J. Agrofor. Environ. 5 (1): 51-54, 2011 ISSN 1995-6983

Combined effect of cowdung, poultry manure, dhaincha and fertilizers on the growth and yield of rice

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Abstract: A field experiment was carried out at the Bangladesh Agricultural University Farm during the T. Aman season to study the combined effect of cowdung, poultry manure, dhaincha and chemical fertilizers on the yield and nutrient uptake of BRRI dhan 41. The experiment was set up in a randomized complete block design with three replications. The treatments were T_o: control, T_1: 100% NPKS, T_1: 70% NPKS + Dhaincha @ 10 t ha^{-1}, T_3: 70% NPKS + Dhaincha @ 8 t ha^{-1}, T_4: 70% NPKS + Poultry manure @ t ha^{-1}, T_5: 70% NPKS + Poultry manure @ 3 t ha^{-1}, T_6: 70% NPKS + Cowdung @ 8 t ha^{-1} and T_7: 70% NPKS + Cowdung @ 5 t ha^{-1}. It was observed that the grain and straw yields as well as the yield attributing parameters like plant height, number of effective tillers hill^{-1}, panicle length, and number of field grains per panicle were significantly influenced due to different treatments except 1000 grain weight. The maximum grain yield was 4.49 t ha^{-1} recorded in T_4 treatment and minimum grain yield of 2.69 t ha^{-1} in T_o (control). The dhaincha or cowdung along with 70% NPKS increase the grain yield significantly over 70% NPKS application. The relative performances of organic manures were in the order of PM>DH>CD.
Key words: Cowdung, Poultry Manure, Dhaincha, Fertilizers, Growth, Yield and Rice

Introduction

Rice (*Oryza sativa* L.) is the leading cereal in the world and staple food crop in Bangladesh. About 22.79% of her total domestic production (GDP) comes from agriculture (BBS, 2006). Although Bangladesh ranks 4th in the world in respect to average production of rice (FAO, 2002), it ranks 37th in respect to yield (IRRI, 2000). Annual food grain deficit could be minimized either by bringing more area under cultivation or by increasing the yield per unit area. Soil fertility deterioration has become a major constraint to higher crop production in Bangladesh. The increasing land use intensity without adequate and balance use of chemical fertilizers and with little or no use of organic manures have caused severe fertility deterioration of our soils resulting in stagnating or even declining of crop productivity. Since fertile soil is the fundamental resource for higher crop production, its maintenance is a prerequisite for long-term sustainable crop production. Sustainable production of crops cannot be maintained by using only chemical fertilizers and similarly it is not possible to obtain higher crop yield by using organic manure alone (Bair, 1990). In the recent years poultry farms of different sizes have been established all over the country and farm holders use concentrate feeds to feed their poultry birds. As a result the poultry excreta are rich in N, P, K, secondary and micronutrients. As the poultry excreta are not used as fuel, these can be the good source of manure for field crops. The most productive green manuring crops such as dhaincha yield of 3 to 4 t ha^{-1} dry biomass, which can accumulate 90 to 120 kg N ha^{-1} in 50 to 60 days. Dhaincha may not be grown in rice-rice cropping pattern. It can be grown adjacent highland areas and then can be incorporated in rice fields. Keeping in view of the needs of high yielding N responsive varieties of rice, recent research in green manuring has been directed more towards its integrated use with inorganic fertilizers (Haque *et al*., 2001). Losses of soil organic matter can only be replenished in the short term by application of organic matter such as manure (Glaser *et al*., 2001). The cowdung, poultry manure and Dhaincha are the excellent sources of soil organic matter, which is rich in macro and micronutrients. A suitable combination of organic and inorganic source of nutrients is necessary for sustainable agriculture. Application of cowdung @ 5 t ha^{-1} yr^{-1} improved rice productivity as well as prevented the soil resources from degradation (Bhuiyan, 1994). Judicious application of manures and fertilizers can increase the crop yield per unit area and minimize the nutrient imbalance in soil. It is also important to look beyond immediate crop needs in order to build up soil fertility and to conserve good soil health so as to provide a solid base for increased crop production in future. The present research work was, therefore, undertaken to study the effects of manures and fertilizers on the growth and yield of BRRI dhan 41.

