



## EFFECT OF POULTRY MANURE AND FARMYARD MANURE WITH AND WITHOUT CHEMICAL FERTILIZERS ON THE GROWTH AND YIELD OF BRRI DHAN28

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**Abstract:** A field experiment was conducted at the Agrotechnology Field Laboratory of Khulna University, Khulna during boro season of 2005 to find out the effects of poultry manure (PM) and farmyard manure (FYM) in presence and absence of chemical fertilizers on BRRI dhan28. The experiment was laid-out in a randomized complete block design with three replications. There were ten treatments viz. T<sub>1</sub>: 100% RFD (Recommended fertilizer doses), T<sub>2</sub>: 100% RFD+10 t FYM, T<sub>3</sub>: 100% RFD+ 5 t FYM, T<sub>4</sub>: 50% RFD+5 t FYM, T<sub>5</sub>: 10 t FYM, T<sub>6</sub>: 100% RFD + 5 t PM, T<sub>7</sub>: 100% RFD+ 2.5 t PM, T<sub>8</sub>: 50% RFD+ 2.5 t PM, T<sub>9</sub>: 5 t PM and T<sub>10</sub>: Control (without manures and fertilizers). The doses of inorganic fertilizers N, P, K, S and Zn were 80, 50, 40, 10 and 5 kg ha<sup>-1</sup>. All the combined application of manures and fertilizers significantly increased the plant height, number of tiller hill<sup>-1</sup>, dry matter hill<sup>-1</sup>, grain and straw yield over the control. The highest grain yield was recorded in 100% RFD + 5 t PM treated plot which was similar to 100% RFD+10 t FYM treated plot, while the lowest yield was recorded in the control. Half of the recommended doses of fertilizer with 5 t ha<sup>-1</sup> farmyard manure or 2.5 t ha<sup>-1</sup> poultry manure produced statistically similar grain yields as produced by RFD which indicates that 50% of the fertilizers can be replaced by PM or FYM without any loss of grain yield.

**Key words:** Poultry manure, farmyard manure, fertilizer, BRRI dhan28.

### Introduction

Soils of Bangladesh are already depleted in many of the essential plant nutrients, intensive cultivation with HYVs and extremely low return from organic recycling is thought to be main reasons for this depletion. Fertilizers are essential for crop production in modern agriculture and inorganic fertilizers hold the key to the success in crop production in Bangladesh (Anonymous, 1997). However, continuous use of inorganic fertilizer to soil has a deleterious effect on soil and steadily declines soil fertility (Nambiar *et al.* 1998). On the other hand inorganic fertilizers, organic fertilizers are relatively poor in plant nutrients, but increase microbial activity and plays important role in improving soil health (physical, chemical and biological properties of soil) and thus helps to increase and conserve the soil productivity.

Thus sustainable crop production is difficult by using chemical fertilizer alone and similarly it is not possible to get higher crop yield by using organic manure only (Bair, 1990). The integrated use of organic and inorganic fertilizers might be helpful for sustainable crop production. Nambiar (1991) cited that integrated use of organic manure and chemical fertilizers would be quite promising not only in providing greater stability in production, but also in maintaining higher soil fertility status. Researchers in Bangladesh Rice Research Institute reported that application of cowdung at the rate of 5 t ha<sup>-1</sup> year<sup>-1</sup> improves rice production as well as prevents the soil resource from the degradation (Bhuiyan, 1994).

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Farmyard manure is the common source of manure in Bangladesh. Poultry manure from poultry farms of different sizes established all over the country. As quality feeds are used in farms, could be very good source of nutrients for field crops. Poultry excreta is rich in nutrients.

In view of the continued need to increase crop yield, proper use of inorganic fertilizers and organic manures is essential. It is essential to look after immediate crop needs in order to build up soil fertility and to conserve soil health for sustaining increased crop production. In addition, global environmental pollution can also be controlled considerably by reducing the use of fertilizer and increasing the use of manures. Hence, the present study was undertaken to observe the effects of combinations of poultry manure (PM), farmyard manure (FYM) and fertilizer on the growth and yield of BRRRI dhan28.

### **Materials and Methods**

A field study was conducted to find out the effect of PM and FYM in presence or absence of fertilizers on boro rice variety BRRRI dhan28. The experiment was carried out at the Agrotechnology Field Laboratory of Khulna University, Khulna. The soil of the experimental plot was silty loam in texture having  $p^H$  7.6, organic matter 3.90%, total N 0.10%, available P 6.78 ppm and exchangeable K 0.22 meq/100g soil. BRRRI dhan28, a high yielding variety of rice was used as the test crop in this experiment.

