

## EFFECT OF FERTILIZER PACKAGES AND AGRONOMIC PRACTICES ON THE YIELD OF BORO RICE IN HAOR AREA

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### Abstract

The experiment was conducted at the farmers' fields Dekar *haor* area of Bahadurpur village under the Lakshmanshri union of Sadar upazila of Sunamganj district in during November 2014 to May 2015 to find out the effect of fertilizer packages and agronomic practices on yield and yield attributing characters of *boro* rice. The test crop was *cv.* BRRI dhan58. The experiment comprised of two fertilizer packages viz. F<sub>1</sub>= Farmers' practice based fertilizers (180-42-42 kg ha<sup>-1</sup> of Urea-TSP-MoP) and F<sub>2</sub>= BARC recommended fertilizers (300-112-127-75-11 kg ha<sup>-1</sup> of Urea-TSP-MoP-CaS04-ZnS04) and three levels of agronomic practices viz. P<sub>1</sub>= Farmers' agronomic practice (45 days-old seedlings, and spacing: 15cm×15cm), P<sub>2</sub>= Proper seedling age with proper spacing (35 days-old seedlings, and spacing: 20cm×20cm) and P<sub>3</sub>= P<sub>2</sub> + IPM (Integrated pest management). The experiment was laid out in a randomized complete block design (RCBD) with five farmers' field as replications. Data were taken on yield and yield contributing characters. The yield and yield contributing characters of *boro* rice (*cv.* BRRI dhan58) varied significantly between used of Farmers' practice based fertilizers and BARC recommended fertilizers. The higher grain yield (9.80 t ha<sup>-1</sup>) and straw yield (10.83 t ha<sup>-1</sup>) were recorded from BARC recommended fertilizers over Farmers' practice based fertilizers. Among the three levels of agronomic practices Proper seedling age and proper spacing (P<sub>2</sub>) + IPM performed the best in respect of grain yield (9.22 t ha<sup>-1</sup>). The highest grain yield (9.94 t ha<sup>-1</sup>) was observed from the interaction of BARC recommended fertilizers with Proper seedling age and proper spacing + IPM. Post-harvest soils showed higher nutrient contents in comparison to initial soil due to application of balanced fertilizers.

**Keywords:** Fertilizer packages, Agronomic practices, BRRI dhan58, Yield, *Haor* area

### Introduction

Agriculture is dominated by intensive rice (*Oryza sativa* L.) cultivation based on soil and climatic conditions are favorable for rice cultivation. The rice growing area of Bangladesh is 11.38 million ha covering 74.85% of the total cultivable area. The total production of rice was 34.71 million metric tonnes (BBS, 2016). In respect of production, it ranks 6<sup>th</sup> among the rice producing countries of the world following China, India, Indonesia, Vietnam and Thailand (FAO, 2014). Sylhet is situated in the North-East portion of Bangladesh which is comparatively a higher rainfall area. Boro rice -Fallow-Fallow is dominant cropping pattern which covers more than 80% of *haor* areas (DAE, Sylhet, 2012). Fertilizers application is indispensable for the crop production systems of modern agriculture.

Chemical fertilizer today holds the key to the success of the crop production systems of Bangladesh agriculture. About 50% of the reduction of yield is occurred in absence of chemical fertilization application (BARC, 2012). Moreover, attempts should be taken to increase the yield through the use of modern production technologies, such as planting methods, use of quality seeds, high yielding and modern varieties, optimum age of seedling, proper spacing as well as integrated pest management (IPM), adopting plant protection measures and seedling raising techniques. The age of seedling is an important factor because it has tremendous capacity to influence on the growth and development, tiller production, grain formation and other yield contributing characters of rice (Islam and Ahmed, 1981). Proper plant spacing

responsible for the plant density that can bring down the seed requirement without sacrificing productivity would go a long way in popularizing the hybrid rice cultivation. Optimum plant spacing ensures plant growth utilizing more solar radiation, soil, water and applied nutrients that produce higher yield. Number of grains panicle<sup>-1</sup> decreased with increasing plant density (Aktar, 2004). In the agronomic practices, integrated pest management (IPM) is playing an important role in boost up the rice production. So there is an opportunity to increase the rice production by proper fertilizer management and agronomic practices and also contributes in raising the national rice production. For this reason, the study was aimed to find out the effect of fertilizers and agronomic practices on yield and yield attributes of *boro* rice (*cv.* BRRI dhan58) as well as post-harvest soils status of *haor* area.