Materials and Methods

The experiment was conducted in typical rice growing soil under the agro-ecological zone of Old Brahmaputra Floodplain at the Bangladesh Agricultural University Farm, Mymensingh during the aman season from July to December, 2007. The soil was silty loam having pH 6.5, organic matter 1.81%, total N 0.113%, available P 12.9 ppm, and exchangeable K 0.106 meq/100 g soil, available S 12.0 ppm and CEC of 12.9 me/100 g soil. The experiment was laid out in the Randomized Complete Block Design, where the experimental area was divided into three blocks representing the replications to reduce the soil heterogenic effect and each block was divided into eight unit plots measuring 5m x 4m (20 m^2). The eight treatment combinations for the experiment were: T_o: control, T_1: 100% NPKS, T_1: 70% NPKS + Dhaincha @ 10 t ha^{-1}, T_3: 70% NPKS + Dhaincha @ 8 t ha^{-1}, T_4: 70% NPKS + Poultry manure @ t ha^{-1}, T_5: 70% NPKS + Poultry manure @ 3 t ha^{-1}, T_6: 70% NPKS + Cowdung @ 8 t ha^{-1} and T_7: 70% NPKS + Cowdung @ 5 t ha^{-1}. BRRI Dhan 41, a high yielding variety of aman rice was used in this experiment as a test crop. The amounts of nitrogen, phosphorus, potash, and sulphur fertilizers required per plot were calculated as per the treatments. The name, rates and sources of different fertilizers and manures are given in the Table 1. One third of urea, total gypsum, TSP and MoP were applied one day before transplanting. The rest of the urea was applied in two equal splits after 30 days of transplantation i.e., at active tillering stage and 60 days of transplantation i.e., at

Table 1. Name, rates and sources of different fertilizers and manures

Fertilizers/Manures	Rate	Source
N	75 kg ha-1	Urea
P	13 kg ha-1	TSP
K	43 kg ha-1	MoP
S	10 kg ha-1	Gypsum
Cowdung	8 t ha-1(T6) 5 t ha-1(T7)	Decomposed cowdung
Poultry manure	5 t ha-1(T4) 3 t ha-1(T5)	Decomposed poultry manure
Dhaincha	10 t ha-1(T2)	Fresh biomass

panicle initiation stage. Finely decomposed cowdung and poultry manure were applied before one week of final land preparation. The fresh biomass of 25 days old dhaincha (*Sesbania rostrata*) plant also incorporated into the soil before 10 days of final land preparation. Thirty-five days old seedlings were transplanted on 13th August 2007 in the well puddle plot maintaining plant to plant spacing of 20 cm x 20 cm and three healthy seedlings hill^{-1}. The intercultural operations like weeding, irrigation and pest control were done as per needed during the growing period of the crop. Ten hills were randomly selected from each plot to record the yield contributing characters. The yield of the grain and straw per plot were recorded after threshing, winnowing and drying and were expressed in t ha^{-1}. All the collected data were analyzed using ANOVA and the differences among the treatment means were evaluated by the Duncan's New Multiple Range Test as outlined by Gomez and Gomez, 1984.

Results and Discussion

Effect of fertilizers and manures on yield contributing characters of BRRI dhan 41

Plant height: All the treatments gave significantly higher plant height over control (Table 2). The tallest plant of 121.50 cm was found in T_4 (70% NPKS+PM_8) where as the lowest plant height of 110.01 cm was found under control (T_0). Plant height was found statistically identical in T_1 (100%NPKS), T_2 (70%NPKS+Dh_{10}) and T_3 (70%NPKS+Dh_8) with the values of 120.40 cm, 118.70 cm and 117.10 cm respectively. Poultry manure performed better in producing more plant height in combination with the chemical fertilizers (70% FRD) as compared to dhaincha and cowdung. Dhaincha when applied @ 10 t ha^{-1} produced taller plant compared to the application of cowdung @ 8 t ha^{-1} with same doses of chemical fertilizers. Babu *et al*. (2001) observed that the plant height was significantly influenced by the incorporation of organic manures with fertilizers.

