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Performance of Sunray Organic Fertilizer on the Growth and Yield of Wetland Rice

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ABSTRACT

The experiment was conducted at Bangladesh Rice Research Institute farm, Gazipur during the T. aman season, 2003 in order to determine the performance of Sunray organic fertilizer on the growth and yield of rice. The following eight treatment combinations were tested in wetland condition: T_1= Native nutrient; T_2 = Sunray Formula + G (SF) @ 100 kg/ha + Sunray Padiplus (PP) 20 ml @ 10 ml/4.5 lit./100m^2 + Sunray Pady Segar (PS) @ 150 kg/ha + (STB - N, P, K, S & Zn content in SF, PP & PS); T_3= STB for high yield goal (HYG); T_4= STB + 20 ml PP; T_5= STB + 10 ml PP; T_6= SF @ 400 kg/ha + (STB - N, P, K, S & Zn content in 400 kg SF); T_7= PS @ 400 kg/ha + (STB - N, P, K, S & Zn content in 400 kg PS); T_8= SF @ 200 kg/ha + PS@ 200 kg/ha + 10 ml PP + (STB - N, P, K, S & Zn content in SF, PS and PP). The blanket doses of fertilizers were applied on soil test based (STB). BRRI dhan31 was used as test crop. The sources of N, P, K, S & Zn were Urea, TSP, MP, gypsum and zinc sulphate. Urea was applied into three equal splits, 1/3rd basal, 1/3rd maximum tillering stage and the remaining 1/3rd at panicle initiation stage. The treatment T_2 where Sunray fertilizer were applied in combination with chemical fertilizer on STB produced substantially higher yield than those of other tested treatments. In terms of economic point of view this treatment also be considered as the most viable treatment in the experiment.

Key words: Sunray, organic fertilizer, growth and yield, wetland rice.

INTRODUCTION

Rice is one of the most extensively cultivated cereals of the world and feed one half of the world's population. Half of mankind depends on rice with more than 90% of the world rice grown and consumed in Asia (Anonymous, 1989). Fertilizers' benefits to crop have been realized by farmers in decades in terms of accelerating plant growth, increasing agricultural production resulting in better food quality and crop yield. Over the past 50 years, agricultural production has increased dramatically, in part through the use of chemical fertilizers and pesticides. These technologies and the intensive production systems provides increased human and environmental health risks (Pradhan, 1992). Continuous use of inorganic fertilizers alone to soils had a deleterious effect on soil productivity and a steadily trend in rice productivity associated mainly with loss of inherent soil fertility (Nambiar *et al.,* 1998). Organic matter content of the soils are constantly decreasing by

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repeated farming which leads to hard soil. Nutrient rich organic fertilizer improves soil condition, reduce soil compactness, clotting and erosion. Now the requirement is to properly understand the organic fertilizer in rice production and adopt proper approach to enhance high yield and quality. Suitable organic sources of nutrients are necessary for sustainable agriculture that will provide maximum rice production with good quality and maintain a sound environment. Therefore, the experiments were conducted to evaluate varying combination of Sunray organic fertilizer's performance in wetland rice culture.

MATERIALS AND METHODS

The experiment was conducted at BRRI farm, Gazipur during T. aman season 2003. The soil was clay loam with pH 6.42, total nitrogen 0.15%, available P 5.23 ppm, available S 9.95 ppm, exchangeable K 0.13 meq/100g soil and available Zn 5.45 ppm. Soil texture, pH, organic matter, available P, S & Zn and exchangeable K were determined following standard methods (Black, 1965; Jackson, 1962; Walkley and Black, 1935; Olsen *et al*., 1954 and Page *et al*., 1982). The following eight treatment combinations were tested: T_1= Native nutrient; T_2 = Sunray Formula + G (SF) @ 100 kg/ha + Sunray Padiplus (PP) 20 ml @ 10 ml/4.5 lit./100m^2 + Sunray Pady Segar (PS) @ 150 kg/ha + (STB - N, P, K, S & Zn content in SF, PP & PS); T_3= STB for high yield goal (HYG); T_4= STB + 20 ml PP; T_5= STB + 10 ml PP; T_6= SF @ 400 kg/ha + (STB - N, P, K, S & Zn content in 400 kg SF); T_7= PS @ 400 kg/ha + (STB - N, P, K, S & Zn content in 400 kg PS); T_8= SF @ 200 kg/ha + PS@ 200 kg/ha + 10 ml PP + (STB - N, P, K, S & Zn content in SF, PS and PP). The estimated fertilizer doses for N, P, K, S and Zn were 80, 30, 40, 10 and 1 kg/ha for STB. The fertilizers were applied as follows T_2 = SF and P at land preparation, N at 20 DAT, PP at 30 & 45 DAT and PS at 40 DAT; T_4= PP at 30 & 45 DAT; T_5= PP at 5-7 DBPI; T_6= SF, P, K, S & Zn at basal and N at 40 DAT; T_7= PS, P, S, Zn at basal and N at 20 and 40 DAT; T_8= SF, PS, P, S and Zn at basal, N at 20 DAT and PP at 45 DAT.

