Bangladesh and agro-climatic condition is favourable for its year round cultivation, but the yield of rice is much lower compared to other rice growing countries (FAO, 2013) [6]. Due to the shortage of land, the scope of its extensive cultivation is very limited. Therefore, attempts must be made to increase the yield per unit area by applying improved technology and fertilizer management practices. The yield of transplant boro rice can be increased with the improved cultivation practices like fertilizer management with appropriate cultural practices.
Among the production factors affecting crop yield, nutrient is the single most important factor that plays a dominant role in yield increase if other production factors are not limiting. It is reported that chemical fertilizers today hold the key to success of production systems of Bangladesh agriculture being responsible for about 50% of the total crop production (BARC, 1997) [1]. Nutrient imbalance can be minimized by judicious application of different fertilizers. There is need to develop appropriate management technique to evaluate the performance and to assess the nutrient requirement for rice cultivation in the country. Among the fertilizersis essential for vegetative growth but excess fertilizers may cause excessive vegetative growth, prolong the growth duration and delay crop maturity with reduction in grain yield. Many workers have reported a significant response of rice to balanced fertilizer in different soils (Bhuiya *et al*., 1989; Hussain *et al*., 1989) [4, 8]. The efficient balanced fertilizer management can increase crop yield and reduce production cost. An increase in the yield of rice by 70 to 80% may be obtained from proper application of balanced fertilizer (IFC, 1982) [9]. Inadequate and improper applications of balanced fertilizer are now considered one of the major reasons for low yield of rice in Bangladesh. The utilization efficiency of applied balanced fertilizer by the rice plant is very low. The optimum dose of balanced fertilizer plays vital role for the growth and development of rice plant. So, it is essential to find out the optimum rate of balanced fertilizer application for efficient utilization of these elements by the plants for better

yield. Under this circumstance the present research work has been taken with the following objective to find out the effects of different levels of fertilizer on growth and yield of BRRI dhan29.

2. Materials and Methods

The experiment was carried out at the experiment of field, Sher-e-Bangla Agricultural University, Dhaka, during the period from December, 2014 to May, 2015. The location of the site is 23.774^0 N latitude and 90.335^0 E longitudes with an elevation of 8.2 m from sea level (FAO, 1988) [5]. The pH of the soil was slightly acidic (6.2). The experimental area has sub-tropical humid climate and is characterized by high temperature accompanied by moderately high rainfall during kharif (April-September) season and low temperature in rabi (October to March). The experiment was laid out in one factor randomized complete block design (RCBD) with 5 replications. One factor was included in the study as mention: four different levels of fertilizer were taken viz., control (T_1), farmer dose (T_2), balanced fertilizer lower dose (T_3) and balanced fertilizer higher dose (T_4). There were 20 unit plots in the experiment. The size of each unit plot was 4.0 m × 3.0 m.

Table 1: Treatments of fertilizer dose (per ha basis) in rice field

Fertilizer	Control treatment (T_1)	Farmer treatment (T_2)	Balanced fertilizer lower dose treatment (T_3)	Balanced fertilizer higher dose treatment (T_4)
Urea	---	400 kg	400 kg	400 kg
TSP	---	150 kg	150 kg	150 kg
MoP	---	190 kg	190 kg	190 kg
Organic	---	---	375 kg	600 kg
Gypsum	---	---	75 kg	110 kg
Zinc	---	---	8 kg	15 kg
Boron	---	---	8 kg	15 kg
$MgSO_4$	---	---	15 kg	24 kg

TSP, MoP, Organic fertilizer, gypsum, zinc, boron and $MgSO_4$ was applied at the time of final land preparation. Urea was applied @ 400 kg ha^{-1} at three times equal splits at 15, 35 and 50 days after transplanting (DAT) (BARC, 2005).

Sprouted seeds were sown in the wet nursery bed on 1stDecember, 2014. Seedlings were transplanted on well-puddled experimental plots on 15thJanuary, 2015 at the rate of 2 seedlings per hill maintaining spacing according to the treatments. After sampling, the crop was harvested plot-wise at full maturity. Two harvests were made at 35 and 50 days after transplanting to study growth characteristics from each sampling, 5 hills were randomly selected from each plot and uprooted for collecting necessary parameters.

Data were collected on plant height (cm), total number of tiller $hill^{-1}$, number of effective tiller $hill^{-1}$, number of ineffective tiller $hill^{-1}$, dry matter content (%), panicle length (cm), panicle weight (g), number of grains $panicle^{-1}$, number of filled grains $panicle^{-1}$, number of unfilled grains $panicle^{-1}$, 1000 seed weight (g), grain weight $hill^{-1}$ (g), straw weight $hill^{-1}$ (g), yield and harvest index (%). The collected data were analyzed statistically following the analysis of variance technique and the mean differences were adjudged with Duncan's Multiple Range Test (DMRT) using the statistical computer package program, MSTAT-C (Gomez and Gomez, 1984) [7].

