

Effect of integrated use of manure and fertilizer on the yield and yield components of *Boro* rice (cv. BRRI dhan55)

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Abstract: An experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh in *Boro* season (January to May 2014) to find out the effect of integrated use of manure and fertilizer on yield and yield components of *Boro* rice (cv. BRRI dhan55). The experiment consisted of twelve treatments: Control (no fertilizer) (T₁), recommended dose of inorganic fertilizer (T₂), full dose of USG 2.7g per four hill in every alternative row and full dose of other inorganic fertilizer (T₃), full dose of poultry manure at the rate of 5 t ha⁻¹ (T₄), cow dung at the rate of 10 t ha⁻¹ (T₅), poultry manure 2.5 t ha⁻¹ + 75% PU (prilled urea) and full dose other inorganic fertilizer (T₇), poultry manure 2.5 t ha⁻¹ + 75% PU and full dose other of inorganic fertilizer (T₈), cow dung 5 t ha⁻¹ + 75% PU and full dose other of inorganic fertilizer (T₉), USG 1.8g per four hill in every alternative row + full dose of other inorganic fertilizer + cow dung 5 t ha⁻¹ (T₁₀), USG 1.8g and full dose of other inorganic fertilizer + Poultry manure 2.5 t ha⁻¹ (T₁₁), USG 1.8g + 1/3 PU and recommended dose of other inorganic fertilizer at panicle initiation stage (T₁₂). The experiment was laid out in a randomized complete block design with three replications. The tallest plant (94.14 cm), highest number of total tillers hill⁻¹ (17.33), effective tillers hill⁻¹ (12.16), longest panicle (24.41 cm), total spikelets panicle⁻¹ (109.64), highest grains panicle⁻¹ (103.42), highest sterile spikelets panicle⁻¹ (19.55) and weight of thousand grains (31.18 g) were recorded when 2.7 g USG was applied per four hill in every alternate row while the lowest values were recorded in control plots. The highest grain yield (4.90 t ha⁻¹) was recorded when the crop was fertilized with 2.7 g USG per four hill and other inorganic fertilizer followed by cow dung 5 t ha⁻¹ + 75% prilled urea and full dose other inorganic fertilizer while the lowest one (2.98 t ha⁻¹) was recorded in control plots. So it can be concluded that BRRI dhan55 can be fertilized with USG 2.7 g per four hill and other inorganic fertilizers to obtain the highest grain yield.

Key words: Poultry manure, Cowdung, Inorganic fertilizers, USG, *Boro* rice, Yield.

Introduction

Bangladesh is one of the most important rice growing countries of the world. Bangladesh ranks fourth among the rice producing countries of the world following China, India, and Indonesia. About 75.61% of cropped area of Bangladesh is used for rice cultivation with annual production of 33.83 million tons from 11.41 million hectares of land (BBS, 2013). *Boro* rice covers about 48.97% of total rice area and contributes to 58.0% of total rice production in the country (BBS, 2012). Rice production area is decreasing day by day due to high population pressure. Therefore, attempts should be taken to increase the yield per unit area by using integrated nutrient management practices. Depletion of soil fertility has been identified as a major constraint for higher crop yield. The repeated use of inorganic fertilizers alone fails to sustain desired yield, impairs the physical condition and reduces the organic matter content of soils (Rabindra *et al.*, 1985; Bhatia and Shukla, 1982; Lal and Mathur, 1988). So, integrated use of organic and inorganic fertilizers has been found to be promising in obtaining sustainable crop productivity on a long term basis under modern intensive cropping, besides meeting the nutrients turn over in the soil plant systems. This has been amply proved by the long term fertilizer experiments (Nambiar and Abrol, 1989). This indicates that an integrated use of organic and inorganic fertilizers is proposed to be an effective approach for sustainable crop production. Similar reports are available elsewhere (Rabindra *et al.*, 1985); Bhatia and Shukla (1982). Application of manures and different doses of urea N fertilizer significantly increased the yield components, grain and straw yields of rice (Rahman *et al.*, 2009).

