J. Bangladesh Agril. Univ. 2(1): 15–18, 2004 ISSN 1810-3030

Effects of rice straw and sulphur on the growth and yield of rice

S.A. Haque and L. Chowdhury
Department of Soil Science, Bangladesh Agricultural University, Mymensingh

Abstract

A field experiment was carried out to investigate the effects of addition of rice straw and S on growth and yield of high yielding variety of rice (BRRI Dhan 30) under flooded condition and on post harvest soil. The experiment was undertaken on an Old Brahmaputra Floodplain silt loam soil at BAU farm. The soil was characterized by mild acidic in reaction and in general poor in nutrient status. The treatments used in the experiment were (1) Control (-S), (2) Rice straw @ 6 t ha^{-1}, (3) S @ 20 kg S ha^{-1} and (4) Rice straw @ 6 t $ha^{-1}$and S @ 20 kg S ha^{-1}. Gypsum was used as the source of S. Basal fertilizers, such as urea @ 70 kg N, TSP @ 17.5 kg P, MOP @ 33.2 kg K and ZnO @ 3 kg Zn per hectare were applied along with gypsum at the time of transplanting of rice seedlings. Nitrogen was applied in three equal splits, at transplanting, maximum tillering and panicle initiation stage. The treatments were laid out in completely randomized block design with three replications of each treatment. The test crop used was HYV rice, BRRI Dhan 30.

Dry matter yield of rice plants significantly increased at both maximum tillering and panicle initiation stage in treatment with rice straw and S applied together. There were significant increases in all yield contributing attributes of the crop except, 1000-grain weight in both rice straw and S treatments over control. Grain and straw yields of rice significantly increased due to application of rice straw and S together over the control treatment. Grain yield increases were 11.90, 19.76 and 25.95% in rice straw, S and rice straw and S (together) treatments respectively over the control treatment. The application of rice straw slightly decreased soil pH, while it significantly improved organic matter content, total N, exchangeable K and available S in post harvest soil.

Keywords: Rice straw, Sulphur, Crop yield, Post-harvest soil

Introduction

Among the soil fertility problems, S has been identified as a major nutritional problem for rice. Sulphur deficiency has been recognized in most of the soils of Bangladesh (Majid, 1986), which covers not less than four million hectares of cultivable lands (Hussain, 1990). The major causes of S deficiency in Bangladesh are due to cropping round the year, use of S free fertilizers, depletion of organic matter with little or no addition of manure, leaching of S in high rainfall areas and particularly leaching loss in light textured soils with flood irrigation. Haque (1997) reported of higher S requirement under wetland rice with phosphate fertilization, which is the major rice cultivation practice in Bangladesh. Gregg and Goh (1982) found that S fertilization resulted in greater release of S from organic matter. Management of crop residues, particularly that of rice should be considered as a means of reducing S requirement of a cropping system. The turn over of S from crop residues has become increasingly important for maintaining supplies of S to the plant, where other inputs of S to soil-plant system such as fertilizer and atmospheric S decreases. Therefore, a field experiment was carried out to investigate the effects of addition of rice straw, S and rice straw and S together on growth and yield of BRRI Dhan 30 under flooded condition and changes on post harvest soil.

Materials and Methods

The experiment was carried out at Bangladesh Agricultural University farm, Mymensingh under the 'Sonatola' soil series, which belonged to Old Brahmaputra Floodplain agro-ecological zone. The experiment was conducted in the Aman season (July-November) of 2000. The soil was characterized by silt loam in texture with pH 6.8, organic matter content 2.75%, CEC 12 m.e.%, total N 0.17%, available P 11.0 ppm, exchangeable K 0.15 m.e.%, available S 8.0 ppm, and available Zn 1.11 ppm.

Treatments used in the experiment were (1) Control (-S), (2) Rice straw @ 6 t ha^{-1}, (3) S @ 20 kg S ha^{-1}, and (4) Rice straw @ 6 t ha^{-1} and S @ 20 kg S ha^{-1}. Gypsum was used as the source of S. Basal fertilizers such as urea @ 70 kg N, TSP @ 17.5 kg P, MOP @ 33.2 kg K and ZnO @ 3 kg Zn per hectare were applied along with gypsum at the time of transplanting of rice seedlings. Nitrogen was applied in three equal splits, at transplanting, maximum tillering and panicle initiation stage. The treatments were laid out in completely randomized block design with three replications of each treatment. The test crop used was HYV rice, BRRI Dhan 30.

Results and Discussion

Dry matter yields of the rice plants were recorded both at the maximum tillering and the panicle initiation stages. At maximum tillering stage, dry matter yield of rice plants ranged from 0.81–0.99 t ha^{-1}. Significant variations at maximum tillering stage were not found between the treatments. During panicle initiation stage, dry matter yield of rice plants rose from 3.34-4.59 t ha^{-1}. At panicle initiation stage, dry matter yield produced by the treatment with rice residue was significantly higher compared to the control treatment and similar to that of the S treatment. Maximum dry matter yield of rice plants (4.59 t ha^{-1}) was obtained in the treatment, where rice straw and S applied together. It increased the dry matter yield of rice plants by 37.43 % over the control treatment (Table 1).