3. Results and Discussions

The table 1 revealed that, plant height was not significantly influenced by different dose of fertilizer application. The numbers of total tillers $hill^{-1}$, effective tillers $hill^{-1}$, ineffective tillers $hill^{-1}$ were significantly influenced by the application of different levels of fertilizers. The maximum (36.67 and 35.67, respectively) number of effective tiller $hill^{-1}$ was found in T_3 and T_4 treatment whereas, the minimum (20.67) was recorded in T_1 treatment. So, Balance fertilizer (lower and higher dose) was given the maximum effective tiller $hill^{-1}$. The maximum dry matter content (25.33) was observed from T_3treatment while the minimum (19.33) was found from T_1 (control) treatment.

Table 1: Growth parameter of BRRI dhan29 with different levels of fertilizers treatment

Treatment	Plant height (cm)	No. of tiller $hill^{-1}$	No. of effective tiller $hill^{-1}$	No. of ineffective tiller $hill^{-1}$	Dry matter (%)
T_1	89.67	38.00 c	20.67 c	17.33 c	19.33 c
T_2	86.67	51.33 ab	26.00 b	25.33 a	23.00 b
T_3	87.33	47.67 b	36.67 a	11.00 d	25.33 a
T_4	90.00	56.67 a	35.67 a	21.00 b	24.06a
$LSD_{(0.05)}$	NS	6.47	4.57	3.57	1.84
CV (%)	6.58	6.68	9.36	9.57	6.49

In a column figures having similar letter(s) do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per LSD

The table 2 revealed that, panicle length and panicle weight was not significantly influenced by different dose of fertilizer application. The numbers of total grain $panicle^{-1}$, filled grain $panicle^{-1}$, unfilled grain $panicle^{-1}$ were significantly influenced by the application of different levels of fertilizers. The highest (200.7 and 153.3, respectively) number of grain $panicle^{-1}$ and filled grain $panicle^{-1}$ was recorded form T_3 treatment whereas, lowest (128.0 and 118.3, respectively) was found in T_1 treatment. So, Balance fertilizer (lower dose) given the maximum filler grain $panicle^{-1}$.

Table 2: Characteristics of panicle of BRRI dhan29 with different levels of fertilizers treatment

Treatment	Panicle length (cm)	Panicle weight (g)	No. of grain $panicle^{-1}$	No. of filled grain $panicle^{-1}$	No. of unfilled grain $panicle^{-1}$
T_1	22.13	12.07	128.0 d	118.3 d	9.67 c
T_2	22.43	11.57	154.0 c	127.0 c	27.00 b
T_3	23.00	12.67	200.7 a	153.3 a	47.33 a
T_4	23.67	12.10	177.0 b	150.7 b	26.33 b
$LSD_{(0.05)}$	NS	NS	13.49	2.52	9.64
CV (%)	3.80	4.76	7.13	6.57	8.79

In a column figures having similar letter(s) do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per LSD

The table 3 revealed that, 1000 seed weight was not significantly influenced by different dose of fertilizer application. The grain weight $hill^{-1}$, straw weight $hill^{-1}$, yield and harvest index (%) were significantly influenced by the application of different levels of fertilizers. The highest (104.3

g) grain weight hill^{-1} and lowest (98.33 g) straw weight hill^{-1} was recorded from T_3 treatment. The lowest (71.80 g) grain weight hill^{-1} and highest (107.3 g) straw weight hill^{-1} was found T_1 treatment. The maximum (6.90 ton) yield per hectare was recorded from T_3 treatment whereas, the minimum (4.73 ton) was recorded from T_1 treatment. So, Balance fertilizer (lower dose) given the highest yield per hectare.

Table 3: Yield parameter of BRRI dhan29 with different levels of fertilizers treatment

Treatment	1000 seed weight (g)	Grain weight hill^{-1} (g)	Straw weight hill^{-1} (g)	Yield (ton ha^{-1})	Harvest index (%)
T_1	18.73	71.80 d	107.3 a	4.73 d	40.10 c
T_2	18.63	80.50 c	102.0 b	5.30 c	44.23 b
T_3	18.77	104.3 a	98.33 c	6.90 a	51.23 a
T_4	18.87	95.37 b	102.0 b	6.30 b	49.17 a
$LSD_{(0.05)}$	NS	6.99	3.31	0.42	3.62
CV (%)	3.22	3.97	6.19	3.62	8.42

In a column figures having similar letter(s) do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per LSD

4. Conclusion

Application of balance fertilizer increased the yield of boro rice. But, the lower dose of balance fertilizer was best for increasing the yield of BRRI dhan29.

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