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EFFECT OF NITROGEN AND SULPHUR ON GROWTH OF HYV RICE (BR3)

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Response of HYV rice to applied nitrogen and sulphur nutritions has been studied in the greenhuse. Result obtained showed that application of nitrogen (0, 50, 75, 100 kg ha^{-1}) and sulphur (0, 5, 10, 20 kg ha^{-1}) alone and in combinations caused an increase in height of the plant after 30 and 110 days of transplantation markedly though not significantly. Applied fertilizers also played the same role to boost up the yield of straw harvested at maximum tillering and flowering stages of growth. Moreover, the picture pattern of accumulation of straw was very much similar to the height of plant. However, the yield of straw accounted at maturity together with the number of tillers increased significantly due to applied fertilizers. Nitrogen alone significantly stimulated the yield of grain. Contrary to this, the main effect of sulphur and its interactions with nitrogen failed to do so. Nevertheless, higher doses of nitrogen along with the highest level of sulphur played the best role to improve the yields of straw and grain of rice. Highest yield of grain was obtained from plant supplemented with $N_{100}S_{20}$.

Keywords **:**BR3 rice; Nitrogen; Sulphur.

Introduction

There is general agreement, that of all the plant nutrient amendments made to soils, N-fertilizer has had by far the most important effects in terms of increasing crop production[1]. It is the nutrient present in greatest amount in the grains of widely grown cereal crops[2]. However, in the tropics, little is known about the use of sulphur. Moreover, the situation is changing rapidly because of the intensification of agriculture, based on high crop yields, multiple cropping, use of improved cultivars and increasing use of high analysis sulphur-free fertilizers create large gaps between the supply of sulphur to soil and its requirements by crops[3]. Bhuiyan and Islam[4] stated that intensive and continuous cultivation of wetland rice may cause deficiency of sulphur resulting low yield.

The total cropped area of Bangladesh is 13.1 million hectare, of which, 1.04 million hectare is under rice cultivation[5]. Although a limited supply of sulphur is added to soil through rainfall, it is however not enough to meet the crop needs and thus becoming a yield limting factor[6]. Consequently, sulphur deficiencies are being reported with increasing frequency in Bangladesh covering about 44% of the total cropped area[7]. Literature review suggests that information available in this area of research is only a meager[6,8,9]. Therefore, an attempt has been made to assess the impact of nitrogen and sulphur on the growth and yield of a HYV rice.

Materials and Methods

Sample of surface soil (0-15 cm) collected from a rice growing area (Kajla series) was air-dried, grounded and passed through 2mm sieve. Some physico-chemical properties of the sample were determined by standard methods.

Greenhouse Experiment : A greenhouse experiment with HYV rice (BR3) was conducted during aman season. Eight killogram processed soil was taken in a series of clean-dry earthen-ware pots (22 cm x 25 cm). Four rates of each of nitrogen (0, 50, 75, 100 kg N ha^{-1}) as urea and (0, 5, 10, 20 kg S ha^{-1}) as gypsum in all possible combinations were added to the soil as per treatment allocation. A basal dose of phosphorus and potassium at the rate of 30 kg P and K ha^{-1} as TSP and MP, respectively, was applied. The fertilizers were mixed thoroughly with the soil and was kept submerged for 3 days before transplantation. Sixteen treatmets, in triplicate, were arranged in a completely randomized block design.

Five weeks old rice seedlings of uniform size were transplanted in each pot at the rate 2 per hill and 4 hills per pot. The pots were kept continuously submerged (2-3 cm standing water) during the growing period. However, the soil was kept at field capacity in the grain maturing stage. Weeds were removed as and when appeared.

Height of plant after 30 and 110 days and number of tiller at maximum tillering stage were recorded. Sampling, one hill from each pot, was done at maximum tillering and flowering (panicle initiation) stages and 2 hills at maturity stage for yield of straw and grain measurement.

Analytical Techniques : Determinations were made of particle size distribution[10] (clay texture), pH (5.0) by corning glass electrode (model-7), organic carbon[11] (1.25%), CEC[12] (55 meq 100 g^{-1}), total N[12] (0.15%), 2M KC1 extractable available N[12] (48 ppm), available P[13,14] (28 ppm) and 500 ppm P extractable available S[15,16] (10 ppm).

Results and Discussion

The impact of nitrogen and sulphur on growth and yield of rice grown during aman season has been assessed and the results thus obtained are presented in Table 1.

Results showed that nitrogen and sulphur alone and in combinations caused an appreciable increase in height of the plant after 30 days of transplantation. Nitrogen alone at the rate of 75 kg ha^{-1} showed the best performance to promote the height of rice plant. Addition of nitrogen at the rate of 100 kg ha^{-1} resulted a retardation in height of the plant. However, the overall performance of nitrogen was found to be statistically not significant. Similar response to applied sulphur was observed so far height of the plant is concerned. Interactions of nitrogen and sulphur also behaved in the same way.

After 110 days of transplantation i.e. at maturity, the height of the plant increased considerably due to applied treatments when compared with the control except a few cases. However, the trend in change of height due to single and dual combinations of fertilizers did not stimulate markedly as campared to 30 days. Individually addition of 75 kg N ha^{-1} and 20 kg S ha^{-1} played the best role to modify the height of the plant at maturity. Lai *et al*[17] observed that height of rice plant was the highest at the highest level of nitrogen application (50-150 kg ha^{-1}). Similar result was also observed by Roy[9].

