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PERFORMANCE OF DIFFERENT ORGANIC FERTILIZERS IN IMPROVING GROWTH AND YIELD OF BORO RICE

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ABSTRACT

A field experiment was conducted at two locations i.e. at Soil Science Field of Bangladesh Agricultural University and at Farmer's field of Fakirakanda village of Mymensingh Sadar to evaluate the effects of different organic fertilizers on the growth and yield of rice (BRRI dhan28). The experiments at each location containing seven treatments were laid out in a randomized complete block design with three replications. The treatments were T_0: Control, T_1: 75% RFD; T_2: 100% RFD, T_3: 75% RFD + Kazi Jaibo Shar (5 tha^{-1}), T_4: 75% RFD + Kazi Jaibo Shar (3 t ha^{-1}), T_5: 75% RFD + Poultry manure (3 t ha^{-1}) and T_6: 75% RFD + Cow dung (5 t ha^{-1}). Application of poultry manure as well as Kazi Jaibo Shar showed positive effects on yield attributes, grain and straw yields of rice, nutrient (N, P, K and S) contents and uptake by grain, straw and in total. The performance of 75% RFD with poultry manure @ 3 t ha^{-1} was the best in producing yield components, grain and straw yields of rice. At both locations, the performance of same dose (3 t ha^{-1}) of poultry manure and Kazi Jaibo Shar was almost similar in producing growth and yield contributing characters, grain and straw yields, - nutrient content and uptake by rice while each of these manures compensated up to 25% of recommended chemical fertilizers. Therefore, considering the soil health, poultry manure or Kazi Jaibo Shar @ 3 t ha^{-1} is recommended for growth and yield enhancement in rice.

Keywords: Cow dung, poultry manure, Kazi Jaibo Shar, rice, yield, nutrient uptake

INTRODUCTION

Bangladesh is predominantly an agrarian country where agriculture sector contributes about 17 percent to the country GDP and employs more than 45 percent of total labour force (BBS, 2016). Rice (*Oryza sativa*) is the most important cereal crop and

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the staple dietary item for the people in Bangladesh and the agriculture sector of the country is largely dominated by rice cultivation. The total area and production of rice are about 11.38 million hectares and 34.71 million metric tons, respectively (BBS, 2016). The average yield of rice in Bangladesh is comparatively lower than those of other South East Asian countries like China, Japan, Korea and Indonesia etc. which might be due to soil fertility depletion as well as poor fertilizer management. Due to ever-rising population, food security has become a key concern in Bangladesh. Consequently, maintenance of soil fertility is necessary for sustainable agriculture and future food security (Majumdar et al., 2016). Hence, to achieve improved and sustainable crop production, the strategy of organic matter and balanced fertilizer management is essential.

Increasing cropping intensity, use of modern varieties (high yielding varieties and hybrids), cultivation of high biomass potential crops, nutrient leaching and unbalanced fertilizer application, with no or little addition of organic manure have resulted in nutrient mining from Bangladesh soils (BARC, 2012). To stop nutrient mining, it is not justified to increase the use of only inorganic fertilizers but the use of organic sources of plant nutrients viz. cow dung, poultry manure, compost, green manure should also be considered. Many farmers use higher amount of inorganic fertilizers while they seldom use organic fertilizers e.g. compost, poultry manure, cow dung. This practice creates imbalance use of fertilizers, which in turn produces a negative impact on crop production. The beneficial aspects of cow dung, poultry manure and compost in increasing crop growth and productivity and maintaining soil fertility have been proven. To increase the efficiency of manure and fertilizer in rice cultivation, it is necessary to identify the suitable combination of manure and fertilizer (Mitu et al. 2017). In recent years, the use of organic fertilizers as alternatives of chemical fertilizers in order to enhance rice production has gained much significance. Kazi Jaibo Shar is a newly developed organic fertilizer based on poultry manure, which is enriched with various nutrient elements. The present study was conducted to clarify the effectiveness of different organic fertilizers at various locations for improving growth, yield and nutritional quality of rice for use as substitute of inorganic fertilizers.

