EFFECT OF DIFFERENT RATES OF SULPHUR ON THE YIELD AND YIELDATTRIBUTES OF RICE IN OLD BRAHMAPUTRA FLOODPLAIN SOIL

M. N. RAHMAN[1], M. B. ISLAM[2], S. M. SAYEM[3], M.A. RAHMAN[1] AND M. M. MASUD[1]

[1]Scientific Officer, Soil Science Division, BARI, Joydebpur, Gazipur, [2]Chief Scientific Officer, OFRD Division, BARI, Joydebpur, Gazipur.
[3]Lecturer, Dept. of Soil Science, Hajee Danesh Science and Technology University, Dinajpur

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ABSTRACT

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A field experiment was conducted on a non-calcareous dark gray floodplain soil (Sonatola series) of BAU farm, Mymensingh during Boro season of 2004 using rice (cv. BRRI dhan29) as a test crop. The soil was silt loam having pH 6.8, organic matter 1.62%, available Sulphur (S) 9 ppm and available Phosphorus (P) 7.62 ppm. There where five treatments viz. T_0 (control), T_1 (10kg S/ha), T_2 (20kg S/ha), T_3 (40kg S/ha) and T_4 (60kg S/ha). A randomized complete block design was followed with four replications. All plots received an equal dose of N, P, K and Zn. The application of S had a significant positive effect on tillers/hill, plant height, panicle length and grains/panicle. The highest grain (5.81t /ha), and straw (7.38t / ha) yields were recorded in the T_2 (20kg S/ha). The T_0 (control) had the lowest grain yield of 4.38t /ha as well as the lowest straw yield of 5.43t /ha. Regression analysis showed that the optimum dose of S was 32.89 kg/ha and the economic dose of S was 31.59 kg/ha for maximizing the yield. Overall results indicate that application of S fertilizer at a recommended rate (20kg S/ha) might be necessary for obtaining higher grain yield as well as straw yield of Boro rice (cv. BRRI dhan29) in BAU farm and also in the areas having similar edaphic factors.

Key Words: Sulphur effect, Yield attributes, Floodplain Soil.

INTRODUCTION

Rice (*Oryza sativa)* is the staple food crop in Bangladesh and the cropping pattern of the country is predominately rice-based. Rice cultivation covers 80% of the arable land of Bangladesh. Bangladesh produces 24.29 million metric tons of rice per year from 10.66 million hectares of land (BBS 2002). The total production of rice of the country is not sufficient to meet the requirement of her people. The agro-climatic and edaphic conditions of Bangladesh are favorable for rice cultivation all the year round. Recently, S deficiencies in rice fields have been reported in different areas of Bangladesh. The practice of intensive cropping with modern varieties causes a marked depletion of inherent nutrient reserve in soils of Bangladesh. The nutrient depletion shows a risk of the prospect for higher crop production in this country. Among the essential elements S is very much beneficial for increasing the production of rice. S is one of the major nutrient elements to synthesis certain amino acids such as methionine, cystine, cysteine and some plant hormones; such as thiamine and biotin (De Datta, 1981). S deficiency in rice in Bangladesh was first defected at BRRI farm in Joydebpur in 1976 (Islam; 1978). S deficiency mainly arises under water-logged condition or in low land rice cultivation. Thus, in Boro rice cultivation where continuous water in needed s deficiency is a major limiting factor. If plant nutrients are not supplied in an adequate amount, high yielding crop varieties under intensive cropping may fail to express their potentiality. Improper nutrient balance in soil results in lower yield and quality of the produce. The goal of sustainable crop productivity in an area can be achieved through a constant monitoring and balancing the existing nutrient deficiencies.

MATERIALS AND METHODS

The experiment was carried out during Boro season 2003-2004 at the Soil Science Field Laboratory of Bangladesh Agricultural University (BAU) Mymensingh. The experimental soil was Sonatala silt loam, a member of hyperthermic aeric haplaquept. The physical and chemical characteristics of the initial soil are shown in Table 1.

