Reprint **ISSN 1994-1978 (Web Version)**

Journal of Soil and Nature (JSN)

(*J. Soil Nature*)

Volume: 7 **Issue: 2** **November 2014**

J. Soil Nature 7(2): 19-22 (November 2014)

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ISSN-1994-1978 (Online)
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PRE-RICE GREEN MANURING ON THE GROWTH AND YIELD OF BINA DHAN7

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Accepted for publication on 25 October 2014

ABSTRACT

Jahan N, Islam MR, Sumon MH, Huda A, Bilkis S (2014) Pre-rice green manuring on the growth and yield of BINA dhan7. *J. Soil Nature* 7(2), 19-22.

An experiment was conducted at the Soil Science Field Laboratory of Bangladesh Agricultural University, Mymensingh during Aman season of 2013 to study the effect of pre-rice green manure (GM) on the growth and yield of BINA dhan7. To undertake field trial with GM, five treatments were chosen: Fallow (No GM), GM with Deshi Dhaincha (*Sesbania aculeata*), African Dhaincha (*Sesbania rostrata*), Black gram (*Vigna radiata*) and Mungbean (*Vigna mungo*). After chopping GM at 50 days, short duration T. Aman rice BINA dhan7 was planted. For T. Aman there were nine treatment combinations: T_1 (No GM + 100%RDN), T_2 (*Sesbania aculeata* + 75%RDN), T_3 (*Sesbania aculeata* + 50%RDN), T_4 (*Sesbania rostrata* + 75%RDN), T_5 (*Sesbania rostrata* + 50%RDN), T_6 (*Vigna radiata* + 75%RDN), T_7 (*Vigna radiata* + 50%RDN), T_8 (*Vigna mungo* + 75%RDN) and T_9 (*Vigna mungo* + 50%RDN). The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The recommended fertilizer doses were used to supply N, P, K and S from Urea, TSP, MoP and gypsum, respectively. Among the yield contributing characters the panicle length and grains/panicle differed significantly due to different treatments which resulted in significant effect on the grain and biological yields of BINA dhan7. However, the other yield components and straw yields were statistically similar. The highest grain yield was found in T_2 (*Sesbania aculeata* + 75%RDN) which was statistically similar to T_6 (*Vigna radiata* + 75%RDN) and the lowest grain yield of 4125 kg ha^{-1} was found in T_8 (*Vigna mungo* + 75%RDN). The straw yields were identical in all the treatments. The N uptake by BINA dhan7 was also influenced by different treatments. The overall results indicate that use of *Sesbania aculeata* or *Vigna radiata* as pre-rice green manure with 75% recommended dose of nitrogen fertilizer could be recommended for higher production of BINA dhan7 in Aman season.

***Key words**: green manure, BINA dhan7, rice yield, N uptake*

INTRODUCTION

Rice (*Oryza sativa* L.) is the leading cereal crop in the world and staple food crop for about 160 million people of Bangladesh. Total rice production in Bangladesh was 31.9M T (DAE 2010). But the government had to import rice and wheat of T59601 million in the fiscal year of 2009-10 (BBS 2010). It indicates food deficiency in Bangladesh which could be minimized either by bringing more area under cultivation or by increasing the rice yield per unit area. Moreover, a significant amount of total agricultural land is going out of agricultural sector every year for building houses and industries for the ever increasing population of the country. To meet the demand of food requirement for our increasing population higher production is essential.

Soil fertility depletion is a major constraint for higher crop yield in Bangladesh. To overcome this constraint, efficient soil fertility and fertilizer management is important. Organic matter contributes to soil fertility and productivity through its positive effect on the physical, chemical and biological properties of the soil. But the organic matter content in many of our soils has been seriously depleted due to intensive cropping with modern varieties, very little use of crop residues, little or no use of organic manures, green manure etc. As a result, soil fertility, in general, has been degraded and stagnation in yield has occurred even with application of high dose of chemical fertilizers in most of our soils under rice based cropping patterns.

Green manure (GM) is a special kind of organic fertilizer grown chiefly to supply nitrogen to the main crop in a cropping system. It can also draw up other nutrients from deeper soil layers and enrich the surface soils. From the economic point of view, green manuring with locally available resources is going to offer a great opportunity since the chemical fertilizers are getting costly day by day. It has been shown that organic matter cycling is related to the agricultural potential of soils (Tissen *et al.* 1994) and that green manure production and incorporation represent an alternate source of nutrients to mineral fertilizers, as it readily decomposes under tropical condition.

