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Effect of planting methods and different source of N fertilizer on some agronomic characters in rice (Vr. BRRI dhan 39)

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Abstract

Proper planting methods are important for crop establishment and fertilizer has a beneficial effect on soil physical properties. Keeping this in view a study was carried out at biological science research field, Rajshahi University campus during June to October 2000 to evaluate the planting methods and different N fertilizer effect on yield and yield contributing characters of BRRI dhan 39. Three planting methods and two N fertilizer materials with no fertilizer treatment using split plot block design with three replications. The results demonstrated that direct seedling line sowing and transplanting produced significantly higher yield components and grain yields. Grain and grain straw yields of BRRI dhan 39 were increased due to different N fertilizer treatment and highest value was recorded with the application of pilled urea in the direct seedling line sowing and transplanting methods that of direct seedling broadcasting methods respectively. The harvest index and straw yield were also higher for the line sowing than broadcast sowing. Fertilizer helps to increase the plant height, straw dry matter, grain weight and fertile tiller number.

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Introduction

Rice is the staple food for more than half of the world's population. About 90% of the world's rice is grown and produced in Asia (FAO, 2010). Rice (*Oryza sativa* L.) is the most important cereal crop and a source of calories for about 40% of the world population. During the last two decades, dramatic increase in the rice production has been witnessed in many developing countries. Bangladesh is an agro based country where rice is the staple food consuming 68% of the total calorie intake of her people (MOA, 1996). Although the cropping patterns of Bangladesh are mainly rice based but stick a chronic problem of food deficiency exists for a long time mainly became of low yields of rice due to poor fertility status of our soils. The intensive rice cultivation with HYV to meet up the food demands and that resulting marked, depleting of nutrient status of soil. The soil and climate of our country is quite suitable for the production of rice still it facing many problems. Rice grows all over in Bangladesh. But in the resign of north side is rich for rice production. Almost all the farmers in our country have no proper knowledge about planting rice and proper fertilizer doses. Among the different crop, rice is one of the most important crop grown in this area widely.

Direct seedling and transplanting are the two common methods of planting rice in the rice growing countries of the world, De Datta (1981);Chatterjee and Maiti (1985); and Sattar (1986). In Bangladesh transplanting methods is predominant in irrigated situation. But in upland and deep water rice culture direct seedling is widely used (Alim 1982). Tillering is a necessary precondition for high yields at most plants densities (Bhuiyan,1980) and adequate nitrogen nutrition is required during the period immediately after transplantation or sowing seeds for higher tillering (De Daattta 1978). The nutrient taken up per unit area increased with the increased planting density. It is very important to improve the methods of rice plantation and use of chemical fertilizer because both are paramount for increasing rice production along with HYV.

Introduction of hybrid rice is an important step towards augmentation of rice yield. Hybrid rice yields about 15-20% more than the promising high-yielding commercial varieties. Earlier studies reveal that judicious and proper use of fertilizers can markedly increase the yield and improve the quality of rice (Place, G.A. et all 1970). Given the importance of nitrogen fertilization on the yield in grain from the rice plant, it is necessary to know what the best dose is for each variety as well as its influence on components of yield and other agronomic parameters such as the cycle, plant height, lodging and moisture content of the grain, in order to obtain better knowledge of said productive response. Tanaka et al. (1966) showed that the height of a rice plant is positively correlated to the length of the maturation cycle. A taller plant is more susceptible to lodging and responds less well to nitrogen. The type of nitrogenous fertilizer may also affect the yield and quality of the grain (Gately, T.F. et all 1987). Some of these fertilizers, like urea, are substantially cheaper than others and their use may be justified on economic grounds provided they do not adversely affect the yield or quality of the grain.
Knowledge on proper N fertilizer and proper planting methods is important. As data on planting methods and proper N fertilizer doses and their effect on BRRI dhan 39 is not up to mark in our country, thus such type of study were under taken. The present study compares the yield performance of different planting methods of rice with different source of nitrogen at the northern part of Bangladesh.

Materials and methods

Plant materials and experimental design

The research work was conducted in the Biological science research field, Rajshahi University campus during June to October 2000 to evaluate the planting methods and different N fertilizer effect on yield and yield component of BRRI Dhan 39. The main experimental field was 32.5m X 16m which

was divided into 3 replication. Each replication includes 3 plots; in total there were 27 plots and land design were spilt plot design. The treatment randomly assigned to each unit plots. The selected rice variety BRRI dhan 39 was collected from BRRI Regional station, shampur, Rajshahi, Bangladesh.