Number of effective tillers hill^{-1}: A significant variation in the effective tiller hill^{-1} of BRRI dhan 41 was recorded due to the combined application of manures and fertilizers (Table 2).The maximum number of effective tiller hill^{-1} (13.23) was found in T_4 (70% NPKS+PM_8) and lowest value was found in control. The treatments T_2 (70%NPKS+Dh_{10}), T_3 (70%NPKS+Dh_8), T_6 (70%NPKS+CD_8) and T_7 (70%NPKS+CD_5) with the value of 10.90, 10.20, 11.43 and 10.33 respectively demonstrated statistically similar effective tillers hill^{-1}, but the performance of T_4 was better than T_1. These results are corroborated with the findings of Rajni *et al*. (2001) who found increased number of effective tiller hill^{-1} with the integrated use of vermicompost, poultry manure and nitrogenous fertilizers. Azim (1999) also reported beneficial effects of manures in combination with chemical fertilizers on effective tillers hill^{-1}.

Panicle length: The application of manures and fertilizers significantly influenced the panicle length of BRRI dhan 41 (Table 2). The highest panicle length (25.41 cm) was found in T_4 (70% NPKS+PM_8) which was statistically identical to the T_1 (100%NPKS) and T_2 (70%NPKS+Dh_{10}) with the value of 24.60 cm and 24.32 cm respectively. The lowest panicle length (20.93 cm) was observed in control. The panicle length of the treatment T_3 (23.78 cm), T_5 (24.03 cm), T_6 (23.81 cm) and T_7 (23.89 cm) was found statistically similar. Ahmed and Rahman (1991) observed that application of organic manures and chemical fertilizers elevated the panicle length.

Table 2. Effects of cowdung, poultry manure, dhaincha and NPKS fertilizers on the yield contributing components and yield of BRRI dhan 41

Treatments	Plant height (cm)	Effective tillers hill^{-1}	Panicle length (cm)	Effective tillers hill^{-1}	Filled grain panicle^{-1}	1000 grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
T_0 (control)	110.01d	7.10e	20.93c	7.10e	97.28e	23.13	2.69e	3.28f
T_1 (100%NPKS)	120.40ab	12.16b	24.60ab	12.16b	121.30ab	24.30	4.42ab	5.43ab
T_2 (70%NPKS+Dh_{10})	118.70abc	10.90cd	24.32ab	10.90cd	114.70c	24.02	4.22c	5.44ab
T_3 (70%NPKS+Dh_8)	117.10abc	10.20d	23.78b	10.20d	111.03cd	23.92	4.19c	5.04e
T_4 (70%NPKS+PM_8)	121.50a	13.23a	25.41a	13.23a	124.60a	24.42	4.49a	5.46a
T_5 (70%NPKS+PM_3)	116.70bc	11.26c	24.03b	11.26c	119.50b	24.11	4.36b	5.24d
T_6 (70%NPKS+CD_8)	115.40c	11.43be	23.81b	11.43be	111.0 d	24.01	4.11d	5.34bc
T_7 (70%NPKS+CD_5)	114.40cd	10.33d	23.89b	10.33d	109.80d	23.59	4.07d	5.30cd
CV (%)	2.05	3.97	2.42	3.97	1.98	3.96	1.33%	1.00%
SE (±)	1.38	0.248	0.332	0.248	1.28	0.547	0.025	0.031

Figures in a column having common letters do not differ significantly at 5% level of significance. CV (%) = Coefficient of variation SE (f) = Standard error of mean

Filled grain panicle^{-1}: A significant variation in filled grain panicle^{-1} of BRRI dhan 41 was recorded due to application of manures and fertilizers in different combinations (Table 2). The number of filled grain panicle^{-1} varied from 97.28 to 124.60. The highest value as found in T_4 (70% NPKS+PM_8) was followed by T_1 (100%NPKS) with the value of 124.60 and 121.30 respectively. The statistically identical treatments were T_2 (70%NPKS+Dh_{10}), T_3 (70%NPKS+Dh_8), T_6 (70%NPKS+CD_8) with the value of 114.70, 111.03 and 111.00 respectively. The lowest number of filled grain panicle^{-1} (97.28) was found under control (T_O). Results revealed that combined application of manures and fertilizers exerted considerable increasing effect on the number of filled grain panicle^{-1}. A similar finding was also claimed by Satyanarayana *et al.* (2002).