The sources of N, P, K, S & Zn were Urea, TSP, MP, gypsum and zinc sulphate respectively and were applied at final land preparation. Urea was applied into three equal splits, 1/3rd basal, 1/3rd maximum tillering stage and the remaining 1/3rd at panicle initiation stage. The experiment was laid out in a randomized complete block design with three replications having unit plot size of 5m x 4m. BRRI dhan31 was used as test crop. Thirty day old 2-3 seedling/hill were transplanted with 20 cm x 20 cm spacing. Necessary intercultural operations were done as and when required. At maturity, the crop was harvested from 5 m^2 area for grain and straw yield and grain yield was adjusted to 14% moisture content. The tiller, panicle, filled grain and unfilled grain production were recorded. Nutrient content of straw and grain were determined using standard analytical procedure. Total nutrient uptake was estimated. Finally economic analyses were done for net benefit and marginal rate of return.

RESULTS AND DISCUSSION

Growth and Yield

Application of Sunray alone or in combination with chemical fertilizer increased the tiller and panicle production over control. Highest number of tiller was recorded in treatment T_7 followed by treatment T_4 (Table 1). On the other hand treatment T_8 produced the highest number of panicle followed by treatment T_7. Lowest filled grain was found in treatment T_1 and highest filled grain was found in treatment T_7. Maximum grain weight was recorded in treatment T_8 followed by T_2.

Application of Sunray fertilizer in combination with chemical fertilizer significantly increased the grain yield of rice over control. Treatment T_2 produced significantly higher grain yield (1.2 t/ha) over control (Table 1). Maximum grain yield was observed in treatments T_7 followed by the treatment T_4. It is appeared from the results that 400 kg Sunray Pady Segar along with other chemical fertilizer may be a good combination for producing reasonable higher yield of rice in T. aman season.

Table 1. Effect of sunray fertilizer alone and in combination with chemical fertilizer on the growth and yield of wetland rice, T. Aman 2003

Treatment[1]	Tillers m^{-2} (no.)	Paniclem^{-2} (no.)	Filled grains%	1000 grain wt.(g)	Grain yield(t/ha)	Straw yield(t/ha)
T1	123	143 c	64.0 b	26.6	2.88 c	3.88 cd
T2	127	181 a	70.3 a	27.4	4.08 ab	5.25 a
T3	131	172 a	66.6 ab	27.1	4.17 ab	4.18 cd
T4	137	161 ab	65.2 b	27.0	4.25 a	4.65 bc
T5	130	163 ab	62.7 b	27.2	4.16 a	4.30 cd
T6	132	165 a	71.6 a	27.3	4.03 b	4.45 bc
T7	141	183 a	73.5 a	27.1	4.36 a	4.84 ab
T8	130	184 a	70.5 a	27.8	3.93 b	4.56 bc
CV (%)	5.72 (NS)	4.04	5.32	5.26 (NS)	3.84	5.12

Note: [1]Treatments are described in Materials and Method
NS= Not Significant
In a column, the figures having common letter(s) do not differ significantly at 5% level of significance

Nutrient Concentration and Uptake

Application of chemical fertilizer alone or in combination with Sunray fertilizer increased the concentration of N but the conc. of P and K was not increased in grain and straw (Table 2). In T. aman season application of chemical fertilizer alone or in combination with Sunray fertilizer increased the total uptake of N, P and K (Table 3).

Table 2. Effect of sunray fertilizer alone and in combination with chemical fertilizer on the nutrient content of BRRIdhan 31, BRRI, Gazipur, T. Aman 2003

Treatments[1]	N%		P%		K%	
	Grain	Straw	Grain	Straw	Grain	Straw
T1	1.25 d	0.59 b	0.18 b	0.046	0.21 b	1.44 ab
T2	1.40 a	0.64 a	0.18 b	0.047	0.23 ab	1.49 ab
T3	1.31 c	0.66 a	0.19 a	0.047	0.24 a	1.52 a
T4	1.34 bc	0.66 a	0.18 b	0.048	0.23 ab	1.36 b
T5	1.33 bc	0.65 a	0.17 c	0.048	0.22 ab	1.49 ab
T6	1.35 abc	0.69 a	0.19 a	0.046	0.21b	1.40 ab
T7	1.37 abc	0.68 a	0.18 b	0.046	0.22 ab	1.48 ab
T8	1.38 ab	0.68 a	0.18 b	0.047	0.22 ab	1.53 a
CV (%)	2.1	5.3	2.6	4.3 (NS)	5.4	5.5

Note: [1]Treatments are described in Materials and Method
NS= Non Significant
In a column, the figures having common letter(s) do not differ significantly at 5% level of significance

Economic Analysis

Net Benefit

Economic analysis of partial budget for the experiment is presented in Table 4. The net benefit of each treatment is calculated by subtracting the total costs that vary from the gross field benefit. The total costs that vary are the sum of all the costs that vary for a particular treatment. The highest net benefit was recorded in T_2 followed by T_4.