The experiment was designed with ten treatments, laid out in a randomized complete block design (RCBD) with three replications. Unit plot size was 4.0m x 2.5m. The treatments were T<sub>1</sub>: 100% RFD (Recommended fertilizer doses), T<sub>2</sub>: 100% RFD+ 10 t FYM, T<sub>3</sub>: 100% RFD+ 5 t FYM, T<sub>4</sub>: 50% RFD+5 t FYM, T<sub>5</sub>: 10 t FYM, T<sub>6</sub>: 100% RFD + 5 t PM, T<sub>7</sub>: 100% RFD+ 2.5 t PM, T<sub>8</sub>: 50% RFD+ 2.5 t PM, T<sub>9</sub>: 5 t PM and T<sub>10</sub>: Control (without manures and fertilizers).

The doses of inorganic fertilizers were 80, 50, 40, 10 and 5 kg ha<sup>-1</sup> N, P, K, S and Zn. All the plots got N, P, K, S, and Zn from urea, TSP, MP, gypsum and zinc sulphate, respectively. One third of urea and the entire amount of other fertilizers were applied as basal in each plot during final land preparation. The second split of urea was applied at maximum tillering stage and the third split of urea at panicle initiation stage. The total amounts of FYM and PM were applied at 15 days before planting. Three healthy seedlings of 40 days old were transplanted in the experimental plots on 18 February, 2005. The spacing was 25 cm x 15 cm. Intercultural operations, such as irrigation and weeding, were done whenever required to ensure normal growth of the crop.

Destructive plant samplings were done at 15 days interval to determine different plant growth parameters starting from 45 days after transplanting (DAT) and continued till maturity. At each sampling date were recorded from five randomly selected hills in each plot and the mean of five hills was taken. Growth parameters like plant height, tiller number, total dry matter were recorded at 45, 60, 75 DAT and at harvest. The crops were harvested at their full maturity when 90% of the grain turned golden yellow in color. Total harvesting was done in a day. Before harvesting 5 hills were uprooted randomly from each plot for taking yield component data. As yield and yield contributing characters plant height, effective tillers hill<sup>-1</sup>, filled grains panicle, 1000 grain weight, grain yield, straw yield, biological yield and harvest index were recorded. Grain and straw yields were recorded from whole plot basis and adjusted to 14% moisture level. Quantitative information on growth and yield performance of rice was subjected to Analysis of Variance (ANOVA) and means of the parameters were compared using Duncan's Multiple Range Test (DMRT).

### **Results**

***Growth parameters as influenced by manures and fertilizers:*** Plant height increased to the maximum at harvest but the rate of increase was higher at early stages of growth. Application of manures and fertilizers influenced markedly on the plant height at each stage of growth. FYM and

PM in combination with RFD always showed better performance over their single application (Table 1).

The number of tillers hill<sup>-1</sup> varied with the passes of time and treatments (Table 2). The number of tillers gradually increased up to 60 DAT and decreased there after. Treatments with only manure and combination of manures and fertilizers produced higher number of tillers at all the growth stages.

The dry matter hill<sup>-1</sup> increased gradually with the passes of time up to harvest (Table 3). Different treatments responded differently in dry matter production at different stages of growth. However, the combination of manures and fertilizers treated plots showed comparatively better result than their sole application.

Table 1. Plant height of BRR1 dhan28 at different growth stages as influenced by manures and fertilizers

Treatments	Plant height (cm)			
	45 DAT	60 DAT	75 DAT	At Harvest
100%RFD	52.40 <sup>a-d</sup>	74.20 <sup>bc</sup>	74.47 <sup>bc</sup>	79.70 <sup>bcd</sup>
100%RFD+10 t FYM	63.40 <sup>a</sup>	87.60 <sup>a</sup>	88.80 <sup>a</sup>	90.87 <sup>a</sup>
100%RFD+5 t FYM	62.47 <sup>ab</sup>	81.13 <sup>ab</sup>	82.23 <sup>ab</sup>	84.00 <sup>abc</sup>
50%RFD+5 t FYM	54.47 <sup>abc</sup>	77.40 <sup>abc</sup>	78.50 <sup>abc</sup>	78.67 <sup>cd</sup>
10 t FYM	46.13 <sup>cd</sup>	67.20 <sup>cd</sup>	68.73 <sup>cd</sup>	70.20 <sup>de</sup>
100%RFD+ 5 PM	61.80 <sup>ab</sup>	83.27 <sup>ab</sup>	87.60 <sup>a</sup>	89.43 <sup>ab</sup>
100%RFD+2.5 t PM	57.07 <sup>abc</sup>	78.33 <sup>abc</sup>	81.83 <sup>ab</sup>	82.43 <sup>abc</sup>
50%RFD+2.5 t PM	50.87 <sup>bcd</sup>	78.40 <sup>abc</sup>	78.83 <sup>abc</sup>	78.97 <sup>cd</sup>
5 t PM	47.80 <sup>cd</sup>	65.67 <sup>cd</sup>	67.87 <sup>cd</sup>	69.97 <sup>de</sup>
Control	41.47 <sup>d</sup>	60.00 <sup>d</sup>	60.87 <sup>d</sup>	61.33 <sup>e</sup>
Level of significance	0.01	0.01	0.01	0.01
CV (%)	8.39	6.60	6.45	5.18