Planting methods

Three planting methods were B=Broadcasting direct seedling, L= Broadcasting line sowing and T =Transplanting were used as parameter to conduct this experiment.

Fertilizer treatment

Fertilizer treatment were F1 (Pilled Urea), F2 (DAP + Guti Urea) and Fo = No Urea (Control). Fertilizer N rate were applied first in direct seedling methods (B+L) of 40 days after sowing seeds and transplanting methods first 10 days after transplant. Second and third time fertilizer applications were 55 and 70 days after sowing the seeds. The doses of fertilizer per plot were pilled urea 117.39gm, Diamonium phosphate 48gm, and Guti urea 97gm respectively.

Management of agronomic characters

The agronomic characters were Plant height(PH), Straw dry matter(DM), Flag leaf Length (FLL), Flag leaf breath (FLB), Total tiller number/m2, Fertile tiller number/m2, Grain weight/m2(g), 1000-grain weight(g), Straw weight/m2(g). The data were analyzed statistically with Fisher's analysis of variance technique at 5% probability level; treatments were compared using a protected LSD test.

Results and discussion

In Plant breeding research quantitative characters are no doubt important because most of the quantitative characters are economically important. Genetic information of the inheritance of quantitative characters is necessary of the production of effective and meaningful breeding program for its improvement. In the present investigation the different character such as Plant height (PH), Straw dry matter (DM), Flag leaf Length (FLL), Flag leaf breath (FLB), Total tiller number (TTN), Fertile tiller number (FTN), Grain weight (GW), 1000-grain weight (1000GW), Straw weight (SW) studied to evaluate proper planting methods and proper source of N fertilizer by the variety of BRRI Dhan 39. The quantitative nature of the characters of BRRI Dhan were also reported by De Datta (1978), Schmier et.al(1990), Peng et.al (1996), Elahi et.al (1995), Salma et.al (2001) and Khanam et.al (2001). The application of different source of N fertilizer showed a positive effect on the yield components. Plant height (PH), Straw dry matter (DM), Flag leaf Length (FLL), Flag leaf breath (FLB), Total tiller number (TTN), Fertile tiller number (FTN), Grain weight (GW), 1000-grain weight (1000GW), Straw weight (SW) responded significantly to the treatment.

All the characters discussed in the following sub heads-

Plant height

The main item different source of N fertilizer (F) was significant at 0.1% level for plant height indicating that application of different source of N fertilizer had significant effect on this character. The item planting method (M) was also significant at the level of 0.1%. Panting method × different source of N fertilizer (F×M) was not significant. In the result of application of different source of urea the tallest plant height (90.22cm) was found in direct seeding broadcasting method (B) and B (89.7cm) in F1. The effect of F0 (control) gave the lowest height (67.83) in transplanting method. Among different source of N fertilizer greatest value for height was (93.2cm) recorded in F2 and lowest (67.83cm) in F0. LSD value shows that in respect of plant height F1 and F2 are not significantly different but F0 significantly different with F1 and F2. Furthermore LSD value reveals that the difference between L and B was significantly different.

Straw dry matter

The ANOVA table displays that the item fertilizer (F) was significant for straw dry matter weight at

0.1% level. The item planting method was significant at 0.1% level. The interaction between fertilizers × planting method (F×M) was significant at 0.1% level. In the result of different planting methods optimum straw dry weight was recorded in transplanting (T) methods (8.79gm) and minimum was recorded in broadcasting direct seedling (B) methods (4.77gm). In case of F2 the maximum straw dry matter weight (13.06gm) was observed in transplanting method (T) and B (4.16gm) of F0 (control) showed the lowest. In the result of application of F2 the optimum straw dry matter (12.1gm) was showed in L and minimum in B of F0. LSD value shows that in respect of straw dry matter weight fertilizer F2 and F1 was highly significant but F1 and F0 were not significantly different in this character. The LSD value also shows that L and T were not significantly different but B was significantly different with other planting methods.