MATERIALS AND METHODS

A comparative study was performed at two different locations viz. Soil Science Field laboratory of Bangladesh Agricultural University, Mymensingh and a farmer's field at Fakirakanda village of Mymensingh Sadar during the boro season of 2017-2018. The soils of the experimental sites belong to the Sonatala series under the AEZ 9 (Old Brahmaputra Floodplain). The soil of BAU farm was silt loam in texture having

pH 6.27, organic matter content 1.95%, total N 0.136%, available P 3.16 ppm, exchangeable K 0.095 % and available S 10.5 ppm whereas the soil of farmer's field was loam in texture with pH 6.39, organic matter content 2.5%, total N 0.168%, available P 4.76 ppm, exchangeable K 0.13 me% and available S 12.47 ppm.

. The treatments at both locations were T_0 (Control), T_1 (75% RFD), T_2 (100% RFD), T_3 (75%RFD + KaziJaiboShar5 t ha^{-1}), T_4 (75% RFD + Kazi Jaibo Shar 3 t ha^{-1}), T_5 (75% RFD + Poultry manure 3 t ha^{-1}) and T_6 (75% RFD + Cow dung 5 t ha^{-1}). Experiments was laid out in a Randomized Complete Block Design (RCBD) with three replications and the size of unit plot was 4 m × 3m. BRRI dhan 28 was used for both of the experiments. Thirty-five days old seedlings of rice were transplanted in the experimental plots on 06 February, 2018 by maintaining a spacing of 20 cm × 20 cm.

The doses of nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and zinc (Zn) were 150, 20, 65, 18 and 2 kg ha^{-1} following the Fertilizer Recommendation Guide (BARC, 2012) in form of urea, triple super phosphate (TSP), muriate of potash (MoP), gypsum and zinc oxide, respectively. The full doses of chemical fertilizers except urea were applied before transplanting as basal dose to all the experimental plots. Organic manures viz. poultry manure, cow dung and Kazi Jaibo Shar were also applied during final land preparation. Urea was applied in three equal splits as top dressing; first installment at 12 days after transplanting (DAT), second installment at 30 DAT i.e. at maximum tillering stage and third installment at 50 DAT i.e. booting stage of the crop.

Different intercultural operations such as irrigation, weeding, pest control were performed as and when required. The rice was harvested at full maturity on 10 June 2018.The data on growth and yield parameters such as plant height, number of effective tillers $hill^{-1}$, panicle length, number of filled and unfilled grains $panicle^{-1}$, 1000-grain weight, dry and fresh weight of root were recorded at harvest. The grain and straw yields were measured plot wise and expressed as t ha^{-1} on sundry basis.

The collected grain and straw samples from each plot were dried in an oven at 65°C for about 48 hours and then ground by a grinding machine. Later, the ground samples were sieved through a 20-mesh sieve. The ground plant materials were stored in paper bags separately and placed in a desiccator. The plant samples were chemically analyzed for determination of N, P, K and S contents. The total N, available P, exchangeable K and available S of plant samples were determined following semi-micro Kjeldahl method (Bremner and Mulvaney, 1982), modified Olsen method (Olsen *et al.*, 1954), NH_4OAc extraction method (Knudsen *et al.*, 1982), and $CaCl_2$ extraction method (Williams and Steinbergs,1959), respectively.

After chemical analysis of grain and straw samples of rice, the nutrient uptake was calculated from the nutrient content and yield of the crop using the following formula;

$$TU = \frac{NC \times Y}{100}$$

where, TU = total nutrient uptake (kg ha^{-1}), NC = nutrient concentration (%), and Y = yield (kg ha^{-1}).

All the data were statistically analyzed by F-test and the mean differences were ranked by Duncan's New Multiple Range Test (DMRT) (Gomez and Gomez, 1984). Differences at $p<0.05$ were considered significant.