BRRI dhan55 is a new released variety which can be grown in the coastal regions of Bangladesh, because it is a salinity tolerant variety. So, integrated use of manure and fertilizers might be necessary for maximizing the yield of BRRI dhan55 to increase the annual production for the

increasing population of Bangladesh. It can thus play an important role to augment the yield and production of rice to attain self-sufficiency in food. Under the above circumstances, the present study was undertaken to evaluate the integrated use of manure and inorganic fertilizer for maximizing the yield of BRRI dhan55.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh in *Boro* season (January to May 2014). The experimental site belongs to the Sonatola series of Old Brahmaputra Floodplain Agro-ecological Zone (AEZ-9) having non-calcareous dark grey floodplain soils. The soil was silt loam having pH 6.5. Soil contained 1.67% organic matter, 0.10% total N, 26.0 ppm available P, 0.14 (me) % exchangeable K and 13.9 ppm available S. The experiment consisted of twelve treatments- control (no manure and fertilizer) (T₁), recommended dose of inorganic fertilizer (T₂), full dose of USG 2.7g per four hill in every alternative row and full dose of other inorganic fertilizer (T₃), full dose of poultry manure at the rate of 5 t ha⁻¹ (T₄), cow dung at the rate of 10 t ha⁻¹ (T₅), poultry manure 2.5 t ha⁻¹ (T₆), cow dung 5 t ha⁻¹ + 50% PU (prilled urea) and full dose other inorganic fertilizer (T₇), poultry manure 2.5 t ha⁻¹ + 75% PU and full dose other of inorganic fertilizer (T₈), cow dung 5 t ha⁻¹ + 75% PU and full dose other of inorganic fertilizer (T₉), USG 1.8g per four hill in every alternative row + full dose of other inorganic fertilizer + cow dung 5 t ha⁻¹ (T₁₀), USG 1.8g and full dose of other inorganic fertilizer + poultry manure 2.5 t ha⁻¹ (T₁₁), USG 1.8g + 1/3 PU and recommended dose of other inorganic fertilizer at panicle initiation stage (T₁₂). The experiment was laid out in a randomized complete block design with three replications. The land was first opened with a tractor drawn disc plough and finally prepared by ploughing and cross ploughing with country plough followed by laddering. Weeds and stubble were

removed from the field as much as possible after leveling. The land was finally prepared and the experiment was laid out on 18 January 2014. The seedlings of BRR1 dhan55 were transplanted on 21 January 2014 @ 2 seedlings hill⁻¹. Cowdung and poultry manure were applied as basal dose (as per treatment) on 20 January before transplanting of rice seedlings. Urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate @ 260, 100, 120, 60 and 10 kg ha⁻¹, respectively as per treatment. The whole amount of triple super phosphate, muriate of potash, gypsum and zinc sulphate were applied at the time of final land preparation as per experimental specification. Urea was applied in 3 equal splits at 15, 30, and 45 days after transplanting (DAT) as per treatment specification. USG were placed manually at 6-8 cm depth at the centre of four hill of two adjacent rows at 10 DAT as per experimental specification. Intensive care was taken during the growing period for the adequate growth and development. Weeding was done at 25 and 40 DAT. The crop was irrigated during growth period as and when necessary. At full maturity prior to harvest five hills were randomly selected (excluding boarder hills and central 1m × 1m) from each plot to record the data on yield components. Maturity of crops was determined when 90% of the grains became golden yellow in color. Crop of central 1m² area were harvested to record the data on grain and straw yields on 7 May 2014. Then the harvested crops of each plot was bundled separately, tagged properly and brought to threshing floor. The crops were then threshed and the fresh weights of grain and straw were recorded plot-wise. The grains were cleaned and finally the weight was adjusted to 14% moisture content. The straw was sun dried and the yields of grain and straw plot⁻¹ were recorded and converted to t ha⁻¹. The collected data were analyzed by using "Analysis of Variance" technique and the differences among treatment means were adjudged by the Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Crop characters, yield components and yield of BRR1 dhan55 were significantly influenced by integrated use of manure and inorganic fertilizer. The maximum plant height (94.14 cm) was found in T₃ treatment (recommended full dose of USG 2.7g per four hill) and the lowest plant height (81.77 cm) was found in T₁ (control) (Table 1). The plant heights obtained in T₅ (cowdung @ 10 t ha⁻¹) treatment and T₆ (poultry manure @ 2.5 t ha⁻¹) treatment were identical to that of T₁ (control). Similar results were reported by Haga and Dayag (1989). Higher dose of USG increased plant height significantly, which was supported by Islam *et al.*, (2014). Increased plant height due to increased level of USG might be associated with stimulating effect of nitrogen on cell division and cell elongation. The highest number of total tillers hill⁻¹ (17.33) was obtained with T₃ (2.7g USG) treatment and the lowest one (6.08) was found in T₁ (control) treatment. Total tillers hill⁻¹ was positively correlated with level of nitrogen application as reported by BRR1 (1991) and Kamal *et al.* (1999).