The figures having different letters in a column are significantly different. RFD=Recommended fertilizer dose; DAT=Days after transplanting; FYM=Farmyard manure; PM=Poultry manure; Control (without manures and fertilizers)

Table 2 Tiller number of BRR1 dhan28 at different growth stages, influenced by manures and fertilizers

Treatments	Tiller number hill <sup>-1</sup>			
	45 DAT	60 DAT	75 DAT	At Harvest
100%RFD	17.60 <sup>bc</sup>	17.90	15.00 <sup>ab</sup>	14.80 <sup>bc</sup>
100%RFD+10 t FYM	25.40 <sup>a</sup>	25.73	18.33 <sup>a</sup>	20.33 <sup>ab</sup>
100%RFD+5 t FYM	20.30 <sup>abc</sup>	19.87	16.30 <sup>a</sup>	16.03 <sup>abc</sup>
50%RFD+5 t FYM	19.73 <sup>abc</sup>	19.40	17.20 <sup>a</sup>	16.27 <sup>abc</sup>
10 t FYM	19.07 <sup>abc</sup>	20.47	16.53 <sup>a</sup>	16.33 <sup>abc</sup>
100%RFD+5 t PM	24.73 <sup>ab</sup>	25.47	20.13 <sup>a</sup>	21.47 <sup>a</sup>
100%RFD+2.5 t PM	21.27 <sup>ab</sup>	23.70	19.87 <sup>a</sup>	19.40 <sup>ab</sup>
50%RFD+2.5 t PM	21.13 <sup>ab</sup>	21.53	18.13 <sup>a</sup>	16.13 <sup>abc</sup>
5 t PM	19.97 <sup>abc</sup>	23.20	17.47 <sup>a</sup>	16.57 <sup>abc</sup>
Control	13.07 <sup>c</sup>	16.73	10.60 <sup>b</sup>	12.03 <sup>c</sup>
Level of significance	0.01	NS	0.05	0.05
CV (%)	13.81	18.16	17.23	18.91

The figures having different letters in a column are significantly different. RFD=Recommended fertilizer dose; DAT=Days after transplanting; FYM=Farmyard manure; PM=Poultry manure; NS=Not significance; Control (without manures and fertilizers)

Table 3. Dry matter hill<sup>-1</sup> of BRRi dhan28 at different growth stages as influenced by manures and fertilizers

Treatments	Dry matter hill <sup>-1</sup> (g)		
	45 DAT	60 DAT	75 DAT
100%RFD	7.33ab	8.59bc	20.23bc
100%RFD+10 t FYM	6.53abc	15.12a	25.80abc
100%RFD+5 t FYM	6.42abc	13.72ab	27.27ab
50%RFD+5 t FYM	5.33abc	11.52abc	19.77bc
10 t FYM	5.17bc	9.77bc	15.93c
100%RFD+ 5 t PM	8.5a	15.54a	32.97a
100%RFD+2.5 t PM	7.00ab	8.98bc	19.07bc
50%RFD+2.5 t PM	5.67abc	10.86abc	19.47bc
5 t PM	4.68bc	9.38bc	21.77bc
Control	3.33c	7.31c	16.17bc
Level of significance	0.01	0.05	0.01
CV (%)	20.43	24.45	19.14

The figures having different letters in a column are significantly different. RFD=Recommended fertilizer dose; DAT=Days after transplanting; FYM=Farmyard manure; PM=Poultry manure; NS=Not significance; Control (without manures and fertilizers)

**Yield and yield attributes as influenced by manures and fertilizers:** The effective tillers hilt of BRRi dhan28 was significantly affected by different treatments (Table 4) ranging from 8.28 to 18.47. The maximum number of effective tillers hill<sup>-1</sup> (18.47) was recorded in T<sub>6</sub> (100% RFD+5 t PM) which was superior to all other treatments except T<sub>2</sub> (100% RFD+10 t FYM). The lowest number of tiller (8.28) was found in the control. The performance T<sub>6</sub> and T<sub>2</sub> treatments were significantly higher than the rest of the treatments.