1000-grain weight: The influence of combined application of manures and fertilizers on 1000 grain weight of BRRI dhan 41 has been shown in the Table 2. The 1000-grain weight was insignificant due to application of manures and fertilizers. The 1000-grain weight ranged from 23.11 g to 24.42 g. The highest result was noted in T_4 treatment and lowest 1000-grain weight was noted in T_o.

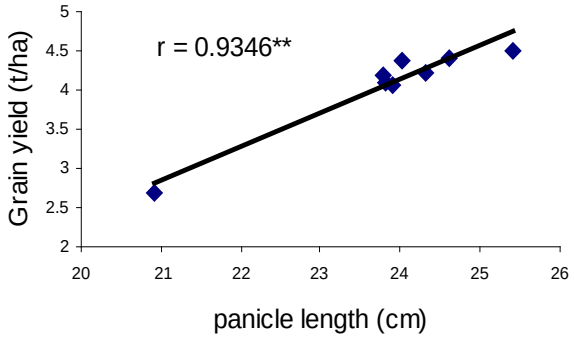

Fig1. Relationship between panicle length and grain yield of BRRI dhan 41

Effect of fertilizers and manures on yield of BRRI dhan 41

Grain yield: Combined application of fertilizers and manures showed the significant effect on grain yield of rice (Table 2) ranged from 2.69 to 4.49 t ha^{-1}. The highest grain yield (4.49 t ha^{-1}) was recorded in T_4 (70% NPKS+PM_8) and the lowest value (2.69 t ha^{-1}) was recorded in control. The yields of T_2 (70%NPKS+Dh_{10}) and T_3 (70%NPKS+Dh_8) were identical and significantly lower than T_4 and T_1 treatments. In association with same recommended fertilizer doses (70% RFD) dhaincha treated plots gave better grain yield than cowdung treated plots but poultry manure showed superior position over other treatments. This might be due to the quick release of nutrients from poultry manure than dhaincha and cowdung. These results are also in agreement with the findings of Rajni *et al.* (2001) and Haque *et al*. (2001). Grain yield was positively and significantly correlated with panicle length (r = 0.9346**) and straw yield (r = 9688**). From the correlation study, it appears that grain yield increase with increasing panicle length and grain panicle^{-1} (Figs.1&2).

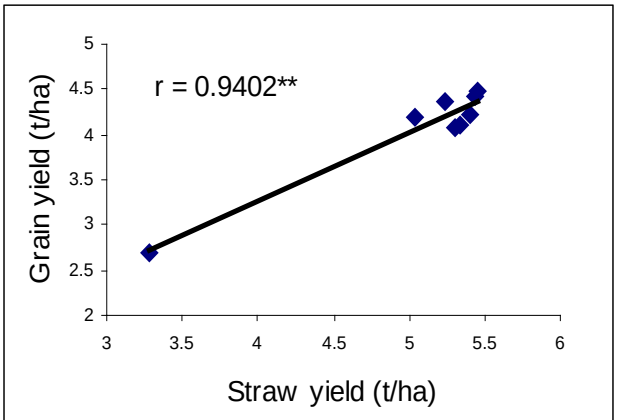

Fig2. Relationship between grain and straw yield of BRRI dhan 41

Straw yield: The straw yield was significantly influenced due to the application of fertilizers and manures found in Table 2 ranged from 3.28 to 5.46 t ha^{-1}. The highest straw yield (5.46 t ha^{-1}) was obtained in T_4 (70% NPKS+PM_8) and the lowest value of 3.28 t ha^{-1}) was noted in control. The straw yields obtained from different treatments may be ranked in the order of T_4> T_2> T_1>T_6> T_7> T_5> T_3>T_o. Poultry manure exerted comparatively better effect in producing higher straw yields as compared to cowdung and dhaincha. This finding is assembled to the work of Islam (1997) and Khan (1998) who found significant effects of manures and fertilizers on straw yield.

