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EFFECT OF SULPHUR AND METHOD OF ZINC APPLICATION ON THE YIELD AND YIELD CONTRIBUTING CHARACTERS OF BR11 RICE

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An experiment was carried out with BR11 rice as the test crop to study the effect of sulphur and method of zinc application. Treatments included two levels of sulphur, namely 0 and 30 kg/ha and four methods of zinc application. Addition of sulphur led to increased panicle length, number of spikelet and grain per panicle and 1000-grain weight and considerably increased grain and straw yield.

Among the different methods of zinc application, the greatest grain yield was achieved after zinc application in the mainfield during land preparation, followed in yield by application of zinc in nursery bed. Application of zinc by dipping seedlings and at tillering stage also gave higher grain and straw yield than where no zinc was applied.

Key words: BR11 rice, Sulphur, Zinc.

Introduction

Bangladesh agriculture is rice-dominated and is characterized by intensive and continuous crop production. This has depleted the fertility status of the soil of this country. Generally, soil is enriched by the farmers through the application of organic fertilizers, crop residues and chemical fertilizers. During the last two decades the use of chemical fertilizers carrying N,P and K has been extended to almost all the major crops, including wheat, jute, sugarcane, mustard and vegetables. The benefit of NPK fertilizers can not be derived fully if there is deficiency of other elements. Recent studies indicate that deficiency of sulphur and zinc occurs in rice soils of Bangladesh, especially under water logged condition.

Sulphur is an important component required for the formation of thiamine, biotin and amino acids namely, cystine, cysteine and methionine of rice grains [1]. It has been found that sulphur is closely associated with the protein metabolism and its uptake is increased with nitrogen [2]. Sulphur deficiency problem is considered as one of the limiting factors in rice production in some countries including Bangladesh. This is caused by the use of almost sulphur free fertilizers such as triple superphosphate and mutiate of potash. Sulphur deficiency in rice in Bangladesh was first detected in 1976 [3] and was identified as a nutritional problem of transplant rice in Modhupur soil tract [4] Comilla basin soil and some other parts of Bangladesh.

Zinc is one of the essential nutrient elements needed in sufficient and balanced amount for the normal growth of plants. Zinc deficiency has been detected as the third major nutritional problem for Bangladesh soil after nitrogen and phosphate, limiting the growth of wet land rice. In some regions of Bangladesh, crop loss due to zinc deficiency ranged from 10-80%. Zinc deficiency also occurs in sodic, calcareous, organic and sandy soils and soils that remain wet for prolonged periods. Visual symptoms of zinc deficiency in rice are characterized by growth retardation, delayed maturity and brown blotches [1]. It is generally thought that zinc is taken up by the plants at the early growth stages of rice plants. If a sufficient quantity of zinc is taken up by the rice seedling it may not require supplementary zinc application after transplanting. For that reason perhaps roots of rice seedlings are treated with zinc before transplanting [5]. But it is not yet clearly known whether the seedlings with sufficient zinc content while they are in the nursery bed required zinc supplementation after transplantation.

A study was therefore, undertaken with the objectives of finding out the effect of added sulphur and various methods of zinc application on the growth and yield of transplant aman rice.

Materials and Methods

The study was conducted in medium high land of sandy loam soil at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during July to Nov. 1984. The climate of the area is charcterized by high temperature and heavy rainfall during the Kharif season (April to Sept.) and low rainfall associated with moderately low temperature during the Rabi season (Oct. to March).

The soil pH and percentage of the soil organic carbon of nursery bed and mainfield (initial soil) were 7.0 and 6.8,0.35 and 0.59 respectively. The available sulphur and zinc content of nursery bed and mainfield (initial soil) was 33.75 and 6.21 and 3.02 ppm respectively.

The study consisted of the following treatments:

A. Levels of sulphur (kg/ha)	B. Method of application of zinc(10 kg/ha)
(a) 0	(a) In nursery bed

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(b) 30

(b) Seedling root dipping
(c) In mainfield
(d) At tillering stage
(e) No zinc

The experiment was laid out in split-plot design with four replications. The levels of sulphur method of zinc application were maintained in the main plot and in the sub plot respectively. The unit plot zinc was 4m x 2.5m. BRII (Mukta), a variety of rice was used as the test crop in this study.

A strip of highland was selected for raising seedlings and the land was puddled well with country plough, and then divided into five equal parts and was fertilized with zinc at the rate of 15.2g (i.e. 12.5 kg/ha of ZnO) on June 19, 1984.

Sprouted seeds were uniformly sown in the nursery bed on 20 June 1984. During seedling raising there was enough rainfall and no irrigation in the nursery bed was needed.

The main plots were fertilized with sulphur from gypsum and subplots with zinc from zinc oxides as per experimental treatments. The seedlings were uprooted and transplanted in the mainplots on August 1, 1984. The root of the seedlings was dipped in ZnO solution prior to transplating and ZnO was applied at tillering stage on August 20, 1984, for the treatments mentioned eariler.

