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Research Article

Hybrid Rice Productivity as Influenced By faecal sludge

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Abstract: The experiment was aimed that the aspects of some plant growth parameters and yield and yield contributing traits of BRAC hybrid rice Aloron (*Oryza sativa*) in response to the effect of decomposed faecal sludge @ 10 t/ha and in combination with different doses of chemical fertilizers and compared with absolute control. Days to 80% heading, days to 80% maturity, total tiller per hill, panicle per square meter, plant height, panicle length, 1000 grain weight and yields were found statistically identical among the sole and integrated use of DFS with chemical fertilizer treatments. Excessive vegetative growth was observed when DFS was applied @ 10 t/ha. The highest grain yields were observed when DFS and recommended chemical fertilizer dose applied in sole but the highest grain yield was observed when DFS @ 10 t/ha along with ½ of the recommended chemical fertilizer dose was used. The average requirement of DFS irrespective of its rate, N, P and K variations, grain yield was about 9.256 t/ha and 9.108 t/ha with DFS in the year of 2013 and 2014 respectively. This implies that DFS can be utilized successfully for growing hybrid rice in Bangladesh.
Keywords: Decomposed faecal sludge (DFS), inorganic fertilizer, Nutrient uptake, yield, hybrid rice.

INTRODUCTION

The decomposed faecal sludge (DFS) contains a considerable amount of plant nutrients (1-1.6, 0.8-1.2, and 0.2-0.6 % of N, P_2O_5, K_2O respectively) that can be used successfully for rice production [1].There are about 114.5 million peoples in Bangladesh [2] and produced a huge amount of faecal, which can be used for crop production [3, 4] and as well as power of generation [5]. The organic source of nutrients not only contributes to crop production but also conserve the nature. On the other hand, availability of fertilizer at the right time is one of the major constraints now a day for rice production in Bangladesh. The cost of fertilizer is also high. So, decomposed faecal sludge could be used under such conditions to supplement plant nutrients for rice production because it contains good amount of available nutrients [3, 6]. Decomposed faecal sludge could be used as sole source of plant nutrients or in combination with chemical fertilizers for crop production and thus saving of costly earned foreign exchange for fertilizer import. The positive impact of decomposed faecal sludge application on our previous studies prompted us to find out the effect of decomposed faecal sludge on growth and yield of hybrid rice.

MATERIALS AND METHODS

The experiment was conducted at BRAC Agricultural Research and Development Centre, Joydebpur, Gazipur during two subsequent Boro seasons 2013 and 2014. Decomposed faecal sludge (DFS) was used @ 10 t/ha and in combination with different doses of chemical fertilizers and compared with absolute control. In Boro season 2013 the treatments imposed were, recommended chemical fertilizer dose @ 132-35-83-20-2 kg/ha N, P, K, S and Zn respectively (T_1), 10 t/ha DFS (T_2) and 10 t/ha DFS+ ½ of recommended chemical fertilizer dose (T_3).

In Boro season 2014 the treatments imposed were, absolute control (T_1), recommended chemical fertilizer dose @ 132-35-83-20-2 kg/ha N, P, K, S and Zn respectively (T_2), 10 t/ha DFS (T_3), 10 t/ha DFS+ 3/4 of recommended chemical fertilizer dose (T_4) and 10 t/ha DFS+1/2 of recommended chemical fertilizer dose (T_5). In the treatment of integrated use of DFS and chemical fertilizers, the amount of NPK in DFS were calculated and then NPKSZn were adjusted as of soil test based (STB) fertilizer application. The treatments were assigned in a randomized complete block design with three replications. Total land was 25 decimal and the unit plot size was 11.8 x 7.8 m2 in Boro 2013 and 6.8 x 7.95 m2 in Boro 2014.

The DFS was used before final land preparation as per treatments; one fourth urea at basal and rest urea in equal splits (3 splits) after 15-17 days interval within 50-55 days after transplantation. Total TSP, Gypsum and Zinc sulphate (never mixed with TSP and Zinc sulphate together) were applied as basal dose during the last ploughing time; two third MOP at the last ploughing time as basal dose and the rest one third MOP applied with second top dressing of urea. Forty-day- old seedlings of BRAC hybrid dhan Alloron were transplanted after three days of DFS application on 06-12-13 and 09-12-14 at 20 x 15 cm spacing. Initially continuous standing water was maintained for about two weeks and then normal water management practices were followed. No herbicide was used for controlling the pre-emergence weeds but controlled by two hands weeding at 25 DAT and 45 DAT. Insecticides were applied as and when necessary. Data on days to 80% heading, days to 80% maturity, tiller per hill, panicle per square meter, plant height (cm), panicle length (cm), spikelet per panicle, filled grain per panicle, panicle weight (g), spikelet fertility (%), 1000-grain weight (g) and yield (t/ha) were recorded. The collected data were analyzed following Gomez and Gomez [7] and means were compared at the 5% level of probability.