RESULTS AND DISCUSSION

Growth parameters of BRRI dhan28

Application of Kazi Jaibo Shar had significant effects on the growth parameters of BRRI dhan28 viz. plant height, root length, fresh and dry weight of root $plant^{-1}$ at both BAU farm as well as in Farmer's field (Table 1). At BAU farm, the highest value for plant height (99.40 cm) was observed in T_5 treatment (75% RFD + Poultry manure 3 t ha^{-1}) which was statistically similar with those of T_3 treatment (75% RFD + Kazi Jaibo Shar 5 t ha^{-1}) and T_4 (75% RFD + Kazi Jaibo Shar 3 t ha^{-1}) treatments. The shortest plant of 82.33 cm was found in T_6 treatment (75% RFD + Cow dung 5 t ha^{-1}). The tallest plant of 83.33 cm at farmer's field was found in T_2 (100% RFD) which was statistically identical with those of T_3, T_4 and T_5. Root length was statistically similar in six treatments but significantly better to control at both locations. For both fresh and dry weight of roots, the highest values (23 and 8.27 g, respectively) were observed in T_4 treatment with the lowest values in control (14.33 and 3.87 g, respectively). The growth parameters of BRRI dhan28 grown at Farmer's field had more or less similar trend (Table 1). The maximum values for root length (14.27 cm), fresh weight of root (23.63 g) and dry weight of root (7.70 g) $plant^{-1}$ were recorded from T_4 (Table 1) where Kazi Jaibo Shar was applied @ 3 t ha^{-1} with 75% RFD. Tazmin et al. 2015 and Islam et al. 2012 also reported that application of manure and fertilizers enhanced the yield contributing the character of rice.

Table 1. Effect of different organic fertilizers on growth parameters of BRRI dhan28

Treatments	BAU farm				Farmer's field			
	Plant height (cm)	Root length (cm)	Fresh weight of root (cm)	Dry weight of root (cm)	Plant height (cm)	Root length (cm)	Fresh weight of root (cm)	Dry weight of root (cm)
T_0	83.00c	9.63b	14.33c	3.87c	67.93bc	7.70b	15.67c	3.20b
T_1	98.40ab	13.70a	19.60ab	6.80ab	78.00ab	13.20a	21.70a	6.50ab
T_2	87.93bc	14.07a	21.80a	6.83ab	83.33a	12.60a	22.83a	7.17a
T_3	90.37abc	14.67a	19.13ab	5.33bc	82.73a	12.53a	22.03a	6.60ab
T_4	96.07ab	13.77a	23.00a	8.27a	82.80a	14.27a	23.63a	7.70a
T_5	99.40a	13.97a	19.07b	7.53ab	80.73ab	13.80a	23.47a	7.23a
T_6	82.33c	13.60a	17.90b	4.93bc	62.47c	12.10a	18.90b	3.77b
CV (%)	6.54	11.82	18.94	22.84	9.49	15.45	6.78	27.74
SE(±)	4.87	1.29	3.02	1.13	5.95	1.55	1.17	1.42

$T_{0:}$ Control; T_1: 75% RFD; T_2: 100% RFD; T_3: 75% RFD + Kazi Jaibo Shar (5 tha^{-1}); T_4: 75% RFD + Kazi Jaibo Shar (3 t ha^{-1}); T_5: 75% RFD + Poultry manure (3 tha^{-1}); T_6: 75% RFD + Cow dung (5 tha^{-1}); CV = Co-efficient of variation; SE = Standard error of means