Pre-rice green manuring with *Sesbania* greatly contribute in improving soil fertility and organic matter build up of the soils in Rice-Rice or other important cropping patterns. Besides *Sesbania*, Mungbean and Blackgram can also be used as GM crop. Therefore, the present research work was undertaken to observe the effect of pre-rice green manuring on the growth and yield of BINA dhan7 and to find out a suitable combination of green manure and N fertilizer for growing BINA dhan7.

MATERIALS AND METHODS

The experiment was carried out at the Soil science Field Laboratory, Bangladesh Agricultural University, Mymensingh during May-November 2013 to study the effect of green manure on the growth and yield of BINA dhan7. The experimental soil belongs to the Sonatala series under the AEZ of Old Brahmaputra Floodplain. Characteristically, the soil was silt loam in texture having pH 6.39, organic matter content 1.72%, and total N 0.039%. The experiment was designed with 9 treatments laid out in randomized complete block design with three replications. The unit plot size was 5m x 4m. The treatments used in the experiment were T_1 (No GM + 100%

RDN), T_2 (*Sesbania aculiata* + 75%RDN), T_3 (*Sesbania aculiata* + 50%RDN), T_4 (*Sesbania rostrata* + 75%RDN), T_5 (*Sesbania rostrata* + 50%RDN), T_6 (*Vigna radiata* + 75%RDN), T_7 (*Vigna radiata* + 50%RDN), T_8 (*Vigna mungo* + 75%RDN), T_9 (*Vigna mungo* + 50%RDN). Green manuring crop was incorporated into the soil at 50 DAS. Nitrogen, phosphorus, potassium and sulphur were supplied through urea, TSP, MoP and gypsum, respectively. The recommended fertilizer doses applied for the experiment were 180 kg urea ha^{-1}, 120 kg TSP ha^{-1}, 70 kg MoP ha^{-1}, 50 kg gypsum ha^{-1}. TSP, MoP and gypsum were applied as basal dose during final land preparation. Urea was applied in three installments (The first installment at 13 DAT, the second at 32 DAT and the third at 43 DAT). The seedlings of 25 days old were transplanted in the plots on the 8th August, 2013. Intercultural operations were done as and when necessary. The crop was harvested at full maturity. Five hills were randomly selected from each plot to record the yield contributing characters. Grain and straw yields were recorded plot wise and converted to kg ha^{-1}. Grain and straw samples were collected, dried, ground, sieved and finally chemical analysis was done. The nitrogen was analysed by micro-kjeldahl method. All the data were statistically analyzed following F-test and mean comparison was made by Duncan s New Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Yield contributing characters of BINA dhan7

The plant height of BINA dhan7 was not significantly influenced due to application of green manure in combination with different levels of N fertilizer (Table 1). The tallest plant (88.5 cm) was recorded in the treatment T_1 (No GM + 100%RDN) and the shortest plant (81.3 cm) was obtained in the treatment T_9 (*Vigna mungo* + 50%RDN). The highest number of effective tillers $hill^{-1}$ (13) was found in T_8 (*Vigna mungo* + 75%RDN) treatment and the lowest number of effective tillers $hill^{-1}$ (11) was found in T_4 (*Sesbania rostrata* + 75%RDN), T_7 (*Vigna radiata* + 50%RDN) and T_9 (*Vigna mungo* + 50%RDN) treatments. The panicle length and grains per panicle of BINA dhan7 were influenced significantly by the treatments. The highest panicle length (25.19 cm) was found in T_6 (*Sesbania aculeate* + 75%RDN) and it was statistically similar to T_4, T_5, T_7 and T_9. The lowest panicle length (20.13 cm) was observed in T_8 (*Vigna mungo* + 50%RDN). The number of grains/panicle varied from 80.59 to 100.3 with the highest value in T_6 (*Sesbania aculeate* + 50%RDN) and the lowest number of filled grains/panicle was found in T_8 treatment. Data in Table 1 show that application of green manure along with different levels of N influenced the 1000-grain weight of BINA dhan7 insignificantly. The highest 1000-grain weight (23.40 g) was recorded in T_6 (*Vigna radiata* + 75%RDN) and the lowest 1000-grain weight (21.27 g) was obtained in the treatment T_7 (*Vigna radiata* + 50%RDN).

