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## Response of zinc and sulphur on growth and yield of rice article type: Original research article

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### Abstract

The Experiment was conducted in Crop Research Farm in department of agronomy during *khari* season 2023-2024. The treatment consisted of three levels of Zinc (25 kg/ha, 0.5% and 12.5 + 0.25%) Sulphur (20, 30 and 40 kg/ha) and control. The experiment was laid out in Randomized Block Design (RBD) with 10 treatments and replicated thrice. Application of Zinc (12.5 kg/ha + 0.25%) and Sulphur (40 kg/ha) recorded highest plant height, plant dry weight and higher yield attributes namely more No. of panicles/hill, no. of grains/panicle, grain yield and straw yield. Maximum B:C ratio was also recorded in same treatment, treatment No. 9 [Zinc: 12.5 kg/ha + 0.25% (Soil + Foliar Application) + Sulphur: 40 kg/ha] in Rice crop.

**Keywords:** Rice, zinc, sulphur, growth, yield

### 1. Introduction

Rice (*Oryza sativa* L.) is one of the most important staple cereal crops in the world and it is one of the main sources of carbohydrate for nearly one half of the world population. India has a long history of rice cultivation and stands first in rice area and second in rice production, after China (Yadav *et al.*, 2004)<sup>[4]</sup>. It is staple food crop of southern, eastern and north eastern part of the country particularly Manipur.

The genetic classification of rice plant belongs to the genus *Oryza* of family *Gramineae* (*Poaceae*). The *Oryza* genus is divided into four species complexes: *O. sativa*, *O. officinalis*, *O. ridley* and *O. granulata*. While Japonica variants are planted across the temperate zone and Javanica is mostly grown in the section of Indonesia that is considered tropical and sub-tropical, Indica rice is grown in around 90% of the world's rice land. In India rice is grown under widely varying conditions of altitude and climate. In India, rice is grown between 8 and 35 °N latitude and up to 3000 metres above sea level. A hot, humid atmosphere is necessary for rice crops. Over the course of the crop's life, the average temperature varies between 21 and 37 °C. Maximum temperature which the crop can tolerate 40- 42 °C.

### 2. Materials and Methods

This experiment was laid out during the *khari* season of 2023 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The crop research farm is situated at 25° 39' 42" N latitude, 81° 06' 56" E longitude and at an altitude of 98 m above mean sea level. The experiment was laid out in Randomized Block Design and comprised of zinc and sulphur with ten treatments and each was replicated thrice. The recommended dose of Nitrogen (120 kg/ha), Phosphorus (60 kg/ha) and Potassium (40 kg/ha) and zinc and sulphur were applied as per the treatments. Data recorded on different aspects of crop, *viz.*, growth, yield attributes were subjected to statistical analysis by analysis of variance method and economic data analysis mathematical method.

### 3. Results and Discussion

#### 3.1 Growth Parameters

##### 3.1.2 Number of tillers/hill

At 80 DAT, significant and maximum tillers/ hill (21.33) was recorded in treatment 9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. However, treatment 8 [Sulphur 40 kg/ha + Zinc 0.5% (Foliar Application)] and treatment 7 [Sulphur 40 kg/ha + Zinc 25 kg/ha (Soil Application)] were found to be statistically at par with treatment 9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)].

Significant and maximum number of tillers/hill was with application of zinc (12.5 kg/ha) might be due to increase in production of metabolites which synthesize and enhance, required nutrients to plant to bear more tillers/plant. Similar result was also reported by Muhammad *et al.*, 2017<sup>[1]</sup>.

##### 3.1.3 Dry weight/hill

At 80 DAT, significant and maximum dry weight/ hill (21.33) was recorded in treatment 9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. However, treatment 8 [Sulphur 40 kg/ha + Zinc 0.5% (Foliar Application)], treatment 7 [Sulphur 40 kg/ha + Zinc 25 kg/ha (Soil Application)], treatment 6 [Sulphur 30 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)] and treatment 5 [Sulphur 30 kg/ha + Zinc 0.5% (Foliar Application)] were found to be statistically at par with treatment 9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. Result similar finding to Muhammad *et al.*, 2017<sup>[1]</sup>.