Yield parameters of BRRI dhan28

Number of effective tillers $hill^{-1}$, panicle length, number of filled grains $panicle^{-1}$ and number of unfilled grains $panicle^{-1}$were significantly affected by different treatments while 1000-grain weight remained statistically unaffected (Table 2). At BAU farm, the treatment T_5 (75% RFD + Poultry manure 3 t ha^{-1}) produced the highest number of effective tillers $hill^{-1}$ (15.60) and the longest panicle (23.60 cm) which were statistically similar with those of treatments T_1 (75% RFD), T_2 (100% RFD), T_3 (75% RFD + Kazi Jaibo Shar 5 t ha^{-1}) and T_4 (75% RFD + Kazi Jaibo Shar 3 tha^{-1}). Interestingly, the maximum number of filled grains $panicle^{-1}$ (99.47) and the minimum number of unfilled grains $panicle^{-1}$(12.27) were recorded in T_4 treatment. For most of the yield parameters (except 1000-grain weight), the lowest values were observed in control treatment. A little difference was found in the yield contributing characters of rice cultivated at Farmer's field where the highest number of effective tillers $hill^{-1}$ (16.03) was recorded in T_4 which has no statistical difference with that of T_5. Similar with the result of BAU farm, the tallest panicle of 23.60 cm and the maximum number of filled grains $panicle^{-1}$ (96.33) were observed in T_5 which were statistically identical with those of T_2, T_3 and T_4 treatments. Notably, the lowest number of effective tillers $hill^{-1}$ (10.67), the lowest panicle length (18.27 cm) and the lowest number of unfilled grains $panicle^{-1}$(8.60) were recorded in T_6 treatment where cow dung was applied @ 5 t ha^{-1} with 75% RFD. Better yield components such as higher panicle length, increased number of effective tillers $hill^{-1}$ and increased number of filled grains $panicle^{-1}$ with poultry manure with inorganic fertilizers were

also suggested by Islam et al 2018, Ali et al., 2018, Sarker et al., 2015 and Hossaen et al. (2011). Better growth under combination of organic and inorganic fertilizer treatments resulted in higher yield contributing characters that ultimately led to higher grain and straw yields of rice.

Table 2. Effect of different organic fertilizers on yield parameters of BRRI dhan28

Treatments	BAU farm					Farmer's field				
	No. of effective tillers hill^{-1}	Panicle length (cm)	No. of filled grains panicle^{-1}	No. of unfilled grains panicle^{-1}	1000-grain weight (g)	No. of effective tillers hill^{-1}	Panicle length (cm)	No. of filled grains panicle^{-1}	No. of unfilled grains panicle^{-1}	1000-grain weight (g)
T_0	8.60c	18.40c	64.80c	17.57bc	21.40	13.33b	19.40b	56.20c	23.00a	22.53
T_1	14.70a	21.60ab	95.07a	28.13a	22.60	13.23b	21.67a	77.00b	17.80ab	24.37
T_2	15.33a	21.27ab	84.07ab	28.57a	21.80	14.33ab	22.27a	80.93ab	15.60bc	24.13
T_3	14.90a	22.07ab	81.27b	13.80bc	24.87	13.40b	22.20a	81.67ab	9.93c	22.70
T_4	14.87a	23.33a	99.47a	12.27c	22.07	16.03a	22.13a	93.33ab	13.33bc	22.73
T_5	15.60a	23.60a	92.00a	15.13bc	22.17	15.47a	22.53a	96.33a	12.20bc	23.97
T_6	12.30b	19.73bc	82.00b	23.83ab	19.73	10.67c	18.27b	76.57b	8.60c	22.87
CV (%)	8.235	6.96	15.53	27.24	8.76	7.41	5.89	12.18	26.24	3.52
SE(±)	0.924	1.22	10.84	4.43	1.58	0.834	1.02	7.98	3.07	0.67

$T_{0:}$ Control; T_1: 75% RFD; T_2: 100% RFD; T_3: 75% RFD + Kazi Jaibo Shar (5 t ha^{-1}); T_4: 75% RFD + Kazi Jaibo Shar (3 t ha^{-1}); T_5: 75% RFD + Poultry manure (3 t ha^{-1}); T_6: 75% RFD + Cowdung (5 t ha^{-1}); CV = Co-efficient of variation; SE = Standard error of means

Yield of BRRI dhan28

Grain yield as well as straw yield of BRRI dhan28 was significantly influenced with application of Kazi Jaibo Shar (Table 3a). At BAU farm, the grain yield ranged from 3.67 to 6.47 t ha^{-1} whereas the straw yield ranged from 4.93 to 7.44 t ha^{-1}. For both grain and straw yields, the maximum values were observed in T_5 treatment (75% RFD + Poultry manure 3 t ha^{-1}) which were statistically similar with those of T_1 (75% RFD), T_2 (100% RFD), T_3 (75% RFD + Kazi Jaibo Shar 5 t ha^{-1}) and T_4 (75% RFD + Kazi Jaibo Shar 3 t ha^{-1}). The minimum values for both yields were found in control (T_0).