RESULTS AND DISCUSSION

Plant height, days to 80% heading, days to 80% maturity, total tiller per hill, plant height, panicle length, spikelet per panicle, spikelet fertility (%), filled grain per panicle, panicle weight, 1000 grain weight and yield were found statistically identical among the sole DFS treated plots and integrated use of DFS and chemical fertilizer treated plots (Table 1 and 2). Excessive vegetative growth was observed when DFS was applied @ 10 t/ha in both the years (Table 1 and 2). The lowest grain yields (9.256 t/ha and 9.082 t/ha) were recorded when the sole recommended chemical fertilizer dose was used in both years respectively (Table 1 and 2). On the other hand, the moderate grain yields (9.465 t/ha and 9.108 t/ha) were recorded when DFS 10 t/ha was used in Boro 2013 and 2014 respectively (Table 1 and 2). However, the highest grain yields (9.640 t/ha and 9.384 t/ha) were observed respectively in two seasons when DFS 10 t/ha along with ½ of recommended chemical fertilizer was used. It was also observed from this study that when greater amount of N, P, K, S and Zn as urea, TSP, MOP, Gypsum and zinc sulphate were applied in combination with DFS, grain yield improved compared to lower rates. Islam *et al*, [1] and Biswas *et al*, [8] also reported that hybrid rice in Boro season could be successively cultivated with DFS alone.

Decomposed faecal sludge (DFS) contain a good amount of plant macro nutrients, especially NPK [1, 9] and consequently, the application of DFS can reduce the amount of N, P and K fertilizers according to the rate of its application for hybrid rice cultivation. The sole application of DFS, if available, also produced a considerably higher grain yield and it was statistically identical compared to integrated application of DFS and chemical fertilizers. However, integrated application of DFS and chemical fertilizers were better (BARDC, 2013 and 2014)[11-12]. A major portion of production cost goes for fertilizer purchase in our country. So, the use of DFS may help in reducing cost of production and odor free environment as well. However, decomposed faecal sludge could be used as sole source or in combination of inorganic fertilizers to supplement nutrients for rice cultivation, because it contains a good amount of plant nutrients [1].

The average grain yield of DFS irrespective of it rate, N, P and K variations was 9.465 t/ha and 9.108 t/ha with DFS in Boro 2013 and 2014 respectively (Fig. 1 and 2). This implies that decomposed faecal sludge could be utilized successfully for growing Boro hybrid rice in Bangladesh.

Table-1: Effect of decomposed faecal sludge and in combination with chemical fertilizers in Boro season 2013, BARDC, Gazipur

Treatment	80% HD	80% MD	TTPH	PPM^2	PH (cm)	PL (cm)	SPP	FGPP	PW (g)	SF (%)	1000 GW (g)	W (t/ha)
T_1	124.0 a	150.0 a	15.00 a	242.0 b	111.7 a	24.00 a	189.7 a	156.7 a	4.197 a	82.67 a	30.05 a	9.256 a
T_2	123.7 a	150.7 a	16.33 a	286.0 a	113.0 a	23.67 a	195.0 a	158.3 a	4.130 b	80.67 a	30.14 a	9.465 a
T_3	124.0 a	150.3 a	14.33 a	253.0 b	110.7 a	24.00 a	181.0 a	143.7 a	4.237 a	79.33 a	30.04 a	9.640 a
CV (%)	0.27	0.27	10.27	6.68	1.40	5.58	11.48	13.60	0.35	4.24	1.80	4.23
LSD (0.05)	0.6273	0.7694	2.944	32.75	2.944	2.511	40.76	39.16	0.05954	6.462	1.017	0.7531

T_1= Recommended chemical fertilizer dose@ 132-35-83-20-2 kg/ha N, P, K, S and Zn respectively, T_2= 10 t/ha DFS, T_3= 10 t/ha DFS +1/2 of Recommended chemical fertilizer dose, 80% HD= Days to 80% heading, 80% MD= Days to 80% maturity, TTPH= Tiller per hill, PPM^2= Panicle per square meter, PH (cm)= Plant height (cm), PL (cm)= Panicle length (cm), SPP= Spikelet per panicle, FGPP= Filled grain per panicle, PW (g)= Panicle weight (g), SF (%)= Spikelet fertility (%), 1000 GW (g)= 1000 grain weight (g), W (t/ha)= Weight (t/ha).