The highest number of effective tillers hill⁻¹ (12.16) was obtained in T₃ treatment (2.7g USG) followed by T₈

(poultry manure 2.5 t ha⁻¹ + 75% PU and full dose of other inorganic fertilizer) whereas the lowest one (6.50) was found in T₁ treatment (control). Ahmed and Rahman (1991) differing in view that organic and inorganic fertilizers increased tiller number hill⁻¹. Adequacy of nitrogen as USG probably favoured the cellular activities during panicle development which led to increased number of effective tillers hill⁻¹. Singh and Singh (1986) also expressed similar views. Numerically the highest number of non-effective tillers hill⁻¹ (0.91) was obtained in T₃ (2.7 g USG) and T₄ (poultry manure @ 5 t ha⁻¹) and the lowest one (0.33) was found in T₁ (control) treatment. The longest panicle (24.41cm) was obtained in T₃ treatment (recommended dose of USG 2.7g) and the lowest one was found (17.38cm) in T₁ treatment (control). Nassai and Varg (1982) found that shorter panicle was obtained when applied lower doses of fertilizer. The highest number of grains panicle⁻¹ (103.42) was obtained in T₃ (2.7g USG) which was as good as (97.64) T₉ (cowdung 5 t ha⁻¹ + 75% PU and full dose of other inorganic fertilizer) and the lowest one was recorded in control treatment. Grains panicle⁻¹ in *Boro* rice increased due to recommended dose of USG (2.7 g/4hills) was reported by Roy (2013). The number of sterile spikelets panicle⁻¹ was maximum (19.55) in T₃ treatment (recommended dose of USG 2.7g) and minimum (8.51) in T₁ treatment (control). The highest 1000-grain weight (31.18g) was found in T₃ (2.7g USG per four hills) followed by recommended dose of inorganic fertilizer and the lowest one (24.26 g) was found in T₁ (control treatment). This result differed with that of Roy (2013). The highest grain yield (4.90 t ha⁻¹) was recorded in T₃ treatment (2.7g USG) followed by T₉ (4.39) and the lowest one (2.98 t ha⁻¹) was recorded in T₁ treatment (control). The highest grain yield was favoured by crop characters like highest effective tillers hill⁻¹ and highest number of grains panicle⁻¹. This result is in conformity with the findings of Singh and Pillar (1996). The highest straw yield (6.23 t ha⁻¹) was found in T₁₁ treatment (USG 1.8g and full dose of other inorganic fertilizer and poultry manure 2.5 t ha⁻¹) and the lowest straw yield (4.06 t ha⁻¹) was recorded in T₅ treatment (cow dung 10 t ha⁻¹). In case of straw yield, T₃ (2.7g USG), T₇ (cowdung 5 t ha⁻¹ + 50% PU and full dose other inorganic fertilizer), T₈ (Poultry manure 2.5 t ha⁻¹ + 75% PU and full dose of other inorganic fertilizer), T₉ (cow dung 5 t ha⁻¹ + 75% PU and full dose other of inorganic fertilizer), T₁₀ (USG 1.8g and full dose other inorganic fertilizer + cow dung 5 t ha⁻¹) and T₁₂ treatments (USG 1.8g + 1/3 PU recommended dose and full dose other inorganic fertilizer at panicle initiation stage) were comparable to T₁₁ treatment (USG 1.8g and other inorganic fertilizer + poultry manure 2.5 t ha⁻¹) in respect of straw yield. Alamet *et al.* (1995) also found similar results. Biological yield was significantly affected by integrated fertilizer management. The highest biological yield (10.90 t ha⁻¹) was obtained in T₃ treatment (recommended dose of USG 2.7g) and the lowest biological yield (7.12 t ha⁻¹) was obtained in T₅ treatment (cow dung 10 t ha⁻¹). Harvest index was significantly affected by integrated fertilizer management. The highest harvest index (45.09%) was recorded in T₃ treatment (2.7g USG and full dose of inorganic fertilizer) and the lowest

harvest index (39.16%) was found in T₁₂ treatment (USG 1.8g +1/3 prilled urea and recommended dose of other inorganic fertilizer).