Table 3. Effect of different organic fertilizers on grain and straw yields of BRRI dhan28

Treatments	BAU farm		Farmer's field	
	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_0	3.67c	4.93c	3.17c	3.80d
T_1	5.97a	6.59ab	5.33b	6.17c
T_2	6.07a	7.24a	5.80ab	7.17ab
T_3	6.06a	7.15a	5.93ab	6.95bc
T_4	6.17a	7.07a	5.77ab	6.90bc
T_5	6.47a	7.44a	6.73a	7.89a
T_6	4.97b	5.87bc	5.70ab	6.23c
CV (%)	7.86	8.10	10.40	6.83
SE(±)	0.361	0.437	0.466	0.359

T_0: Control; T_1: 75% RFD; T_2: 100% RFD; T_3: 75% RFD + Kazi Jaibo Shar (5 t ha^{-1}); T_4: 75% RFD + Kazi Jaibo Shar (3 t ha^{-1}); T_5: 75% RFD + Poultry manure (3 t ha^{-1}); T_6: 75% RFD + Cowdung (5 t ha^{-1}); CV = Co-efficient of variation; SE = Standard error of means well as straw yield, different treatments showed their rank in the order of $T_5>T_4>T_3>T_2>T_1>T_6>T_0$.

Almost similar findings were noted in the yield of BRRI dhan28 grown at Farmer's field where the grain yield varied from 3.17 to 6.73 t ha^{-1} and the straw yield ranged from 3.80 to 7.89 t ha^{-1}. For both grain and straw yields, treatment T_5 produced the highest yields and the control produced the lowest yields. The highest yields from T_5 were statistically identical with the yields from T_2, T_3, T_4 and T_6 for grain and with the yield from T_2 for straw.

At BAU farm, the percent increase in rice yield over control ranged from 35.42 to 76.29 for grain and 19.07 to 50.91 for straw (Fig. 1). On the other hand, the percent increase in rice yield over control at farmer's field varied from 68.14 to 112.30 for grain and 62.37 to 107.63 for straw For both grain and straw yield, T_5 treatment gave the highest yield increase over control, respectively. Yield enhancement of rice by applying poultry manure in association with chemical fertilizers was reported by many researchers (Ali et al., 2018; Islam et al., 2012, 2018; Roy et al., 2018; Bhuiyan et al., 2015; Sarker et al., 2015; Tazmin et al. 2015; Issaka et al. 2014; Sangeetha et al., 2013; Hossaen et al., 2011; Hasanuzzaman et al., 2010; Myint et al., 2010).