### Materials and Methods

The experiment was conducted at Bahadurpur village under the Laksmanshri union of Sadar upazila of Sunamganj district during November 2014 to May 2015. The experimental site was located under Sylhet Basin (AEZ-21) having soil of moderately acidic, medium or low drainage facility. The experiment comprised of two fertilizer packages viz. F<sub>1</sub>= Farmers' practice based fertilizers (180-42-42 kg ha<sup>-1</sup> of Urea-TSP-MoP) and F<sub>2</sub>= BARC recommended fertilizers (300-112-127-75-11 kg ha<sup>-1</sup> of Urea-TSP-MoP-CaSO<sub>4</sub>-ZnSO<sub>4</sub>) and three levels of agronomic practices viz. P<sub>1</sub>= Farmers' agronomic practice (45 days-old seedlings, and spacing: 15cm×15cm), P<sub>2</sub>= Proper seedling age with proper spacing (35 days-old seedlings, and spacing: 20cm×20cm) and P<sub>3</sub>= P<sub>2</sub> + IPM (Integrated pest management) (Hand picking of harmful insects after 10 days intervals, perching, removal diseased infected plants by hands when necessary). The test crop was *cv.* BRRI dhan58. The experiment was laid out in a randomized complete block design (RCBD) with five replications. Farmer's plot is represented as replication. Total numbers of plots were 30, the unit plot size was 5 m × 4 m. BRRI recommended seeds were sown on the seedbed on 29 November, 2014 for raising nursery seedlings and Farmers' seeds were sown on the seedbed on 19 November, 2014. The experiment

field was ploughed on 14 December, 2014 with the help of a power tiller, later on 30 December, 2014. The field was prepared by three successive ploughings and cross ploughings with a power tiller and subsequently leveled by laddering. Fertilization was taken according to treatments mentioned above. All the fertilizers were applied at the time of final land preparation except urea. Urea was applied at three equal splits at 15, 35 and 60 DATs (Day after plantation). The layout of the field was made after final land preparation. The seedlings were transplanted on 3 January 2015. Two hand weeding were done for each plot at 25 and 50 DATs, Standing water was maintained 2-3 cm in the field throughout the growing period and other intercultural operations were done as and when necessary. Crop (BRRI dhan58) was harvested on 30 April 2015 and 3 May 2015. The harvested crop of 1m<sup>2</sup> areas at the center of each plot was separately bundled separately and tagged properly, and then brought to threshing floor. The grains and straws were cleaned and sun dried and straws were also sun dried properly. Finally grains and straw yields of 1m<sup>2</sup> plot<sup>-1</sup> were recorded and converted to t ha<sup>-1</sup>. The initial and post-harvest soil samples were collected from 0-15 cm depth of soil and analyzed from Soil Resource Development Institute (SRDI), Sylhet. The recorded data were compiled and tabulated for statistical analysis. Analysis of variance was done with the help of computer package; MSTAT-C. The mean differences among the treatments were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

### Results and Discussion

Fertilizers affect the number of effective tillers hill<sup>-1</sup>, number of grains panicle<sup>-1</sup>, number of spikelets panicle<sup>-1</sup>, length of panicle, 1000-grains weight, grain yield and straw yield significantly (Table 1). The higher number of effective tillers hill<sup>-1</sup> (17.62), number of grains panicle<sup>-1</sup> (178.30), longer panicle (22.34 cm), 1000-grains weight (23.53g), grain yield (9.80 t ha<sup>-1</sup>) and straw yield (10.83 t ha<sup>-1</sup>) were obtained using BARC recommended fertilizers (F<sub>2</sub>). The lower number of effective tillers hill<sup>-1</sup> (16.58), number of grains panicle<sup>-1</sup> (170.74), longer panicle (21.22 cm), 1000-grains weight (22.47g), grain yield (8.61 t ha<sup>-1</sup>) and straw yield (10.07 t ha<sup>-1</sup>) were obtained using

Farmers' practice based fertilizers (F<sub>1</sub>). These results are in conformity with the result that obtained by BARI (2014) conducted experiment in farmers' field at *Singpur haor*, Nikli, Kishoreganj district. The report indicated the higher grain yield (9.67 t ha<sup>-1</sup>) from 318-63-130-29-5-1.25 kg ha<sup>-1</sup> N-P-K-S-Zn-B in comparison to farmers' practice (6.26 t ha<sup>-1</sup>) with 60-30-40-25 kg ha<sup>-1</sup> N-P-K-S in boro season. The results are also as par with the BARI (2013) and Hossain *et al.* (2011).

Agronomic practices did not influenced significantly on the number of effective tillers hill<sup>-1</sup>, number of grains panicle<sup>-1</sup>, number of spikelets panicle<sup>-1</sup>, length of panicle, 1000-grains weight, grain yield and straw yield (Table 2).