Table 1. Effect of integrated use of manure and inorganic fertilizers on crop characters, yield components and yield of *Boro* rice (cv. BRRI dhan55)

Treatments	Plant height (cm)	Total tillers hill ⁻¹	Effective tillers hill ⁻¹	Non-effective tillers hill ⁻¹	Panicle length (cm)	Total spikelets panicle ⁻¹	Gains panicle ⁻¹
T ₁	81.77e	6.08f	6.50e	0.33	17.38f	88.01d	84.16c
T ₂	91.62ab	8.25ef	7.00cde	0.66	20.26de	93.48cd	88.67c
T ₃	94.14a	17.33a	12.16a	0.91	24.41a	109.64a	103.42a
T ₄	89.08abcd	8.66ef	7.75bcde	0.91	21.09bcd	96.61bc	89.00c
T ₅	84.06de	7.08ef	6.66de	0.41	20.70cd	101.29bc	89.00bc
T ₆	85.72cde	8.91de	8.50bcde	0.41	21.18bcd	100.59bc	91.81bc
T ₇	89.76abc	8.55ef	7.83bcde	0.75	18.79ef	100.17bc	90.04bc
T ₈	88.15bcd	11.50cd	9.58b	0.51	21.05bcd	100.51bc	89.35c
T ₉	89.83abc	15.91ab	8.91bcd	0.51	22.82ab	102.12ab	97.64ab
T ₁₀	93.25ab	13.91bc	9.16bc	0.75	22.32bc	103.65ab	91.63bc
T ₁₁	92.58ab	9.75de	9.16bc	0.66	21.75bcd	96.44bc	90.65bc
T ₁₂	92.85ab	9.41de	8.83bcde	0.58	21.94bcd	102.36ab	88.40c
Level of sign.	**	**	**	NS	**	**	**
CV (%)	3.70	15.38	16.74	49.54	5.23	4.94	5.36

Contd.

Treatments	Sterile spikelets panicle ⁻¹	Weight of 1000 grains (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
T ₁	8.51e	24.26e	2.98d	4.15d	7.13d	41.78bcde
T ₂	8.80e	29.1b	4.07bc	5.32bc	9.39bc	43.32abc
T ₃	19.55a	31.18a	4.90a	5.99ab	10.90a	45.09a
T ₄	8.94e	28.71bc	3.83c	4.77cd	8.60c	44.70ab
T ₅	10.37de	28.02bcd	3.06d	4.06d	7.12d	43.28abc
T ₆	11.45cde	28.29bcd	3.94c	5.25bc	9.19bc	42.98abc
T ₇	10.12e	28.94bc	3.88c	5.46abc	9.34bc	41.49cde
T ₈	13.83bcd	28.48bcd	4.03bc	5.53abc	9.57bc	42.19abcde
T ₉	11.14cde	28.79bc	4.39b	5.97ab	10.37ab	42.33abcd
T ₁₀	15.68b	28.26bcd	3.92c	5.65abc	9.58bc	41.01cde
T ₁₁	14.45bc	27.32d	4.10bc	6.23a	10.33ab	39.68de
T ₁₂	15.96b	27.79cd	3.73c	5.80ab	9.54bc	39.16e
Level of sign.	**	**	**	**	**	*
CV (%)	16.90	2.55	6.88	9.82	8.03	4.29

In a column, figures with same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

**= Significant at 1% level of probability, NS = Non-significant. T₁– Control, T₂– Recommended dose of inorganic fertilizer, T₃– Full dose of USG 2.7g per four hill in every alternate row, T₄– Full dose of poultry manure at the rate of 5 t ha⁻¹, T₅– Cow dung at the rate of 10 t ha⁻¹, T₆– poultry manure 2.5 t ha⁻¹, T₇– Cow dung 5 t ha⁻¹ + 50%PU and full dose other inorganic fertilizer, T₈– Poultry manure 2.5 t ha⁻¹ + 75%PU and full dose of other inorganic fertilizer, T₉– Cow dung 5 t ha⁻¹ + 75%PU and full dose other of inorganic fertilizer, T₁₀– USG 1.8g and full dose other inorganic fertilizer + Cow dung 5 t ha⁻¹, T₁₁– USG 1.8g and full dose other inorganic fertilizer + Poultry manure 2.5 t ha⁻¹, T₁₂– USG 1.8g +1/3 PU recommended dose and full dose of other inorganic fertilizer applied at panicle initiation stage.

From the study it can be concluded that USG at 2.7g per four hill in every alternate row along with other inorganic fertilizer is the ideal dose for BRRI dhan55 to obtain the highest grain yield.

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