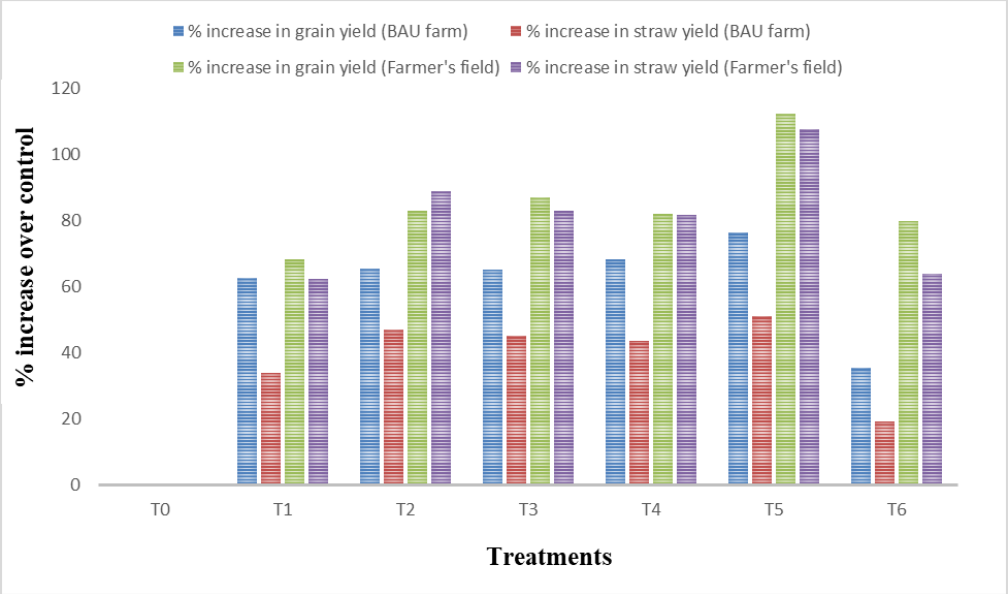

Fig. 1. Percent increase in grain and straw yield of BRRI dhan28 as influenced by application of different organic fertilizers

Nutrient content of BRRI dhan28

Application of Kazi Jaibo Shar exerted positive effects on N, P, K and S contents in rice grain and straw at both locations (Table 4a and 4b). However, a non-significant effect was observed in case of straw N content at BAU farm and straw P content at Farmer's field (Table 4b). For BAU farm, the highest N contents in rice grain and straw (1.21% and 1.05%, respectively) were recorded in T_5 (75% RFD + Poultry manure 3 t ha^{-1}). In grain samples, the highest contents of P (0.407%), K (0.173%) and S (0.358%) were found in treatment T_4 (75% RFD + Kazi Jaibo Shar 3 t ha^{-1}). On the other hand, in straw samples, the maximum contents of P (0.151%), K (1.80%) and S (0.302%) were recorded in T_1 (75% RFD), T_5 and T_4 (75% RFD + Kazi Jaibo Shar 3 t ha^{-1}), respectively.

Table 4a. Grain nutrient content of BRRI dhan28 as influenced by different organic fertilizers

Treatments	BAU farm				Farmer's field			
	% N	% P	% K	% S	% N	% P	% K	% S
T_0	0.98c	0.259d	0.135d	0.271b	0.93c	0.246d	0.129c	0.295c
T_1	1.12b	0.301c	0.145cd	0.299b	1.12b	0.291c	0.144abc	0.313bc
T_2	1.18ab	0.291cd	0.143cd	0.307b	1.16ab	0.277c	0.151abc	0.324b
T_3	1.14b	0.335b	0.155bc	0.353a	1.15ab	0.333b	0.161ab	0.366a
T_4	1.16ab	0.407a	0.173a	0.358a	1.15ab	0.377a	0.167a	0.368a
T_5	1.21a	0.381a	0.168ab	0.356a	1.20a	0.382a	0.165ab	0.357a
T_6	1.04c	0.281cd	0.143cd	0.279b	0.97c	0.273c	0.140bc	0.289c
CV (%)	3.12	5.30	6.32	6.12	3.51	4.43	8.81	4.70
SE(±)	0.0284	0.0139	0.0078	0.0159	0.0315	0.0113	0.0109	0.0127

T_0: Control; T_1: 75% RFD; T_2: 100% RFD; T_3: 75% RFD + Kazi Jaibo Shar (5 t ha^{-1}); T_4: 75% RFD + Kazi Jaibo Shar (3 t ha^{-1}); T_5: 75% RFD + Poultry manure (3 t ha^{-1}); T_6: 75% RFD + Cowdung (5 t ha^{-1}); CV = Co-efficient of variation; SE = Standard error of means

Similar trend was observed for nutrient contents in grain and straw of BRRI dhan28 cultivated at the Farmer's field. For grain samples, the highest N and P contents (1.20% and 3.82%, respectively) were recorded in T_5 treatment while the highest K and S contents (0.167% and 0.368%, respectively) were found in T_4 treatment. On the other hand, for straw samples, the highest values for N, P, K and S contents (1.08%, 0.144%, 1.75% and 0.291%, respectively) were noted in T_3, T_2, T_5 and T_4, respectively. In general, there was no significant difference between T_5 and T_4 for nutrient content in grain and straw samples at both locations. These findings are partially similar to those of Saha et al., 2014; Hossain et al. 2010; Myint et al., 2010 who obtained higher contents of nutrient elements such as N, P, K and S in rice by applying poultry manure with inorganic fertilizers.