Table 1. Mean performance of plant height. The mean performance was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	74.7	89.7	93.2	85.86a
L	67.83	85.1	88	80.31b
T	70.46	87.53	89.4	82.48ab
Mean	70.99C	87.44AB	90.22A	

a, b = Variation between planting methods

A, B =Variation between fertilizer

Table 2. Mean performance of straw dry weight. The mean performance was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	4.16*DE*	4.43*DE*	5.76*CD*	4.77c
L	6.3*CD*	6.96*CD*	12.10*B*	8.45ab
T	6.16*CD*	7.16*CD*	13.06*A*	8.79a
Mean	5.54BC	6.18B	10.30A	

a, b = Variation between planting methods

A, B =Variation between fertilizer

AB = Comparison of planting methods and fertilizer each other

Flag leaf length

Among the different source of N fertilizer F2 gave (31.38cm) the highest length of flag leaf and F0 (22.11cm) gave the lowest length of flag leaf. In the result of application of DAP + Guti urea the tallest length of flag leaf (31.73cm) was found in transplanting (T) method and L (31.5cm) in F2. The ANOVA table shows that the item fertilizer (F) was significant for length of flag leaf at 0.1% level but the item planting method (M) was not significant. The interaction between fertilizer × planting method (F×M) was not significant. LSD value shows that in respect of length of flag leaf fertilizer F0 highly significant with F2 and F1 but F2 and F1 are not significantly different.

Flag leaf breath

In the result of application of DAP + Guti urea the highest breath of flag leaf (1.53cm) was found in broadcasting line showing method and lowest breath was (1.06cm) of F0 in B and L. The ANOVA table shows that the item fertilizer (F) was significant for breath of flag leaf at 0.1% level but the item planting methods (M) and interaction (F×M) are not significant. LSD value shows that in respect of breath of flag leaf F0 highly significant with F1 and F2 but F2 and F1 are not significantly different.

Table 3. Mean performance of length of flag leaf. The mean performance was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	22.46	30.76	30.93	28.05
L	22.16	29.4	31.5	27.68
T	21.73	29.04	31.73	27.50
Mean	22.11C	29.74AB	31.38A	

A, B =Variation between fertilizer

Table 4. Mean performance of breath of flag leaf. The mean performance was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	1.06	1.36	1.5	1.30
L	1.06	1.4	1.53	1.33
T	1.13	1.43	1.43	1.33
Mean	1.08C	1.39AB	1.48A	

AB = Variation between fertilizer

Total tiller number

The highest total tiller number (420) was recorded in L of F1 and lowest (242.66) in F0 of T. The ANOVA table displays that the item fertilizer (F) was significant at 0.1% level. The interaction

between fertilizers × planting methods (F×M) was non-significant. LSD value shows that in respect of total tiller number F1, F2 and F0 were not significantly difference. The value also shows that in respect of total tiller number the planting method L, B and T was not significantly difference.

Fertile tiller number

The maximum fertile tiller number was found in L of F2. The B of F0 showed minimum fertile tiller number. The ANOVA table reveals that the item fertilizer (F), planting methods (M) and interaction between fertilizer × planting methods (F×M) were significant at 0.1% level. LSD value shows that in respect of fertile tiller number F1 and F2 have no significantly difference but F0 significantly difference from F1 and F2 planting methods L, B and T all are significantly difference. LSD value also shows that the interaction between ((F×M) are mostly significantly difference.

Table 5. Mean performance of total tiller no. The mean performance was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	243	293	302	279.33bc
L	247.66	420	415.66	361.10a
T	242.66	304.66	364	303.77ab
Mean	244.44CB	339.22AB	360.55A	

ab = Variation between planting methods

AB = Variation between fertilizer

Table 6. Mean performance of fertile tiller no. The mean performance was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	154.33*GH*	152.66*HI*	174.66*EF*	160.55c
L	163.33*FG*	296.66*B*	355.33*A*	271.77a
T	185.33*DE*	268*C*	213*D*	222.11b
Mean	167.66C	239.10AB	247.66A	

ab = Variation between planting methods

AB = Variation between fertilizer

AB = Comparison with planting methods and fertilizer

Total Grain weight

The maximum grain weight was found in T of F2. The B of F0 showed minimum grain weight. The highest grain weight (593.66gm) was recorded in T of F1 fertilizer and lowest in F0 of B. The ANOVA table displays that the item fertilizer (F) was significant at 0.1% level. The item planting methods (M) was significant at 0.1% level. The interaction between fertilizers × planting methods (F×M) were significant at the level of 0.1%. LSD value shows that in respect of grain weight F1 and F2 are not significantly difference but F0 is significantly difference by the treatment of F1 and F2. The planting methods of B and L are not significantly difference but T is difference with L and B for the character of grain weight. Most of the interaction is significantly difference with each other.