Table 1. Effects of rice straw and S on dry matter yield of rice at maximum tillering and panicle initiation stages

Treatment	Maximum tillering stage		Panicle initiation stage	
	DM yield (t ha^{-1})	Increase (%)	DM yield (t ha^{-1})	Increase (%)
1. Control (-S)	0.81 b	--	3.34 c	--
2. Rice straw @ 6 t ha^{-1}	0.88 b	8.64	4.27 b	27.84
3. Sulphur @ 20 kg S ha^{-1}	0.97 a	19.75	4.36 b	30.54
4. Rice straw @ 6 t ha^{-1} and Sulphur @ 20 kg S ha^{-1}	0.99 a	22.22	4.59 a	37.43
SE±	0.0258	--	0.0577	--

Figures in a column having common letters do not differ significantly at 5% level of significance

Yield contributing attributes of rice plants, such as effective tillers $hill^{-1}$, panicle length, filled grains $panicle^{-1}$ and 1000-grain weights were recorded at harvest. The number of effective tillers $hill^{-1}$ ranged from 7.27-10.10, panicle length from 21.19-24.25 cm and the number of filled grain $panicle^{-1}$ from 88.81-98.08, while 1000-grain weight varied from 23.20-23.57g only. There were significant increases in all the yield contributing parameters except 1000-grain weight in both rice straw and S treatments over the control (Table 2). Grain and straw yields of rice significantly increased due to application of rice straw and S applied together as well as singly over the control treatment (Table 3). Grain yield increases were 11.90, 19.76 and 25.95% in rice straw, S and rice straw and S treatments respectively over the control treatment. Both maximum grain (5.29 t ha-1) and straw (6.04 t ha^{-1}) yields were obtained in rice straw and S treatment.

Table 2. Effects of rice straw and S on yield contributing characteristics of rice

Treatment	Effective tillers hill^{-1} (no)	Panicle length (cm)	Filled grains panicle^{-1} (no)	1000-grain weight (g)
1. Control (-S)	7.27 c	21.19 b	88.81 c	23.20
2. Rice straw @ 6 t ha^{-1}	9.07 b	23.93 a	93.08 b	23.40
3. Sulphur @ 20 kg S ha^{-1}	9.93 a	24.21 a	97.46 a	23.50
4. Rice straw @ 6 t ha^{-1} and Sulphur @ 20 kg S ha^{-1}	10.10 a	24.25 a	98.08 a	23.57
SE±	0.1414	0.1238	0.9504	NS

Figures in a column having common letters do not differ significantly at 5% level of significance

Table 3. Effects of rice straw and S on grain and straw yields of rice

Treatment	Effective tillers hill^{-1} (no)	Panicle length (cm)	Filled grains panicle^{-1} (no)	1000-grain weight (g)
1. Control (-S)	4.20 c	--	4.45 c	--
2. Rice straw @ 6 t ha^{-1}	4.70 bc	11.90	4.83 bc	8.54
3. Sulphur @ 20 kg S ha^{-1}	5.03 ab	19.76	5.47 ab	22.90
4. Rice straw @ 6 t ha^{-1} and Sulphur @ 20 kg S ha^{-1}	5.29 a	25.95	6.04 a	35.86
SE±	0.1505	--		--

Figures in a column having common letters do not differ significantly at 5% level of significance

Application of rice straw slightly decreased pH of the post harvest soil. It however, significantly improved organic matter status of the soil. Rice residues also significantly improved plant nutrients such as available sulphur, total nitrogen and exchangeable potassium contents of the post-harvest soil (Table 4).

Table 4. Effects of rice straw and S on changes in properties of the post-harvest soil

Treatment	pH	O.M. (%)	Avail. S (ppm)	Total N (%)	Avail. P (ppm)	Exch. K (m.e.%)
1. Control (-S)	7.76	1.60 b	12.4 d	0.19 b	12.0 b	0.14 c
2. Rice straw @ 6 t ha^{-1}	6.65	1.65 a	14.2 c	0.22 a	12.8 ab	0.19 a
3. Sulphur @ 20 kg S ha^{-1}	6.70	1.60 b	15.4 b	0.22 ab	12.2 b	0.14 c
4. Rice straw @ 6 t ha^{-1} and Sulphur @ 20 kg S ha^{-1}	6.58	1.64 a	16.0 a	0.21 ab	13.2 a	0.16 b
SE±	--	0.0082	0.1653	0.0082	0.3596	0.0082

Figures in a column having common letters do not differ significantly at 5% level of significance

Acknowledgement

Financial support provided by the Bangladesh Agricultural University Research System (BAURES) to carry out the research project is gratefully acknowledged.

References

Gregg, P.E.H. and Goh, K.M. 1982. Field studies with radioactive sulphur labelled gypsum fertilizer. 4: Recover by pasture and soil components. N.Z.J. Agric. Res. 25: 345-353.

Haque, S.A. 1997. Phosphate fertilization affecting sulphur balance in soil. Procedings, 11th World Fertilizer Congress on Fertilization for Sustainable Plant Production and Soil Fertility. Ghent, Belgium, Vol-II: 140-145.

Hussain, S.G. 1990. Sulphur in Bangladesh agriculture. Sulphur in Agriculture. Vol. 14, 25-28.

Majid, S.A. 1986. The response of major crops to sulphur. Proceedings, International Symposium on Sulphur in Agricultural Soils. BARC, Dhaka. 18-28.