From the results of the experiment, it may be concluded that BRRI dhan 41responded better to the nutrients supplied from the combined use of chemical fertilizers and manures thereby giving better growth and yield of T- aman rice. However, application of poultry manure @ 5 t ha^{-1} with 70% NPKS showed better performance over cowdung and dhaincha. There is also a positive relationship between yield and yield contributing characters.

References

Ahmed, M. and Rahman, S. 1991. Influence of organic matter on the yield and mineral nutrition of modern rice and soil properties. Bangladesh Rice J. 2 (1 – 2): 107 – 112.

Azim, S. M. A., Rahman, M. M., Islam, M. R. and Hoque, M. A. 1999. Effect of sulphur, zinc and boron supplied from manures and fertilizers on BRRI Dhan 29. M. S. Thesis . Dept. Soil Sci. 1999, BAU, Mymensingh.

Babu, S., Marimuthu, R., Manivannan, V. and Rameshkumar, S. 2001. Effect of organic and inorganic fertilizers on growth and yield of rice. Agril. Sci. Digest. 21 (4): 232 – 234.

Bair, W. 1990. Characterization of the environment for sustainable Agriculture: Issues, Perspectives and Prospects in Semi-Arid Tropics. Singh R.P. Ed. Hyderabad, India. Indian Soc. Agron. 1: 90 – 128.

BBS, 2006. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics (BBS). 26th edition, Ministry of Planning, Govt. of the People's Republic of Bangladesh, Dhaka. p. 156.

Bhuiyan, N.I. 1994. Crop production trends and nee of sustainability in Agriculture. Paper presented at the workshop on Integrated Nutrient Management of Sustainable Agriculture, held at SRDI, Dhaka, Bangladesh, during June 26-28. 1994.

FAO. 2002. Year Book of Production. Food and Agricultural organization. FAO Statistics Division. 57: 76-77.

Glaser, B., Lehman, J., Fuhrboter, M., Solomon, D. and Zech, W. 2001. Carbon and nitrogen mineralization in cultivated and natural savanna soils of northern Tanzania. Boil. Fertil, Soils. 33: 301-309.

Gomez, K. A. and Gomez, A. A. 1984. Statistical Procedures for Agricultural Research (2nd edn.) John Wiley and Sons, New York. p. 680.

Haque, M. Q., Rahman, M.H., Fokrul, I., Jan Rijpma and Kadir, M.M. 2001. Integrated nutrient management in relation of soil fertility and yield sustainability under wheat-Mung-T. aman cropping pattern. Online J. Biol. Sci. 1(8): 731-734.

IRRI (International Rice Research Institute). 2000. World Rice Statistics 1993-94. Int. Rice. Res. Inst., manila, Philippines: 2-19.

Islam, M.R. and Bhuiya, Z.H. 1997. Effect of nitrogen and phosphorus on the growth, yield and nutrient uptake of deep water rice. Bangladesh J. Agril. Sci. 24(2): 93-96.

Khan, M.M.R. 1998. Effect of Cowdung, poultry manure and urea-N on the growth and yield of BRRI dhan 29. M.S. Thesis, Dept. Soil Sci. 1999, BAU, Mymensingh.

Rajni, R., Srivastava, O.P. and Rani, R. 2001. Effect of integrated use of organics with fertilizer N on rice and N uptake. Fertilizer News. 46(9): 63 – 65.

Satyanarayana, V., Prasead, P. V. V., Murthy, V. R. K. and Rodty, K. J. 2002. Influence of integrated use of farm yard manure aad inorganic fertilizers on yield components of irrigated lowland rice J. 87(1 – 3): 90 – 93.