Table 1. Physical and chemical properties of the soil

Particle size analysis	Results
Sand (%) (2.0-0.02 mm)	20
Silt (%) (0.02 0.002 mm)	68
Clay (%) (<0.002 mm)	12
Soil textural type	Silt loam
Organic matter content (%)	1.62
pH	6.80
Total N (%)	0.12 (low)
Available P (ppm)	7.6 2 (Medium)
Available S (ppm)	9.00 (low)
Exchangeable K (me/100 g soil)	0.15 (low)

The experiment was laid out in a Randomized Complete Block Design (RCBD). The unit plot size was 4m × 3m. Five treatments 0, 10, 20, 40 and 60 Kg S /ha were used in the experiment. Treatments were randomly distributed within the blocks. The variety of the rice crop was BRRI dhan 29. Fertilizer such as urea, TSP, MP, gypsum and ZnO were used as sources for N, P, K, S and Zn, respectively. One-third dose of urea and the full dose of all other fertilizers were applied as basal to the individual plots during final land preparation. The fertilizers were incorporated into soil by hand. As the amount of ZnO for a unit plot was small, the fertilizer was mixed with ground dry soil before application. The second split of urea was applied 35 days after transplanting i.e. at maximum tillering stage and the third split 60 days after transplanting i.e. at panicle initiation stage. Intercultural operations were done for ensuring and maintaining the normal growth of the crop. The crop was harvested at full maturity on May 23, 2004. The harvested crop of each plot was bundled separately and brought to the threshing floor. Grain and straw yields were recorded plot wise and expressed as t /ha on 14% moisture basis. Plant data were recorded for yield and yield components of rice. The yield components were of plant height, number of effective tillers per hill, panicle length, filled grains in panicle and thousand-grain weight.

RESULTS AND DISCUSSION

The effect of different rates of S application on different yield contributing characters and yield of BRRI dhan29 rice were studied at Bangladesh Agricultural University farm. The height and effective tillers was significantly affected due to application of S. Plant height due to different treatments varied from 84.8 to 94.9 cm (Table 2). Apparently, the tallest plant was observed in T_2, and the shortest plant was recorded in T_0 (control). Significant effect of S on plant height of rice has also been observed by many others in the past (Salam and Subramanian, 1988, Uddin *et al*., 1997). The number of tillers /hill due to different treatments varied from 7.68 to 12.15. The maximum tillers (12.15) were recorded in T_2, which was superior to all other treatments and the lowest in control receiving no 7.68. Islam *et al*., (1996) also reported a significant increase in tillering of BR11 rice at Bangladesh Agricultural University farm and at farmer's field of Melandha by applying 20kg S/ha. Similar to plant height and tillering, panicle length and filled grains/panicle responded significantly to S application (Table 2). The T_2 produced the highest and the control did the lowest. Panicle length was approximately similar between treatments except the control. Islam *et al*., (1996) observed a significant increase in the number of grains/panicle of BR11 rice at farmer's field in Melandha by applying 20kg S coupled with 5kg Zn/ha. S application increased the 1000-grain weight inconsistently (Table 2). The highest 1000 grain weight (24.71 g) was observed in T_2 and the lowest 1000-grain weight (23.45 g) was found in T_0. The effect of S on grain and straw yield was significant. The maximum grain and straw yield (5.81t /ha and 7.38t /ha) was obtained in T_2 and the minimum (4.38t /ha and 5.43t /ha) was in T_0. Increase in yield due to S application was also observed by many researchers. (Idris and Jahiruddin 1983, Mian and Eaqub, 1983, Bugaevaskii *et al*., 1983).