1000-grain weight

The maximum 1000-grain weight was found in F1, F2 of L. The F0 of L showed the minimum 1000-grain weight. The highest 1000-grain weight (23.86gm) was found in F2 of B and lowest in F0 of L. The ANOVA table reveals that the item fertilizer was significant for 1000-grain weight at 0.1% level but the item planting methods (M) and interaction between (F×M) are non-significant. LSD value shows that5 fertilizer F1, F2 and F0 have no significantly difference by the character of 1000-grain weight.

Table 7. Mean performance on the character of total grain weight the mean difference was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	336.66*H*	408.33*EF*	450*DE*	398.33bc
L	240*H*	483.33*CD*	506.66*BC*	409.99b
T	343.33*G*	593.66*A*	536.66*B*	491.10a
Mean	306.66C	494.99AB	497.77A	

AB=Variation between fertilizer

AB=Comparison of planting methods with fertilizer each other

Table 8. Mean performance of 1000- grain weight the mean difference was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	22.38	22.08	23.86	22.77
L	19.76	23.18	23.36	22.08
T	20.63	22.02	22.46	21.70
Mean	20.92BC	22.42AB	23.22A	

AB=Variation between fertilizer

Straw weight

The maximum straw weight was found in B of F2. The B of F0 showed the minimum straw weight. The highest straw weight (1800gm) was found in L of F2 fertilizer and lowest in F0 of B. The ANOVA table reveals that the item fertilizer (F) was significant for straw weight at 0.1% level. The planting methods (M) were significant at 5% level. the item planting methods (M) and interaction between (F×M) are non-significant. LSD value shows that in respect of straw weight F2 and F1 was highly significant but F1 and F0 were not significantly difference .The value also shows that L and T were not significantly different but B was significantly different.

Table 9. Mean performance on the character of straw weight. The mean difference was tested by LSD.

Planting methods	Fertilizer			Mean
	F0	F1	F2	
B	510	880	1096.66	828.88ab
L	396.66	1143.33	1800	1113.33a
T	520	903.33	990	804.44c
Mean	475.55c	975.55AB	1295.55A	

ab=Variation between planting methods

AB=Variation between fertilizer

Table 10. Analysis of variance of all the characters with level of significance.

Item	F Value								
	PH	DM	FLL	FLB	TTN	FTN	GW	1000 GW	SW
Replication	1.915n	1.47n	0.79n	1.12n	0.79n	2.575n	1.743n	0.50n	3.04n
Fertilizer	221.33s	136.79s	134.15s	66.61s	7.29s	22.56s	54.65s	7.47s	19.31s
Methods	16.06s	101.06s	0.42n	0n	3.36s	36.30s	11.63s	1.59n	3.33s
F × M	0.33n	15.84s	0.8n	0.96n	0.91n	11.32s	4.76s	1.66n	2.47n

n = Non significant, where p>0.05 and

s = Significant, where p<0.05

Table 11. Cultivation cost for BRRI Dhan 39 as influenced by planting methods.

Operations/Items	B	L	T
Grand total	510	570	750
Cost increased or decreased (%) over broadcasting methods			
Average grain yield(t/h)	0.33194166	+11.76	+47.05
Average straw weight(t/h)	0.690733	0.3416583	0.4925
Average grain yield increased (%) broadcasting method		0.927775	0.670366
Value of average grain and straw yield (Tk. 6.00/kg rice & Tk.0.50/kg straw)		+2.92	23.28
Value of output increased (%) over broadcasting methods	2337.015	2513.836	2790.683
		+7.56	+19.41

Note: "+"means increase "-"means decrease.

Cost analysis

The analysis of cost were increased line sowing and transplanting methods respectively over broadcasting direct seeding method. In case of output value it was increased in line sowing and transplanting methods respectively over broadcasting direct seeding method. Similar trends were observed by BRRI (1993) and Halder et al (2000).