Table-2: Effect of decomposed faecal sludge and in combination with chemical fertilizers in Boro season 2014, BARDC, Gazipur

Treatment	80% HD	80% MD	TTPH	PPM^2	PH (cm)	PL (cm)	SPP	FGPP	PW (g)	SF (%)	1000 GW (G)	W (t/ha)
T_1	121.0 b	142.0 d	8.667 c	198.0 b	93.33 b	24.67 a	132.0 b	107.7 b	2.846 b	81.67 a	28.16 a	5.790 c
T_2	122.3 a	148.0 a	14.33 a	264.0 a	103.7 a	24.33 a	162.0 a	122.7 ab	3.302 ab	75.67 a	27.85 a	9.082 a
T_3	122.3 a	146.0 b	13.33 ab	286.0 a	99.67 a	25.67 a	159.3 a	114.7 ab	3.343 ab	72.00 a	27.71 a	9.108 a
T_4	121.7 ab	145.0 c	12.00 b	264.0 a	102.7 a	25.67 a	167.0 a	127.3 a	3.430 a	76.67 a	28.34 a	8.287 b
T_5	122.0 a	148.0 a	14.00 ab	264.0 a	103.3 a	25.67 a	161.7 a	131.7 a	3.323 a	81.67 a	27.84 a	9.384 a
CV (%)	0.40	0.31	9.93	4.03	2.99	3.12	4.52	9.15	10.19	9.24	1.91	4.03
LSD (0.05)	0.8453	0.7832	2.168	50.60	5.268	1.376	12.39	19.36	0.5808	12.54	0.9365	0.5887

T_1= Absolute control, T_2= DFS control + Recommended chemical fertilizer dose @ 132-35-83-20-2 kg/ha N, P, K, S and Zn respectively, T_3= 10 t/ha DFS, T_4= 10 t/ha DFS + 3/4 of the recommended chemical fertilizer dose, T_5= 10 t/ha DFS +1/2 Recommended chemical fertilizer dose, 80% HD= Days to 80% heading, 80% MD= Days to 80% maturity, TTPH= Tiller per hill, PPM^2= Panicle per square meter, PH (cm)= Plant height (cm), PL (cm)= Panicle length (cm), SPP= Spikelet per panicle, FGPP= Filled grain per panicle, PW (g)= Panicle weight (g), SF (%)= Spikelet fertility (%), 1000 GW (g)= 1000 grain weight (g), W (t/ha)= Weight (t/ha).

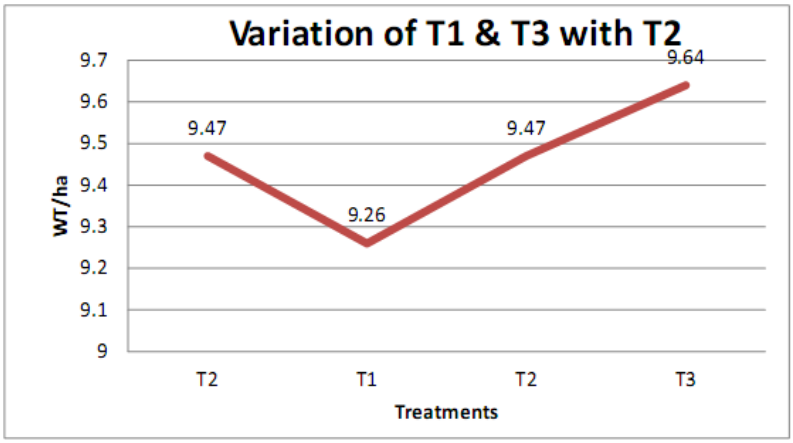

Fig-1: Grain yield of BRAC Hybrid Rice Alloron as influenced by DFS, BARDC, Gazipur[11,12]

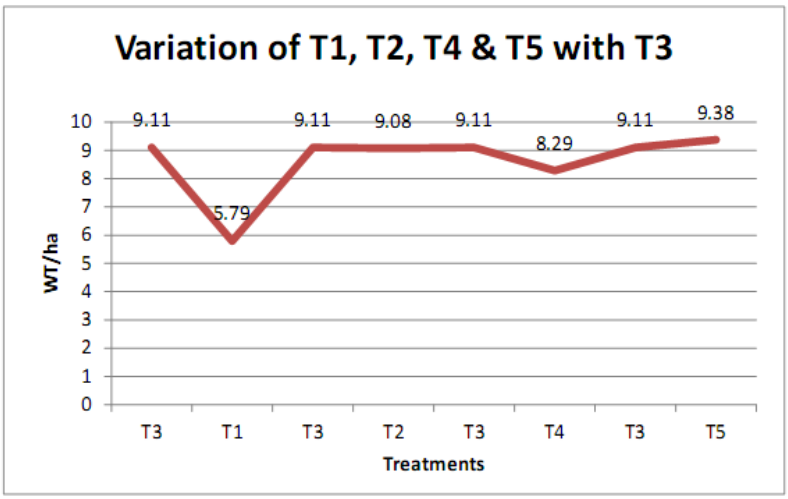

Fig-2: Grain yield of BRAC Hybrid Rice Alloron as influenced by DFS, BARDC, Gazipur[11-12]

CONCLUSION

From the above discussion, it was found that production of hybrid rice in boro season gave more yields under the treatment of 10 t/ha decomposed faecal sludge (DFS) with ½ of the recommended chemical fertilizer dose compared to sole chemical fertilizers. Thus we conclude that the decomposed faecal sludge (DFS) can be used either in combination with chemical fertilizers or alone for satisfactory grain yield of hybrid Boro rice.

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