Table 2. Effect of different rates of Sulphur fertilization on growth and yield components of Boro rice (cv. BRRI dhan29)

Treatment	Plant height (cm)	No. of effective tillers/hill	Panicle length (cm)	Filled grains panicle^{-1} (no.)	1000 grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)
T_0	84.80 b	7.68 d	23.19 b	127.75 c	23.45 b	4.38 e	5.43 c	9.81
T_1	91.85 a	9.35 c	23.83 ab	146.45 b	24.63 a	5.14 c	6.32 b	11.46
T_2	94.93 a	12.15 a	25.25 a	153.15 a	24.71 a	5.81 a	7.38 a	13.19
T_3	93.85 a	12.08 a	24.08 ab	152.43 a	24.65 a	5.54 b	6.95 ab	12.49
T_4	90.93 ab	11.08 b	23.73 ab	151.50 a	24.25 ab	4.95 d	6.21 b	11.16
SE (±)	3.09	0.306	0.745	2.264	0.504	0.337	0.275	-
CV (%)	4.87	3.09	4.43	6.21	2.90	9.2	5.71	-

Figures having common letter(s) in a column are not significantly different by DMRT at 5% level.
SE = Standard error means, CV = Co-efficient of variation

Correlation Studies

The relationship between panicle length and grain yield rice:
Panicle length and grain yield of rice were positively correlated (Figure 1) with each other. The value of correlation coefficient "r" was 0.8301. The regression line was Y = 0.6598X - 10.683.

The relationship between filled grain and grain yield of rice:
Filled grain and grain yield of rice showed an insignificant correlation (Figure 2) with each other. The value of correlation coefficient "r" was 0.731. The regression line was Y = 0.0442X – 1.3059.

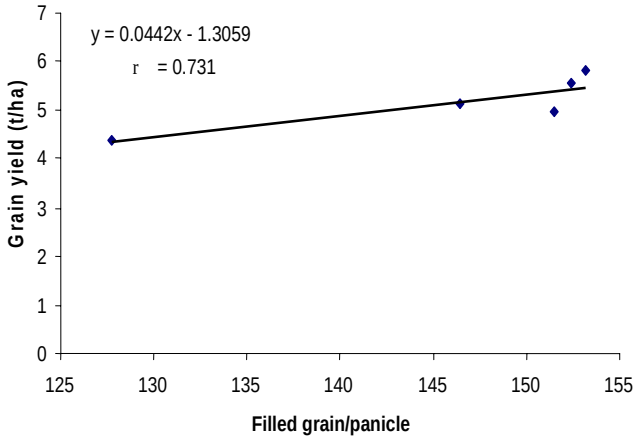

Figure 1. The relationship between panicle length and grain yield of rice

The relationship between 1000 grain weight and grain yield of rice:
The Figure 3 showed a positive relationship between 1000-grain weight and grain yield with r value of 0.8333. The regression line was Y = 0.9538X - 18.049.

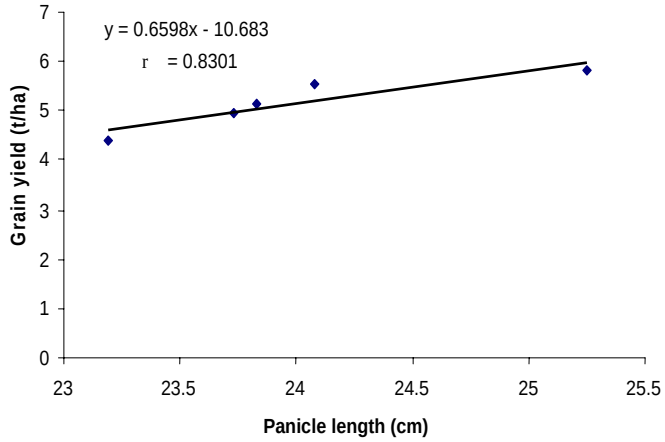

Figure 2. The relationship between Filled grain /panicle and grain yield of rice

Response Function

Regression analysis showed that there was a positive and quadratic relationship between grain yield and levels of applied sulphur (Figure 4). The estimated equation was $y = 4444.9 + 82.955x - 1.2612x^2$ where y = grain yield (kg/ha) and x = levels of applied S (kg/ha). The optimum dose of S was calculated 32.89 kg/ha for maximizing the yield the economic dose of S was calculated 31.59 kg/ha.