Interaction effect of fertilizers and agronomic practices was significant only on sterile spikelets panicle<sup>-1</sup> (Table 3). The highest number of sterile spikelets panicle<sup>-1</sup> (33.88) was obtained due to farmers' practice based fertilizers and agronomic practices (F<sub>1</sub>P<sub>1</sub>). The lowest number of sterile spikelets panicle<sup>-1</sup> (30.80) was obtained from BARC recommended fertilizers with Proper seedling age and proper spacing (P<sub>2</sub>) + Integrated Pest Management (IPM) (F<sub>2</sub>P<sub>3</sub>).

The pH value of initial soil was 4.90 (Table 4). Post-harvest soil analysis showed that the pH values were lower than initial sample. The total N of the initial soil was 0.11% where in post-harvest soils, the total N were 0.12, 0.12, 0.12, 0.14, 0.14 and 0.15% in F<sub>1</sub>P<sub>1</sub>, F<sub>1</sub>P<sub>2</sub>, F<sub>1</sub>P<sub>3</sub>, F<sub>2</sub>P<sub>1</sub>, F<sub>2</sub>P<sub>2</sub> and F<sub>2</sub>P<sub>3</sub>, respectively. The initial soil organic matter was 2.90% and post-harvest organic matters were 3.00, 2.90, 2.88, 3.10, 3.05 and 3.10 % because of treatments combination of F<sub>1</sub>P<sub>1</sub>, F<sub>1</sub>P<sub>2</sub>, F<sub>1</sub>P<sub>3</sub>, F<sub>2</sub>P<sub>1</sub>, F<sub>2</sub>P<sub>2</sub> and F<sub>2</sub>P<sub>3</sub>, respectively. Post-harvest soil available P were observed 5.20, 5.60, 5.50, 5.30, 5.10 and 5.60 ppm due to interaction treatments of F<sub>1</sub>P<sub>1</sub>, F<sub>1</sub>P<sub>2</sub>, F<sub>1</sub>P<sub>3</sub>, F<sub>2</sub>P<sub>1</sub>, F<sub>2</sub>P<sub>2</sub> and F<sub>2</sub>P<sub>3</sub>, respectively which was higher than initial soil. The exchangeable K of the initial soil was 0.15 meq100 g<sup>-1</sup>. Post-harvest soil exchangeable K values were 0.18, 0.19, 0.19, 0.20, 0.23 and 0.25 meq100 g<sup>-1</sup> in F<sub>1</sub>P<sub>1</sub>, F<sub>1</sub>P<sub>2</sub>, F<sub>1</sub>P<sub>3</sub>, F<sub>2</sub>P<sub>1</sub>, F<sub>2</sub>P<sub>2</sub> and F<sub>2</sub>P<sub>3</sub>, respectively. In post-harvest soil available S were 29, 28, 29, 35, 36 and 36 ppm due to interaction treatments of F<sub>1</sub>P<sub>1</sub>, F<sub>1</sub>P<sub>2</sub>, F<sub>1</sub>P<sub>3</sub>, F<sub>2</sub>P<sub>1</sub>, F<sub>2</sub>P<sub>2</sub> and F<sub>2</sub>P<sub>3</sub>, respectively that was much higher than initial soil status. It was due to balanced nutrients supply by BARC recommended fertilizers. This finding was similar of the findings of Maiti *et al.* (2007) and Singh *et al.* (2005).

Table 1. Effect of fertilizer packages on the yield and yield contributing characters of *boro rice* (*cv.* BRRI dhan58) in the Bahadurpur village of Dekar *haor* area

Fertilizers	Effective tillers hill <sup>-1</sup> (no.)	Grains panicle <sup>-1</sup> (no.)	Sterile spikelets panicle <sup>-1</sup> (no.)	Panicle length (cm)	1000 grains weight (g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )
F <sub>1</sub>	16.58	170.74	33.59	21.25	22.47	8.61	10.07
F <sub>2</sub>	17.62	178.30	31.85	22.34	23.53	9.80	10.83
LS	**	**	**	**	**	**	**

Note: LS = Level of Significance; \*\* = Significant at 1 % level of provability, F<sub>1</sub> = Farmers' practice based fertilizers (180-42-42 kg ha<sup>-1</sup> of Urea-TSP-MoP) and F<sub>2</sub> = BARC recommended fertilizers (300-112-126-75-11 kg ha<sup>-1</sup> of Urea-TSP-MoP-CaSO<sub>4</sub>-ZnSO<sub>4</sub>)

Table 2. Effect of agronomic practices on the yield and yield contributing characters of *boro rice* (*cv.* BRRI dhan58) in the Bahadurpur village of Dekar *haor* area