Table 1. Effects of different green manures with different levels of nitrogen on yield components of BINA dhan7

Treatments	Plant height (cm)	Effective tillers $hill^{-1}$ (No.)	Panicle length (cm)	Grains $panicle^{-1}$ (No.)	1000 grain weight (g)
T_1 (No GM+100% RDN)	88.5	12	24.02ab	94.17abc	22.12
T_2 (*Sesbania aculeate* + 75%RDN)	88.0	12	24.73ab	96.57abc	21.57
T_3 (*Sesbania aculeate* + 50%RDN)	86.0	12	21.90bc	83.58cd	22.15
T_4 (*Sesbania rostrata* + 75%RDN)	84.8	11	24.20ab	98.65ab	22.25
T_5 (*Sesbania rostrata* + 50%RDN)	83.8	12	23.60ab	89.01abcd	23.08
T_6 (*Vigna radiata* + 75%RDN)	88.3	12	25.19a	100.3a	23.40
T_7 (*Vigna radiata* + 50%RDN)	85.9	11	23.27ab	86.62bcd	21.27
T_8 (*Vigna mungo* + 75%RDN)	87.8	13	20.13c	80.59d	23.12
T_9 (*Vigna mungo* + 50%RDN)	81.3	11	22.45abc	85.10cd	22.75
SE(±)	1.8	0.67	0.945	4.054	0.61
CV%	3.63	10.02	7.03	7.76	4.78
P value	0.147	0.326	0.040	0.026	0.275

Figure (s) in a column having common letters does not differ significantly.
GM= Green manure; RDN= Recommended dose of nitrogen; SE= Standard error of means; CV= Coefficient of variation

Grain yield

Grain yield of BINA dhan7 responded significantly to the application of green manure in combination with N fertilizer (Table 2). The highest grain yield (5483 kg ha^{-1}) was obtained in the treatment T_2 (*Sesbania aculeata* + 75%RDN) which was statistically similar with T_6 (*Vigna radiata* + 75%RDN) with the values of 5408 kg ha^{-1}. The lowest grain yield (4125 kg ha^{-1}) was obtained in the treatment T_8 (*Vigna mungo* + 75%RDN). The increased panicle length and grains/panicle in treatments T_2 and T_6 contributed to higher grain yield of BINA dhan7 in the same treatments (Table 2). The results of the present study are in agreement with Pervin *et al.* (1999) who found increased rice yield with the application of *Sesbania* green manure with *Azolla* and NPKS fertilizers. The grain yields obtained from different treatments may be ranked in the order of decreasing trend T_2> T_6> T_5> T_7> T_9> T_4> T_1> T_3> T_8.

Straw yield

Straw yield of BINA dhan7 did not respond significantly to the treatments. The numerical variation shows the highest straw yield (5482 kg ha^{-1}) recorded in the treatment T_5 (*Sesbania rostrata* + 50%RDN) and the lowest straw yield (4456 kg ha^{-1}) recorded in the treatment T_9 (*Vigna mungo* + 50%RDN).

Biological yield

Biological yield of BINA dhan7 was influenced significantly due to the use of green manure in combination with different levels of fertilizer-N (Table 2). The highest biological yield (10665 kg ha^{-1}) was recorded in the treatment T_6 (*Vigna culeat* + 75%RDN) and the lowest biological yield (8677 kg ha^{-1}) was noted in the treatment T_3 (*Sesbania culeate* + 50%RDN). The significant influence of the treatments T_2 and T_6 on the biological yield of BINA dhan7 is supported by the increased panicle length and grains/panicle in the same treatments. The biological yield obtained from different treatments may be ranked in the order of T_6> T_2> T_5> T_7> T_4> T_9> T_1> T_8> T_3. Hossain (2013) reported that grain yield, straw yield, and biological yield were increased significantly due to application of green manure in combination with N fertilizer.