All the treatments produced higher number of grain and straw in comparison to control and in broadcasting direct seedling methods. This indicated that different source of nitrogen fertilizer and different planting methods showed superior beneficial effect in producing grains and straw. Similar results were obtained by Azim (1999) and Hoque (1999). When fertilizer N was not applied, yield of broadcast seeded was lower than transplanted rice because of limited sink formation caused by a severally N deficient leaf canopy which resulted in reduced dry matter production and N uptake after panicle initiation relative to transplanted rice. This suggests that transplanted rice acquires and utilizes indigenous soil N more

efficiently to produce grain than broadcast seeded rice.

The percent increase of grain and straw yields and other character that influenced the yields due to different planting methods. The results indicate that BRRI Dhan 39 responded better to the T method rather than from B. But among the planting method T and L was similar response. Same results were given in a technology transfer meeting BARC Shampur, Rajshahi, in June 28-30, 1999.

References

Ahmed M, Rahman,S. 1991. Influence of organic matter on the yield and mineral nutrition of modern rice and soil properties. Bangladesh rice J. **1,** 107-112.

Azim SMA. 1999. Effect of sulphur, Zinc and boron supplied from manures and fertilizers on BRRI Dhan 29. M.S. Thesis. Dept. Soil Sci., BAU, Mymensingh

Alim A. 1982. Bangladesh Rice.18 Garden Road, Dhaka 15.Bangladesh (1st edn) PP.96-99.

Akita S. 1989. Physiological aspects for improving yield potential in tropical rice culture, In: Progress in Irrigated Rice Research, PP 41-76, International Rice Research Institute, and Manila. Philippines.

BARC. 1997. Fertilizer Recommendation Guide, BARC, Soils Pub,. No.41.Dhaka.

Bhuiyan NI. 1980. Study of nitrogen in soil plant system in relation to growth and yield of wetland rice as influenced by n-supply and crop management. Thesis for the degree of Doctor of Philosophy. Graduate school of cornell University, USA, p. 3.

Bhuiyan NI, Zaman SK. 1984. study on the potential of organic materials relative to chemical fertilizers for wet land Rice culture. Proc. of the inter congress meeting of Commission IV.BARC.Dhaka., p. 478-504.

Chatterjee BN, Maiti S. 1985. Principles and practices of rice growing. Oxford and IBM Publishing Co.London. p. 40-47.

De datta SK. 1978. Fertilizer management for efficient use in wet land rice soil. Soils and rice. Int. Rice Res. Instr. Los Banos. Loguna, Philippines, PP.671-701.

Hoque MA. 1999. Response to BRRI 29 to sulphur,Zinc and boron supplied from manners and fertilizer. M.S. Thesis, Dept. Soil Sci. BAU. Mymensingh.

Halder KP, Chowdhury A. 1997. Effect of planting methods Nitrogen Rates on thye yield and yield components of Aus.Rice Grown under Rainfed condition at the coastal area of Bangladesh. Bangladesh J. Agril. Sci. **27 (1),** 59-64.

Khanam M, Rahman MM, Islam MR, Islam MR. 2001**.** Effect of marcures andferttilizer on the growth and yioeld of BRRI Dhan 30, Pakistan J. of Bio. Sci. **4 (2),** 172-174.

Khan MMR. 1998. Effect of Cowdung . Poultry manures and urea-N on the growth andyield of BRI29.M.S. Thesis Dept.Soil. Sci. BAU, Mymensingh.

Mohmmad TJ, Haider A. 2001. Influence of sowing Methods and Mulching on yield components of Wheat. Pakistan Journal of Biological Sciences4 **(6),** 657-659, 2001.

Sardar N. Aand Rosario EL. 1994. Effect of planting methods on crops establishment, growth and yield of magbean after rainfed wet land rice, Bang. j.Agril.Sci. **21 (2),** 223-233.

Sattar SA. 1986. Methods of planting rice .A rtice production training handbook. Bangladesh Rice Res. Inst. Gazipur p. 1-6.

Singh R, Agarwol SK. 2001. Analysis of growth and productivity of wheat in relation to levels, of FYM and nitrogen. Indian journal of plant physiology **6, 279**-83.