Cost benefit analysis of Boro rice (cv. BRRI dhan 29)

The cost of production of different treatments under the study has been presented in Table 3 The total production cost ranged from Tk. 36589 to 39189.The cost of production was highest in T_4 (60 kg S/ha) and lowest in T_0 (control). The maximum gross and net income was obtained in T_2 (20 kg S/ha). The second maximum gross and net income were obtained in the T_3 (40 kg S/ha). The T_0 (control) gave the lowest gross and net income. The results indicated that application of S (20 kg/ha) is highly profitable to the farmers.

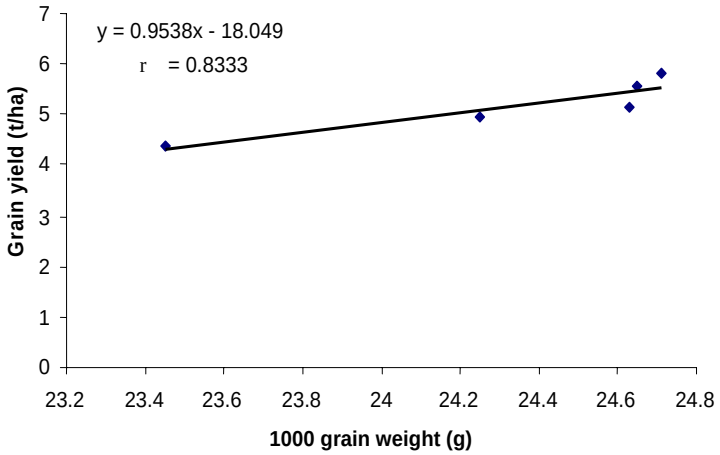

Figure 3. The relationship between 1000 grain weight and grain yield of rice

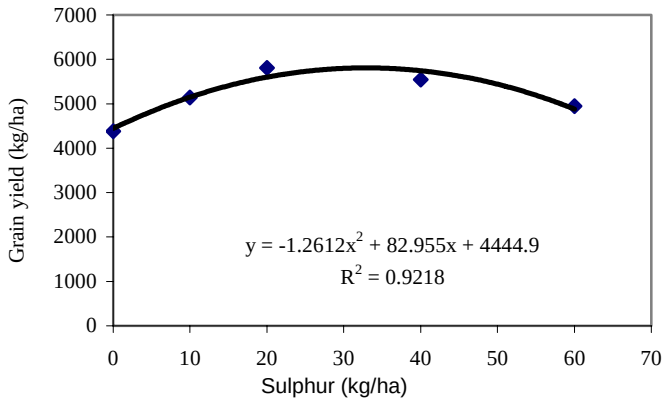

Figure 4. Response of Boro rice (cv. BRRI Dhan-29) to sulphur fertilization at Old Brahmaputra Floodplain Soil

Table 3 Cost benefit analysis of Boro rice (cv. BRRI dhan 29)

Treatment	Total production cost (Tk)	Gross income (Tk)		Total gross income (Tk)	Net income (Tk)	Net income increase over control
		Grain	Straw			
T_0 : (control)	36589	35040	4887	39927	3338	-
T_1: 10kg S/ha	36914	41040	5688	46725	9811	6473
T_2: 20kg S/ha	37239	46480	6642	53122	15883	12545
T_3: 40kg S/ha	37889	44320	6255	50575	12686	9348
T_4: 60kg S/ha	39189	39600	5589	45189	6000	2662

Grain = Tk 8.00/Kg, Straw =Tk 0.90/Kg

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