Table 3. Effect of sunray organic fertilizer on nutrient uptake by BRRI dhan31 BRRI, Gazipur, T. Aman 2003

Treatments[1]	Total uptake (kg/ha)		
	N	P	K
T1	59 c	6.99 b	62 bc
T2	91 a	9.96 a	88 a
T3	83 b	9.93 a	73 ab
T4	82 b	9.76 a	66 bc
T5	84 ab	9.38 a	73 ab
T6	88 ab	9.54 a	71 ab
T7	90 a	9.80 a	73 ab
T8	85 ab	9.39 a	79 a
CV (%)	5.81	4.73	4.67

Note: [1]Treatments are described in Materials and Methods
In a column, the figures having common letter(s) do not differ significantly at 5% level of significance

Table 4. Economic analysis on partial budget for the experiment of sunray fertilizer in T. Aman rice production 2003

Particulars	Treatments							
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
Grain yield (t/ha)	2.88	4.08	4.17	4.25	4.16	4.03	4.36	3.93
Straw yield (t/ha)	3.88	5.25	4.18	4.65	4.30	4.45	4.84	4.56
Adjusted grain yield (t/ha)	2.59	3.67	3.75	3.83	3.74	3.63	3.92	3.54
Adjusted straw yield (t/ha)	3.49	4.73	3.76	4.19	3.87	4.01	4.36	4.10
Gross field benefit, grain (Tk/ha)	20720	29360	30000	30640	29920	29040	31360	28320
Gross field benefit, straw (Tk/ha)	3490	4730	3760	4190	3870	4010	4360	4100
Total gross field benefit (Tk/ha)	24210	34090	33760	34830	33790	33050	35720	32420
Total gross field cost (Tk/ha)	0	3660	4448	5188	48178	8784	9441	9310
Net benefit (Tk/ha)	24210	30430	29312	29642	28972	24266	26279	23110

Note: Urea = Tk. 6.00 /kg, TSP= Tk 14.00/kg, MP= Tk.10.00./kg , Gypsum= Tk. 4.00/kg,

Zinc Sulphate=Tk. 65.00/kg, Sunray Formula+ G =Tk 18.00/kg, Sunray Pady Segar = Tk.19.00/kg, Sunray Pady Plus =Tk.400.00/lit., Paddy= Tk.8.00/kg and straw= Tk. 1.00 /kg, Yield adjustment of paddy and straw = 10% and Minimum rate of return = 100%

Dominance and Marginal Analysis

The analysis has been done in stepwise manner, passing from the treatment with the lowest costs that vary to the next considering. As the increase in cost, the net benefit would be increased. The net benefits are lower in T_3, T_4, T_5, T_6, T_7 and T_8 as the cost increase (Table 5). Thus T_3, T_4, T_5, T_6, T_7 and T_8 are cost dominated treatment and can be eliminated for further consideration.

It is well known that the minimum marginal rate of return for the crop is 100%. If the marginal rate of return of the change from the first to the second treatment is equal or above the minimum marginal rate of return then the next comparison was made between second and third treatment (not between first and third). This comparison was continued (i.e. increasing level of investment) until the marginal rate of return falls below the minimum rate of return.

In the experiment, the marginal rate of return between T_1 and T_2 is 187% well above the 100% minimum. Farmers will continue to invest as long as the returns to each extra unit invested

(measured by MRR) which are higher than the cost of the extra invested (measured by the minimum acceptable rate of return) (Table 5). Thus it can be concluded that T_2 is the most economically viable treatment of the experiment.

Table 5. Dominance and marginal analysis of sunray organic fertilizer for rice production. BRRI, Gazipur, T. Aman 2003

Treatments[1]	Total costs that vary (Tk./ha)	Net benefit (Tk./ha)	Marginal rate of return
T1	0	24210	187%
T2	3330	30430	
T3	4447.76	29312.24 D	
T5	4817.76	28972.24 D	
T4	5187.76	29642.24 D	
T6	8783.66	24266.34 D	
T8	9310.38	23109.62 D	
T7	9441.10	26278.90 D	

Note: [1]Treatments are described in Materials and Method

D=Dominated

CONCLUSION

The treatment T_2 where Sunray fertilizer were applied in combination with chemical fertilizer on STB produced substantially higher yield than those of other tested treatments. In terms of economic point of view this treatment also be considered as the most viable treatment of the experiment.

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