Number of tillers increased significantly due to various treatment combinations (Table 1). Tiller number generally increased with increasing rates of both nitrogen and sulphur significantly. Supply of nitrogen and sulphur increased the number of tiller from 21.3 (N_oS_o) to 35.3 ($N_{50}S_{10}$) per pot. However, the number increased to the maximum (39.3 pot^{-1}) when the increase in amount of applied fertilizers reached to $N_{100}S_{20}$. This possibly explains the fact that nitrogen and sulphur interacted positively to promote the number of tiller of rice plant. Similar opinions were also put forwarded by other investigators. IRRI workers[18] observed that increasing application of nitrogen significantly improved the number of tillers. However, Ahmed *et al*[19] and Blair *et al*[20] found that number of tiller in rice could be significantly increased due to supply of sulphur too.

Yield of straw as a growth component

Table 1. Effect of nitrogen and sulphur on growth and yield of rice.

Treatment (kg ha^{-1})	Height (cm) Days		Tillers (pot^{-1})	Yield of straw (g hill^{-1}) Stages of harvest			Yield of grain (g pot^{-1})
	30	110		Maximum tillering	Flowering	harvesting	
NoSo	59.6	94.0	21.3	4.2	8.3	13.2	12.2
$N_{50}So$	64.7	97.7	29.3	8.8	7.7	14.5	17.9
$N_{75}So$	78.3	101.3	27.0	7.2	8.2	18.1	18.1
$N_{100}So$	67.3	91.0	32.7	6.3	8.8	14.3	18.0
NoS_5	66.7	96.7	33.3	8.6	8.5	17.9	11.7
$N_{50}S_5$	72.7	99.3	34.7	7.7	7.5	15.0	14.1
$N_{75}S_5$	64.7	99.7	32.7	5.6	13.3	15.7	13.7
$N_{100}S_5$	75.3	106.3	34.7	5.7	8.8	19.3	17.9
Nos_{10}	67.7	99.0	30.3	6.2	7.6	17.1	13.7
$N_{50}S_{10}$	73.3	101.3	35.3	6.2	10.9	13.6	12.6
$N_{75}S_{10}$	68.3	99.0	27.7	6.9	7.7	16.1	21.8
$N_{100}S_{10}$	64.7	94.7	33.3	8.7	8.9	15.1	12.1
Nos_{20}	66.0	100.0	25.3	4.6	6.4	12.8	12.3
$N_{50}S_{20}$	73.3	104.7	27.3	5.3	11.8	21.5	20.9
$N_{75}S_{20}$	64.0	93.0	28.3	4.3	10.4	23.9	20.8
$N_{100}S_{20}$	66.67	102.7	39.3	7.3	12.7	22.1	27.4
LSD (P=0.05)							
N	NS	NS	1.3	NS	NS	0.5	1.6
S	NS	NS	2.4	NS	NS	1.8	NS
N x S	NS	NS	3.5	NS	NS	2.9	NS

has been recorded at three different stages (Table 1). Yield of straw at maximum tillering stage has been stimulated by single and dual combinations of nitrogen and sulphur positively. All the treatments casused an increase in accumulation of dry weight of straw at the tillering stage appreciably though not significantly. It appears that production of straw increased ranging between 1.25 and 2.0 times more than the control due to fertilization of rice with nitrogen and sulphur.

However, the yield of straw harvested at flowering stage also revealed the same trend as was observed at maximum tillering stage. Accumulation of dry matter increased notably in most of the treatments with the advancement of growth span from maximum tillering to flowering stage. In some treatments ($N_{75}S_5$, $N_{50}S_{10}$, $N_{50}S_{20}$, $N_{75}S_{20}$, $N_{100}S_{20}$), the recovery in accumulation of dry matter was very much pronounced yielding about twice the amount as compared with maximum tillering stage.

Accumulation of dry matter as straw attained at harvesting stage increased significantly due to various treatments of applied nitrogen and sulphur fertilizers (Table 1). Application of nitrogen and sulphur also produced significantly higher yield of straw with the increase in amount of applied fertilizers. Combined application of nitrogen and sulphur at the highest levels, however, resulted better performance as compared to their individual achievements. Among the treatments, 75 kg N ha^{-1} alone and inconjunction with 20 kg S ha^{-1} in dual combination played better role to produce straw of rice. Nevertheless, the later treatment ($N_{75}S_{20}$) accounted better. These findings are in good agreement with the observations of Islam *et al*[6] who recorded that addition of sulphur promoted the accumulation of dry matter of straw of BR3 variety of rice.

Grain yield of rice improved significantly when supplemented with nitrogen (Table 1). Yield increased significantly upto 100 kg N ha^{-1} when compared with the control (N_oS_o). However, the yield variation among the only nitrogen treated pots was found to be statistically not significant. On the other hand, addition of sulphur alone failed to increase the yield of grain significantly upto the level used. Interactions of nitrogen and sulphur also did so. However, highest dose of both the fertilizers when applied together increased the grain yield profoundly. The yield increased more than 70% when compared with the control. Investigators working in this line also proposed that rice plants fertilized with nitrogen[21] and sulphur[20,22] always gave higher yield of grain.

The overall summerization of the results reveal that highest yield of rice was recorded from potted plant treated with 100 kg N supplemented with 20 kg S ha^{-1}.

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