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RESEARCH ARTICLE

EFFECT OF SULPHUR AND SILICON FERTILIZATION ON GROWTH AND YIELD OF RICE

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ABSTRACT

Field experiment was conducted at Experimental Farm, Annamalai university, Annamalai Nagar,Tamil Nadu, India during 2008-2009 to study the effect of sulphur and silicon fertilization on growth and yield of rice. The treatments comprised four levels of sulphur (0, 15, 30 and 45 kg ha^{-1}) and four levels of silicon (0, 40, 80 and 120 kg ha^{-1}) and were laid out in factorial randomized block design with three replications. Among the different levels of sulphur and silicon, sulphur @ 45kg ha^{-1} and 120 kg Si ha^{-1} recorded higher values for growth (plant height, number of tillers $plant^{-1}$ and dry matter production), yield attributing (number of panicles m^{-2} and number of grains $panicle^{-1}$) characters and yield (grain and straw) of rice respectively. With regard to interaction effect, the above said treatment combination proved its superiority over other treatments by registering maximum growth, yield attributes and yield of rice.

INTRODUCTION

Rice is the staple food for 65% of Indian population and there is a need to increase 2.5 m.t of milled rice every year to sustain self-sufficiency. Among the rice growing countries of the world, India has the largest area under rice cultivation (42.9 m.ha) and has occupies second position in production (85m.t) next to china. Declining trend in production and productivity of rice has been observed due to inadequate supply of macro and micro nutrients. Sulphur (S) is the fourth major nutrient next to NPK, crop requires sulphur generally as much phosphours and one tenth of nitrogen. Among the essential elements, sulphur is very much beneficial for increasing the production of rice and is one of the major essential nutrient elements involved in the synthesis certain amino acids such as methionine, cystine, cysteine and some plant hormones such as thiamine and biotin (Rahman, 2007).Growing of sulphur responsive crops, high intensive cropping and use of sulphur free fertilizers caused S deficiency in soils of India (Tandon,1991). Flyash is the major solid waste produced in thermal power stations. The quantity of flyash produced annually by the 70 thermal power plants in the country is estimated to be 100 million tonnes. In the absence of a well planned strategy in India for the disposal of this flyash, it is posing serious health and ecological hazards (Kanojia *et al*., 2001). Flyash containing naturally occurring essential elements as similar to that of soil except humus and nitrogen (Tripathi and Sahu,1997). It has also been successfully used as a source of essential plant nutrients for boosting crop growth and it's a cheap and rich source of silicon for crop production (Raghupathy, 1988). Silica is a structural element in diatoms and a cell wall component in rice and many other grasses but also occurs in vegetative tissues in

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Table.1. Effect of sulphur and silicon fertilization on growth and yield of rice

Treatments	Growth attribute			Yield attributes		Yield (kg ha^{-1})	
	Plant height (cm)	No.of tillers hill^{-1}	DMP (kgha^{-1})	No.of panicles m^{-2}	No.of grains panicle^{-1}	Grain	Straw
Sulphur levels(S) (kg ha^{-1})							
0	83.98	10.55	10237	220.37	104.39	4595.94	7543.46
15	94.19	13.30	11094	238.86	114.54	5299.68	8627.69
30	98.93	14.38	11564	248.40	119.41	5625.72	9130.07
45	102.25	15.325	11916	255.13	122.44	5855.33	9475.33
CD	1.99	0.64	233	5.21	1.95	135.27	197.06
Silicon levels(Si) (kg ha^{-1})							
0	87.245	11.31	10536	226.47	107.67	4766.92	7824.88
40	93.90	13.12	11069	237.45	113.90	5293.74	8598
80	97.75	14.14	11440	246.21	118.19	5573.96	9052.88
120	100.46	14.98	11766	252.64	121.02	5742.06	9300.79
CD	1.74	0.42	174	3.98	1.23	109.46	153.25
Interaction (S X Si)							
CD	2.24	0.81	291	6.33	2.47	167.03	244.71

lesser amounts. Silica in plants contributes to the compression resistance and rigidity of cell walls, which in turn improve light interception and drought resistance and photosynthetic efficiency (Epstein, 1999).As rice is known as silicon accumulator, there is a definite reason to consider Si as an agronomicaly essential element for increasing and or sustaining rice production. Among the cereals, rice responds more to Si and magnitude of yield advantage due to silicon application reached 20-30% (Kalyan Singh *et al.,* 2006). Hence, it became imperative to study the combined effect of sulphur and silicon fertilization on yield attributes and yield of rice.

MATERIALS AND METHODS

The experiment was performed on a wetland field of Annamalai University Experimental Farm, (11^{o} 24' N and 79^{o} 44' E with an altitude of + 5.7 m. m.s.l.), Annamalai Nagar, Tamil Nadu, India during 2008-2009. The soil of the experimental field is moderately fertile and clay loam in texture with the pH of 7.6. The treatment comprised of four levels of sulphur (0, 15, 30 and 45 kg S ha^{-1} through Gypsum) and four levels of silicon (0, 40, 80 and 120 kg Si ha^{-1} through Fly ash) and were applied as basal along with recommended dose of fertilizers (150:50:50 kg NPK ha^{-1}). The amount of applied K and S were adjusted according to the nutrients content of fly ash. The experiment was laid out in factorial randomized block design with three replications. All the biometric observations were taken at the time of harvest. The experimental data were analyzed as per the procedure outlined by Panse and Sukhatme (1978). The critical difference was worked out as five percent probability level for significant results.

RESULTS AND DISCUSSION

Sulphur and silicon application significantly influenced the growth (plant height, number of tillers plant^{-1} and dry matter production), yield attributing (number of panicles m^{-2} and number of grains panicle$^{-1)}$ characters and yield (grain and straw) of rice (Table 1). The highest values on growth and yield were noticed under sulphur at 45 kg ha^{-1}. It was followed by 30 kg S ha^{-1}. The increase in growth, yield attributing characters and yield might be due to enhanced chlorophyll system, improved nutritional availability in the soil, which favorably influenced the carbohydrate metabolism due to the role of S in energy transformation and activation of carbon fixing enzymes. These favorable effects lead to increased transformation of photosynthates towards sink and resulted in the formation of relatively bold grain and increased the yield (Rahman, 2007).

With regard to silicon levels, Si at 120 kg ha^{-1} (Si_4) recorded highest growth and yield of rice. This could be due to adequate silicon supply might have been improved the photosynthetic activity which enable rice plant to accumulate sufficient photosynthates which increased dry matter production and these together with efficient translocation resulted in more numbers of filled grains with increased test weight and ultimately led to higher grain and straw yield (Rani and Narayanan,1994).Among the different combinations, application of sulphur at 45 kg S ha^{-1} and silicon at 120 kg ha^{-1} significantly increase the yield attributes and yield of rice. This might be due to combined and sustained nutrient supply by S and Si applied plots, which ultimately leads to photosynthetic activity by the crop and resulted in higher values for yield attributes and yield. These results are in conformity with the findings of Sudhakar *et al*. (2004). In the light of above said facts, it can be concluded that the conjoint application of 45 kg S with 120 kg Si ha^{-1} holds immense potentiality to boost the productivity and profitability of rice.

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