Table 4b. Straw nutrient content of BRRI dhan28 as influenced by different organic fertilizers

Treatments	BAU farm				Farmer's field			
	% N	% P	% K	% S	% N	% P	% K	% S
T_0	0.96	0.121cd	1.43d	0.202f	0.91b	0.126	1.36d	0.221e
T_1	0.98	0.151a	1.48cd	0.250c	0.99ab	0.143	1.47cd	0.257bcd
T_2	0.99	0.142ab	1.69abc	0.231d	1.00ab	0.144	1.50abc	0.242cde
T_3	1.02	0.126bcd	1.65abcd	0.251c	1.08a	0.135	1.60ab	0.265abc
T_4	1.01	0.122cd	1.79ab	0.302a	1.02ab	0.131	1.68ab	0.291a
T_5	1.05	0.134bc	1.80a	0.271b	1.07a	0.143	1.75a	0.281ab
T_6	0.97	0.115d	1.56bcd	0.221e	0.97ab	0.124	1.49abc	0.235de
CV (%)	4.47	6.90	7.50	2.18	5.62	10.92	9.28	6.02
SE(±)	0.0365	0.0073	0.0997	0.0044	0.0461	0.012	0.1175	0.0126

$T_{0:}$ Control; T_1: 75% RFD; T_2: 100% RFD; T_3: 75% RFD + Kazi Jaibo Shar (5 tha^{-1}); T_4: 75% RFD + Kazi Jaibo Shar (3 t ha^{-1}); T_5: 75% RFD + Poultry manure (3 t ha^{-1}); T_6: 75% RFD + Cow dung (5 t ha^{-1}); CV = Co-efficient of variation; SE = Standard error of means

Nutrient uptake by BRRI dhan28

Uptake of nutrients (N, P, K and S) by BRRI dhan28 varied significantly due to addition of Kazi Jaibo Shar with inorganic fertilizers (Table 5a and 5b). At BAU farm, the values for grain N-uptake, straw N-uptake and total N-uptake varied from 36.0 to 78.0, 47.3 to 75.7 and 83.7 to 152.3 kg ha^{-1}, respectively (Table 5a). The maximum values for both grain N-uptake and total N-uptake were found in T_5 treatment while the maximum value for straw-N-uptake was observed in T_4. Again, the uptake of grain-P, straw P and total P ranged from 9.7 to 25.0, 6.0 to 10.3, and 15.7 to 34.0 kg ha^{-1}, respectively. In the same manner, T_4 and T_5 performed the best in grain P uptake and straw P-uptake, respectively; while total P-uptake was same for both treatments.

Table 5a. Effect of different organic fertilizers on N and P uptake by BRRI dhan28

Treatments	BAU farm						Farmer's field					
	N uptake (kg ha^{-1})			P uptake (kg ha^{-1})			N uptake (kg ha^{-1})			P uptake (kg ha^{-1})		
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
T_0	36.0d	47.3c	83.7d	9.7c	6.0b	15.7d	29.7c	35.0c	65.0c	8.0d	5.0c	12.3
T_1	66.3b	64.7ab	131.0b	18.0b	10.0a	27.7b	60.0b	60.7b	120.3b	15.3c	9.0ab	24.0d
T_2	71.3ab	71.7a	143.3ab	17.3b	10.3a	28.0b	67.0b	71.7ab	139.0ab	16.0c	10.7a	26.3cd
T_3	68.7ab	73.0a	142.3ab	20.3b	9.0a	29.3b	68.3ab	75.0ab	143.3ab	19.7b	9.3ab	29.3bc
T_4	71.7ab	75.7a	147.4ab	25.0a	9.0a	34.0a	66.3b	70.0ab	136.3ab	21.7b	9.0ab	30.7b
T_5	78.0a	74.7a	152.3a	24.7a	9.3a	34.0a	80.7a	84.0a	164.7a	25.7a	11.0a	37.3a
T_6	52.0c	57.0bc	108.7c	16.0bc	7.0b	23.0c	55.3b	66.0b	130.0b	15.7c	7.7b	23.3d
CV (%)	7.94	9.22	6.86	12.81	8.96	8.20	11.48	11.35	11.57	10.83	14.83	8.81
SE (±)	0.0041	0.005	0.0073	0.002	0.0006	0.0018	0.0057	0.0061	0.0121	0.0015	0.0011	0.0019