Filled grain panicle<sup>-1</sup> varied significantly due to various treatments. The highest number of filled grains was recorded in the treatment T<sub>6</sub> (100% RFD+5 t PM) which was statistically similar to T<sub>2</sub> (100% RFD+10 t FYM) but superior to rest of the treatments (Table 4).

The 1000-grain weight was significantly affected by different treatments ranging from 16.55 to 22.14g. The highest 1000-grain weight was recorded in T<sub>6</sub> (100% RFD+5 t PM) which was statistically similar with T<sub>2</sub> (100% RFD+10 t FYM). The lowest 1000-grain weight was in T<sub>10</sub> (control).

A significant variation in grain yield of BRRi dhan28 was found due to application of manures and fertilizers. The highest grain yield of 3.58 t ha<sup>-1</sup> was observed in the treatment T<sub>6</sub> (100% RFD+5 t PM) and that of the lowest (0.97 t ha<sup>-1</sup>) was in T<sub>10</sub> (control) treatment. The grain yield of T<sub>6</sub> was statistically similar to that of T<sub>2</sub> (100% RFD+ 10 t FYM). Combined use of RFD with PM or FYM showed better result in contrast to their sole application (Table 4).

Straw yield of rice also varied remarkably due to the application of manures and fertilizers. Among the treatments T<sub>6</sub> (100% RFD+5 t PM) produced the highest straw yield which was statistically similar with T<sub>2</sub> (100% RFD+10 t FYM), T<sub>1</sub> (100% RFD), T<sub>3</sub> (100% RFD+5 t FYM) and T<sub>7</sub> (100% RFD+2.5 t PM) treatments. The lowest straw yield was obtained from the treatment T<sub>10</sub> (control).

Table 4. Effect of manures and fertilizers on yield components and yield of BRRI dhan28

Treatments	Effective tillers hill <sup>-1</sup> (no)	Filled grains panicle <sup>1</sup> (no)	1000-grain weight (g)	Grain yield (t ha <sup>-1</sup> )	Straw yield (t ha <sup>-1</sup> )	Biological yield (t ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub>	9.23 <sup>c</sup>	46.60 <sup>cd</sup>	20.08 <sup>c</sup>	2.52 <sup>bcd</sup>	3.48 <sup>ab</sup>	5.74 <sup>cd</sup>	39.12 <sup>abc</sup>
T <sub>2</sub>	15.47 <sup>ab</sup>	65.37 <sup>ab</sup>	21.49 <sup>ab</sup>	2.99 <sup>ab</sup>	4.52 <sup>a</sup>	7.52 <sup>ab</sup>	39.84 <sup>abc</sup>
T <sub>3</sub>	12.13 <sup>bc</sup>	52.67 <sup>bc</sup>	20.69 <sup>bc</sup>	2.60 <sup>b</sup>	3.79 <sup>ab</sup>	6.31 <sup>bc</sup>	40.10 <sup>abc</sup>
T <sub>4</sub>	9.60 <sup>c</sup>	42.07 <sup>cd</sup>	18.78 <sup>de</sup>	1.72 <sup>d</sup>	3.03 <sup>bc</sup>	4.75 <sup>de</sup>	36.97 <sup>abcd</sup>
T <sub>5</sub>	8.67 <sup>c</sup>	32.87 <sup>de</sup>	17.73 <sup>ef</sup>	1.19 <sup>e</sup>	3.13 <sup>bc</sup>	4.33 <sup>c</sup>	27.33 <sup>d</sup>
T <sub>6</sub>	18.47 <sup>a</sup>	70.07 <sup>a</sup>	22.14 <sup>a</sup>	3.58 <sup>a</sup>	4.55 <sup>a</sup>	8.13 <sup>a</sup>	43.98 <sup>a</sup>
T <sub>7</sub>	12.10 <sup>bc</sup>	50.60 <sup>c</sup>	20.02 <sup>cd</sup>	2.65 <sup>bc</sup>	3.62 <sup>ab</sup>	6.28 <sup>bc</sup>	42.29 <sup>ab</sup>
T <sub>8</sub>	10.40 <sup>c</sup>	40.17 <sup>cde</sup>	19.55 <sup>cd</sup>	1.98 <sup>cde</sup>	3.36 <sup>b</sup>	5.30 <sup>cde</sup>	36.61 <sup>a-d</sup>
T <sub>9</sub>	8.50 <sup>c</sup>	32.93 <sup>de</sup>	17.75 <sup>ef</sup>	1.28 <sup>ef</sup>	2.90 <sup>bc</sup>	4.15 <sup>ef</sup>	30.01 <sup>cd</sup>
T <sub>10</sub>	8.28 <sup>c</sup>	27.47 <sup>e</sup>	16.55 <sup>f</sup>	0.97 <sup>f</sup>	2.08 <sup>c</sup>	3.05 <sup>f</sup>	32.01 <sup>bcd</sup>
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.05
CV (%)	17.42	11.87	2.63	14.57	12.81	9.31	15.18