##### 3.1.4 No. of grains/panicle

The highest significant number of grains/panicle (181.67) was recorded under the treatment-9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. However, treatment-8 [Sulphur 40 kg/ha + Zinc 0.5% (Foliar Application)], treatment-7 [Sulphur 40 kg/ha + Zinc 25 kg/ha (Soil

Application)] and treatment-6 [Sulphur 30 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)] were statistically at par with treatment-9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. Result similar finding to Muhammad *et al.* 2017<sup>[1]</sup>.

##### 3.1.5 Test weight (g)

The significantly highest test weight (18.56g) was recorded in the treatment 9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. However, treatment 8 [Sulphur 40 kg/ha + Zinc 0.5% (Foliar Application)], treatment 7 [Sulphur 40 kg/ha + Zinc 25 kg/ha (Soil Application)], were statistically at par with treatment-9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. Similar result was also reported by Muhammad *et al.*, 2017<sup>[1]</sup>.

##### 3.1.6 Number of panicle/hill

The highest significant number of panicle/hill (18.56) was recorded under the treatment-9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. However, treatment-8 [Sulphur 40 kg/ha + Zinc 0.5% (Foliar Application)] and treatment-7 [Sulphur 40 kg/ha + Zinc 25 kg/ha (Soil Application)] were statistically at par with treatment-9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. Similar result was also reported by Kamble *et al.*, 2016.

##### 3.1.7 Grain yield (t/ha)

The data showed the significantly highest grain yield (5.69 t/ha) was observed in treatment-9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)]. However, treatment-8 [Sulphur 40 kg/ha + Zinc 0.5% (Foliar Application)], treatment-7 [Sulphur 40 kg/ha + Zinc 25 kg/ha (Soil Application)] and treatment-6 [Sulphur 30 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)] were statistically at par with treatment-9 [Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)].

**Table 1:** Influence of foliar and soil application of zinc and sulphur on yield attributes and yield of Rice.

S. No.	Treatment combination	Dry weight of plant (g/hill)	No. of panicle/hill	No. of grains/panicle	Test Weight (g)	Grain yield (t/ha)
1.	Sulphur 20 kg/ha + Zinc 25 kg/ha (Soil Application)	13.33	22.90	145.27	14.77	4.12
2.	Sulphur 20 kg/ha + Zinc 0.5% (Foliar Application)	13.67	24.01	149.03	14.90	4.48
3.	Sulphur 20 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)	14.33	25.28	156.63	15.66	4.35
4.	Sulphur 30 kg/ha + Zinc 25 kg/ha (Soil Application)	15.00	27.17	162.04	16.27	4.70
5.	Sulphur 30 kg/ha + Zinc 0.5% (Foliar Application)	16.00	29.88	163.35	16.30	4.79
6.	Sulphur 30 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)	16.67	30.48	167.38	16.70	4.88
7.	Sulphur 40 kg/ha + Zinc 25 kg/ha (Soil Application)	17.33	32.74	172.42	17.28	5.26
8.	Sulphur 40 kg/ha + Zinc 0.5% (Foliar Application)	20.33	35.04	175.43	17.53	5.47
9.	Sulphur 40 kg/ha + Zinc 12.5 kg/ha + 0.25% (Soil + Foliar Application)	21.33	37.60	181.67	18.56	5.69
10.	Control 120:60:40 kg/ha N:P:K	12.67	20.20	148.42	13.19	3.69
	F-test	S	S	S	S	S
	S.Em(±)	1.52	2.09	5.08	0.46	0.77
	CD (p=0.05)	4.51	6.75	15.10	1.37	2.29

### 5. Conclusion

It is concluded that application of Sulphur along with soil and foliar application of Zinc 12.5 kg/ha and 0.25% recorded highest yield and benefit cost ratio in rice.

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