Table 2. Effects of different green manures with different levels of nitrogen on grain, straw and biological yield of BINA dhan7

Treatments	Grain		Straw		Biological yield (kg ha^{-1})
	Yield (kg ha^{-1})	% increase Over control	Yield (kg ha^{-1})	% increase Over control	
T_1 (No GM + 100% RDN)	4253bc	-	4542	-	8795c
T_2 (*Sesbania aculeate* + 75%RDN)	5483a	28.92	5160	13.61	10643a
T_3 (*Sesbania aculeate* + 50%RDN)	4221bc	-0.75	4456	-1.89	8677c
T_4 (*Sesbania rostrata* + 75%RDN)	4293bc	0.94	4992	9.91	9285bc
T_5 (*Sesbania rostrata* + 50%RDN)	4624b	8.72	5482	20.7	10106ab
T_6 (*Vigna radiata* + 75%RDN)	5408a	27.16	5358	17.97	10665a
T_7 (*Vigna radiata* + 50%RDN)	4531bc	6.54	5080	11.85	9611bc
T_8 (*Vigna mungo* + 75%RDN)	4125c	-3.01	4628	1.89	8754c
T_9 (*Vigna mungo* + 50%RDN)	4306bc	1.25	4788	5.42	9094c
SE(±)	144		301.6		281.4
CV%	5.43		10.59		5.12
P value	<0.001		0.292		<0.001

Figure (s) in a column having common letters does not differ significantly.
GM= Green manure; RDN= Recommended dose of nitrogen; SE= Standard error of means; CV= Coefficient of variation

Nitrogen uptake by grain and straw

A significant variation in N uptake by grain of BINA dhan7 was observed in response to application of green manure in combination with N-fertilizer (Table 3). The highest N uptake (70 kg ha^{-1}) by grain was recorded in the treatment T_6 (*Vigna radiata* + 75%RDN) and the lowest N uptake (51 kg ha^{-1}) by grain was obtained in the treatment T_8 (*Vigna mungo* + 75%RDN). These results are also in agreement with Dekamedhi and Medhi (2000), Paturde and Patankar (1998), Singh *et al.* (2006), Ghosh *et al.* (2007), Chaudhary *et al.* (2011). The N uptake in straw of BINA dhan7 was not statistically significant due to application of green manure along with Fertilizer-N (Table 3). The highest straw N uptake (35 kg ha^{-1}) was obtained in the treatment T_5 (*Sesbania rostrata* + 50%RDN). The treatment T_3 (*Sesbania aculeate* + 50%RDN) produced the lowest N uptake (25kg ha^{-1}) in rice straw. There was a significant effect of integrated use of green manure and urea-N on total N uptake by BINA dhan7 (Table 3). The highest total N uptake (101 kg ha^{-1}) was recorded in the treatment T_6 (*Vigna radiata* + 75%RDN). The lowest total N uptake (77 kg ha^{-1}) was obtained in the treatment T_8 (*Vigna mungo* + 75%RDN). The total N uptake obtained from different treatments may be ranked in the order of T_6> T_2> T_5> T_7>T_4 > T_1> T_9> T_3> T_8.

Table 3. Effects of different green manure with different levels of nitrogen on N uptake by BINA dhan7

Treatments	N uptake by grain (kg ha^{-1})	N uptake by straw (kg ha^{-1})	Total N uptake (kg ha^{-1})
T_1 (No GM+100% RDN)	55c	25	80cd
T_2 (*Sesbania aculeate* + 75%RDN)	65ab	32	98ab
T_3 (*Sesbania aculeate* + 50%RDN)	53c	25	78d
T_4 (*Sesbania rostrata* + 75%RDN)	52c	32	84bcd
T_5 (*Sesbania rostrata* + 50%RDN)	59bc	35	93abc
T_6 (*Vigna radiata* + 75%RDN)	70a	31	101a
T_7 (*Vigna radiata* + 50%RDN)	58bc	27	85bcd
T_8 (*Vigna mungo* + 75%RDN)	51c	26	77d
T_9 (*Vigna mungo* + 50%RDN)	51c	27	78d
SE(±)	3.25	3.4	4.5
CV%	9.86	20.40	9
P value	<0.001	0.402	<0.001

Figure (s) in a column having common letters does not differ significantly.
GM= Green manure; RDN= Recommended dose of nitrogen; SE= Standard error of means; CV= Coefficient of variation

CONCLUSION

In the present research, it was found that panicle length, filled grains per panicle, 1000- grain weight, grain and straw yield and N uptake were higher in the plots treated with green manure in combination with 75% recommended fertilizer. Among the green manuring crops used in the experiment *Sesbania aculeata* performed better. However, there was no significant difference between *Sesbania aculeata* and *Vigna radiata.* Therefore, use of *Sesbania aculeata* or *Vigna radiata* with 75% of recommended fertilizer N application could be recommended for BINA dhan7 production during Aman season in Bangladesh.

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