The figures having different letters in a column are significantly different. RFD=Recommended fertilizer dose; PM=Poultry manure; FYM=Farmyard manure

T<sub>1</sub>= 100% RFD  
 T<sub>2</sub>= 100% RFD + 10 t FYM  
 T<sub>3</sub>= 100% RFD + 5 t FYM  
 T<sub>4</sub>= 50% RFD + 5 t FYM  
 T<sub>5</sub>= 10 t FYM  
 T<sub>6</sub>= 100% RFD + 5 t PM  
 T<sub>7</sub>= 100% RFD + 2.5 t PM  
 T<sub>8</sub>= 50% RFD + 2.5 t PM  
 T<sub>9</sub>= 5 t PM  
 T<sub>10</sub>= Control (without manures and fertilizers)

A significant variation in the biological yield of BRRI dhan28 was recorded due to the application of manures and fertilizers. The highest biological yield (8.13 t ha<sup>-1</sup>) was recorded in T<sub>6</sub> (100% RFD+5 t PM) which was followed by the treatment T<sub>2</sub> (100 % RFD+10 t FYM) and the lowest biological yield (3.05 t ha<sup>-1</sup>) was noted in the treatment T<sub>10</sub> (control).

Application of manures and fertilizers influenced harvest index significantly. The harvest index range from 27.33 to 43.98% and the maximum was in the treatment T<sub>6</sub> (100% RFD+5 t PM) which was statistically similar to those of other combined application and 100% recommended doses of fertilizers. The lowest harvest index was recorded in control (T<sub>10</sub>).

## Discussion

Application of manures and fertilizers influenced differently on the plant height of BRRi dhan28 and the variation was significant. Farmyard manure and poultry manure with incorporation of recommended fertilizer treated plots always showed better performance over solely fertilizer and manure applied plots. Budhar *et al.* (1991) found that the plant height was significantly influenced due to basal incorporation of farm wastes. Almost similar information was also reported by Azim *et al.* (1999), Jin *et al.* (1996), and Babu *et al.* (2001).

Filled grain panicle<sup>-1</sup> varied significantly due to various treatments. Mondal *et al.* (1990) reported that the percentage of filled grains increased with increasing NPK rates and FYM application.

A significant variation in grain yield of BRRi dhan28 was found due to application of manures and fertilizers. Combined use of RFD with PM or FYM showed better result in contrast to their sole application. Ahmed and Rahman (1991) reported that rice grain yield increased with the application of organic matter and chemical fertilizer. The combination of manures and fertilizers treated plots showed comparatively better dry weight than their sole application; so these plots produced comparatively higher yield.

PM when applied in combination with fertilizer performed better in increasing biological yield and the variation was significant. Azim *et al.* (1999) reported a significant increase in biological yield of rice due to application of manures and fertilizers.

## Conclusion

From the findings of the present study it might be concluded that integrated use of manures and fertilizers showed better performance in contrast of solely applied fertilizers and manures. The combined application of recommended dose of fertilizer with poultry manure 5 t ha<sup>-1</sup> or farmyard manure @ 10 t ha<sup>-1</sup> showed similar result on the grain yield of BRRi dhan28 and produced statistically higher grain yields than RFD.

Half of the recommended doses of fertilizers with 2.5 t ha<sup>-1</sup> poultry manure or 5 t ha<sup>-1</sup> farmyard manure produced statistically similar grain yields as produced by RFD which indicates that 50% of the fertilizers can be replaced by PM or FYM without any loss of grain yield.

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