T_0: Control; T_1: 75% RFD; T_2: 100% RFD; T_3: 75% RFD + Kazi Jaibo Shar (5 tha^{-1}); T_4: 75% RFD + Kazi Jaibo Shar (3 t ha^{-1}); T_5: 75% RFD + Poultry manure (3 tha^{-1}); T_6: 75% RFD + Cowdung (5 tha^{-1}); CV = Co-efficient of variation; SE = Standard error of means

At farmer's field, the values for grain-N uptake, straw N-uptake and total N uptake ranged from 29.7 to 80.7, 35.0 to 84.0 and 65.0 to 164.7 kg ha^{-1}, respectively (Table 5a). The highest values for grain-N uptake, straw N-uptake and total N uptake were found in T_5 treatment. Furthermore, the uptake of grain-P, straw P and total P varied from 8.0 to 25.7, 5.0 to 11.0, and 12.3 to 37.3 kg ha^{-1}, respectively. Similarly, in all three cases of P-uptake (grain P, straw P and total P), the highest values were observed in T_5 treatment. While, there was no significant variation in N and P uptake between treatment T_4 and T_5 for both grain and straw.

At BAU farm, the values for grain-K uptake, straw K-uptake and total K uptake varied from 4.7 to 10.7, 71.0 to 133.0 and 75.7 to 143.3 kg ha^{-1}, respectively (Table 5b). The maximum values for both straw-K uptake and total K uptake were found in T_4 while the maximum value for grain-K uptake was observed in T_5 treatment. Again, the uptake of grain-S, straw-S and total S ranged from 10.0 to 23.0, 10.0 to 22.7, and 19.7 to 44.3 kg ha^{-1}, respectively. In the same manner with K-uptake, treatment T_4 caused the highest straw-S uptake and total S uptake while T_4 performed the best in grain S-uptake.

In case of Farmer's field, the values for grain-K uptake, straw K-uptake and total K uptake varied from 4.0 to 11.0, 51.7 to 138.0 and 56.0 to 149.0 kg ha^{-1}, respectively while the uptake of grain-S, straw-S and total S ranged from 9.3 to 24.3, 8.3 to 22.0,

and 17.0 to 46.3 kg ha^{-1}, respectively (Table 5b). For both K and S, the maximum values for grain uptake, straw uptake and total uptake were observed in T_5 treatment. Notably, there was no statistical difference between treatment T_4 and T_5 for grain K-uptake as well as S-uptake by grain and straw. In case of all four nutrient elements (N, P, K and S), the lowest uptake was recorded in control treatments at both BAU farm and Farmer's field. The results of our study were partially accorded to those of several comparable studies of some researchers (Roy et al., 2018; Saha et al., 2014; Hossain et al., 2010) who observed increased uptake of N, P, K and S in rice due to application of poultry manure combined with inorganic fertilizers.

CONCLUSION

From the above results, it may be concluded that organic fertilizers – in form of poultry manure has a potential to increase the growth parameters, yield components, grain and straw yields and nutritional quality of rice. The use of Kazi Jaibo Shar as an organic fertilizer for rice also had positive effects on growth, yield as well as nutrient content and uptake by the crop. The performance of Kazi compost @ 3 t ha^{-1} is comparable with poultry manure of the same dose in association with chemical fertilizers, and the effect of each of these manures can compensate up to 25% reduction of recommended chemical fertilizers. Further long-term experimentation in different locations with different crop species is necessary to draw a valid conclusion on effectiveness of these manures.

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