Agronomic practices	Effective tillers hill <sup>-1</sup> (no.)	Grains panicle <sup>-1</sup> (no.)	Sterile spikelets panicle <sup>-1</sup> (no.)	Panicle length (cm)	1000 grains weight (g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )
P <sub>1</sub>	17.16	173.65	33.48	21.76	22.75	9.20	10.45
P <sub>2</sub>	17.10	174.64	32.34	21.82	23.20	9.18	10.43
P <sub>3</sub>	17.05	175.28	32.34	21.82	23.05	9.22	10.46
LS	NS	NS	NS	NS	NS	NS	NS

Note: LS = Level of Significance, NS = Not-significant, P<sub>1</sub> = Farmers' agronomic practice, P<sub>2</sub> = Proper seedling age and proper spacing and P<sub>3</sub> = Proper seedling age and proper spacing + Integrated Pest Management (IPM)

Table 3. Effect of fertilizer packages and agronomic practices on the yield and yield contributing characters of *boro* rice (cv. BRR1 dhan58) in the Bahadurpur village of Dekar *haor* area

Fertilizers × Agronomic practice	Effective tillers hill <sup>-1</sup> (no.)	Grains panicle <sup>-1</sup> (no.)	Sterile spikelets panicle <sup>-1</sup> (no.)	Panicle length (cm)	1000 grains weight (g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )
F <sub>1</sub> P <sub>1</sub>	16.68	169.04	33.88	21.22	22.20	8.67	10.04
F <sub>1</sub> P <sub>2</sub>	16.64	171.28	33.24	21.23	22.70	8.64	10.08
F <sub>1</sub> P <sub>3</sub>	16.42	171.92	33.64	21.30	22.50	8.51	10.08
F <sub>2</sub> P <sub>1</sub>	17.64	178.26	33.72	22.29	23.30	9.76	10.86
F <sub>2</sub> P <sub>2</sub>	17.56	178.00	31.04	22.40	23.70	9.75	10.77
F <sub>2</sub> P <sub>3</sub>	17.68	178.64	30.80	22.34	23.60	9.94	10.85
LS	NS	NS	*	NS	NS	NS	NS
CV%	2.10	1.04	4.23	1.12	2.41	3.02	1.46

Note: LS = Level of Significance, NS = Non-significant, \* = Significant at 5 % level of provability, CV (%) = Coefficient of Variance, F<sub>1</sub> = Farmers' practice based fertilizers (180-42-42 kg ha<sup>-1</sup> of Urea-TSP-MoP), F<sub>2</sub> = BARC recommended fertilizers (300-112-127-75-11 kg ha<sup>-1</sup> of Urea-TSP-MoP-CaSO<sub>4</sub>-ZnSO<sub>4</sub>), P<sub>1</sub> = Farmers' agronomic practice, P<sub>2</sub> = Proper seedling age and proper spacing and P<sub>3</sub> = Proper seedling age and proper spacing + Integrated Pest Management (IPM)

Table 4. Nutrients status of initial and post-harvest soil of experimental field in the Bahadurpur village of Dekar *haor* area

Fertilizers × Agronomic practice	pH	Total-N %	OM %	Available P (ppm)	Exchangeable K (meq100 g <sup>-1</sup> )	Available S (ppm)
F <sub>1</sub> P <sub>1</sub>	4.30	0.12	3.00	5.20	0.18	29
F <sub>1</sub> P <sub>2</sub>	4.40	0.12	2.90	5.60	0.19	28
F <sub>1</sub> P <sub>3</sub>	4.40	0.12	2.88	5.50	0.19	29
F <sub>2</sub> P <sub>1</sub>	4.30	0.14	3.10	5.30	0.20	35
F <sub>2</sub> P <sub>2</sub>	4.30	0.14	3.05	5.10	0.23	36
F <sub>2</sub> P <sub>3</sub>	4.40	0.15	3.10	5.60	0.25	36
Initial Soil	4.90	0.11	2.90	4.00	0.15	27

Note: OM = Organic matter, F<sub>1</sub> = Farmers' practice based fertilizers (180-42-42 kg ha<sup>-1</sup> of Urea-TSP-MoP), F<sub>2</sub> = BARC recommended fertilizers (300-112-127-75-11 kg ha<sup>-1</sup> of Urea-TSP-MoP-CaSO<sub>4</sub>-ZnSO<sub>4</sub>), P<sub>1</sub> = Farmers' agronomic practice, P<sub>2</sub> = Proper seedling age and proper spacing and P<sub>3</sub> = Proper seedling age and proper spacing + Integrated Pest Management (IPM)

## Conclusion

The BARC recommended fertilizers (F<sub>2</sub>) with proper seedling age and proper spacing + along with Integrated Pest Management (P<sub>3</sub>) combindly produced the highest yield (9.94 t ha<sup>-1</sup>). This indicated that it could be recommended to the farmers of *haor* area for getting higher yield of boro rice (cv. BRR1 dhan58) using similar soil and environment.

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