Intercultural operations, like weeding, thinning etc. were done uniformly in all the treatments. The data of the crop characters were collected in respect of (i) plant height, (ii) total number of tillers/hill, (iii) number of effective tillers/ hill, (iv) panicle length, (v) number of spikelets/panicle, (vi) number of grains/panicle, (vii) 1000-grain weight, (viii) grain yield/plot and (ix) straw yield/plot.

The collected data were statistically analysed and the means were adjudged by Duncan's Multiple Range Test.

Results and Discussion

The results of the experiment have been presented in Table 1. From the experimental results, it is clearly evident that all the crop characters studied were affected significantly both by sulphur and the method of zinc application excepts the plant height, total number of tillers and number of effective tillers/ hill. Panicle length was increased by sulphur application but was not affected by the interaction of sulphur and method of zinc application. Such effects have already been observed on this character [6]. Application of sulphur significantly increased the number of spikelets per panicle. Zinc application by seedling root dipping and in the mainfield during final land preparation produced identical number of spikelets per panicle. Significantly, the lowest number of spikelets was obtained in plots which received no supplemental zinc.

The number of grains was highest when zinc was applied in seedling stage produced identical number of grains per panicle, while the lowest number was recorded in the control plot. It was reported that seedling root dipping in ZnO suspension effectively increased the number of grains per panicle and grain yield which might be due to the increase in the number of spikelets per panicle in that treatment [7,8]. It was observed in this study that the number of spikelet per

TABLE 1. EFFECT OF SULPHUR ANDMETHODOF ZINC APPLICATION ON THE YIELD AND YELD CONTRIBUTING CHARACTERS OF BR11 RICE.

Treament	Plant height (cm)	Total tillers/ hill (No)	Effective tillers/hill (No)	Panicle length (cm)	Spikelet panicle (No)	Grains/ panicle (No)	1000 Grain weight (g)	Grain yield Quantity (kg/ha)	Grain yield Increase over control (%)	Straw yield Quantity (kg/ha)	Straw yield Increase over control (%)
A. level of sulphur(kg/ha)											
0	102.48	8.06	6.14	24.22b	129.99b	106.45b	24.76b	5165b	–	5125b	–
30	103.76	8.19	6.35	26.47a	147.95a	123.40a	25.57a	5498a	6.45	5925a	15.61
B. Method of application of zinc											
In nursery bed	102.53	8.14	6.30	24.60	132.04c	110.32c	25.36b	5880b	35.69	5866b	35.39
Seedling root dipping	105.08	7.64	6.35	26.65	148.95a	124.14a	24.94c	5316c	22.69	5216c	20.39
In main-field	102.28	7.89	5.99	26.44	143.14ab	119.53b	26.22a	7253a	67.39	6150a	41.92
At tillering stage	102.50	8.66	6.38	24.94	141.14b	116.20b	25.24b	5543c	27.92	6066ab	40.00
No zinc	103.25	8.20	6.40	24.11	129.67c	103.94c	24.20b	5333d	–	4333d	–

In the column and within the treatment figures followed by same or no letter(s) are not significantly different, whereas, those followed by dissimilar letter(s) are significantly different at 5 percent level.

panicle increased due to zinc application.

Sulphur application led to a significant increase on the grain weight, expressed in 1000-grain weight. Of the zinc treatments the heaviest grain was obtained when zinc was applied in the mainfield. This was followed by the zinc treatment at the nursery bed stage and at tillering stage. The lightest grain was obtained from the control plot. Increased 1000-grain weight due to zinc application have already been reported [9].

The grain yield was significantly increased (6,45 per cent) by the application of sulphur. This increased might be due to the significant increase in the number of grains and grain weight [10,11].

The highest grain yield was obtained when zinc was applied at the mainfield. The increase was more than 67% over the control and this was followed in yield by the zinc application at the nursery bed stage (35.39%). Zinc application at tillering stage also gave higher yield than the control. The interaction of sulphur and method of zinc application was not significant for this character. Significantly highest grain yield with the application of ZnO in the nursery bed or in the mainfield have already been observed [12,13].

The straw yield was significantly affected by the application of sulphur with an increase of 15.61% over the control. Similar results have already been obtained by different workers [4,14-16].

The highest straw yield was obtained from zinc applied at the mainfield which was identical to that of zinc application at tillering stage. The increase in straw yield in these treatments was from 40.00 to 41.92% over control. Application of zinc at the nursery bed also significantly increased straw yield by 35.39%. This was followed in yield by seedling root dipping method which increased straw yield to 30.39%. The interaction of sulphur and method of zinc application had no significant effect on straw yield. Similar findings were also reported by different workers [9,17].

The experimental findings show that the soil on which the experiment was carried out was deficient in zinc and sulphur for the growth and development of rice plant. However, the grain yield increased due to sulphur supplementation was only 6.45% campared with a 67.39% increased following zinc application in the mainfield. Although zinc application in all the methods gave higher grain and straw yield than did the control, the maximum yield were obtained following soil incorporation of zinc in the mainfield.

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