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EFFECT OF SILICATE MATERIALS ON INCIDENCE OF RICE PESTS

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ABSTRACT

A field experiment was conducted to find out the effect of various sources of silicate materials on yield, Si content and incidence of rice crop pests. Applied silicate materials significantly increased the yield and Si content at all stages and reduced the incidence of rice pests viz., thrips (Stenchaetothrips biformis Bagnall), gall-midge (Orseolia oryzae Wood-Mason) and leaf folder (Cnaphalocrocis medinalis Guen.).

Key Words: Silicate materials, Rice Pests.

Rice shows the largest uptake of silicon among the cereals. The silicon tends to be deposited as silica gel under the 'cuticle silica double layer' and is related to the increase in resistance for rice to pests and diseases. Maxwell *et al.* (1972) found that the infestations of rice stem borer were markedly reduced by adding silicon to soil, but no change was observed in high silicon soil. Panda *et al.* (1977) observed that higher silica content would discourage the rice stem borers from utilizing plant nutrients. Tayabi and Azizi (1984) concluded that the application of silica at 1 t/ha reduced the density of stem borer. The effect of silicate materials application on the silicon content on three rice pests viz., thrips, gall-midge, leaf folder are discussed in this paper.

MATERIALS AND METHODS

A field experiment was conducted at the Central Farm, Agricultural College and Research Institute, Madurai to study the effect of silicate materials on yield, silicon content of rice and incidence of three rice pests. The soil is sandy clay loam with pH 7.7, EC 0.25 m.mhos/cm, organic carbon 0.72% and is having 55.4 ppm available silicon. The treatments were replicated four times in Randomized Block Design. The silicate materials viz., furnace slag and rice husk were powdered to pass through 100 mesh sieve. The furnace slag at 4940 kg/ha, rice husk at 6900 kg/ha and sodium meta silicate at 2060 kg/ha to get 1 t SiO_2/ha were applied basally according to the treatments.

Nitrogen, phosphorus and potassium @ 50 kg/ha each were applied basally as urea, superphosphate and muriate of potash respectively before transplanting of IR 50 rice. The remaining quantity of N was applied in two splits, one at tillering and other at panicle initiation stage.

Plant samples during tillering and panicle initiation stages and grain, straw samples at harvest were analysed for Si content using Atomic Absorption Spectrophotometer (Nayar *et al.*, 1975) besides recording grain and straw yields.

The population of thrips *S. biformis* was recorded at tillering stage. The damage caused by Rice gall-midge *O. oryzae* and leaf folder *C. medinalis* was assessed following the standard procedures (Dyck, 1978) at tillering and panicle initiation stages of the crop.

RESULTS AND DISCUSSION

Yield of rice

It was observed that rice husk addition recorded the highest yield of both grain and

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Table 1. Effect of silicate materials on yield and Si content of rice

Treatment	Yield (kg/ha)		Si content (%)			
	Grain	Straw	Tillering	Panicle initiation	Grain	Straw
Control	3333	5666	1.67	2.22	1.66	3.14
Sodium meta silicate	3641	5883	1.82	2.83	1.87	3.43
Furnace slag	3802	6183	1.87	3.02	2.11	3.52
Rice husk	3847	6330	1.94	3.12	2.17	3.60
C.D. (P = 0.05)	186	289	0.05	0.09	0.03	0.05

straw, but it was on par with furnace slag, followed by sodium meta silicate (Table 1). The lowest yield was noticed in the control. Application of silicate materials increased the grain and straw yield. This may be attributed to the greater amount of silica in plant which enables the tillers to be more erect, providing more exposure to sunlight. The spreading of rice husk improving rice yield was reported earlier by Yein *et al.* (1983).

Si content

Application of silicate materials significantly increased Si content of plant at all the stages. Among the silicate materials, rice husk was found to be superior than furnace slag and sodium meta silicate. The increased availability of Si in soils due to the addition of silicate materials might have been the reason for higher Si content. Increase in Si uptake by added silicate slag and rice husk was also reported by Lee (1983). The Si content in plant increased with advancement of crop growth. This could be attributed to the uptake of Si by the plant continuously. Si content was higher in straw than in rice grain. This may be ascribed to the immobility of silicon as silicagel to the other parts of plant. Similar view was expressed earlier by Yoshida *et al.* (1962).

Incidence of rice pests

The incidence of *S. biformis* at tillering stage was significantly decreased by added silicate materials (Table 2). The maximum reduction in population of thrips was observed in the rice husk treated plots followed by plots treated with

Table 2. Effect of silicate materials on incidence of rice pests

Treatments	Tillering		Panicle initiation	
	Thrips (No./leaf)	Gallmidge (%)	Gallmidge (%)	Leaf folder (%)
Control	10	11.3	24.7	28.0
Sodium meta silicate	6	9.8	23.1	21.8
Furnace slag	6	10.7	18.2	18.7
Rice husk	7	10.0	20.4	18.0
C.D. (P = 0.05)	1	NS	2.2	2.3

furnace slag and sodium meta silicate. Silicon tends to be deposited as silica gels under the cuticle of the leaf forming the so called 'cuticle silica double layer'. This layer may be responsible for increasing the resistance of rice to thrips. Similar view was expressed by Maxwell *et al.* (1972). The results could be further supported by the negative relationship which existed between Si content in plant and incidence of thrips at tillering stage ($r = -0.531^{**}$).

Eventhough, the application of silicate materials had not significantly reduced the incidence of gall-midge at tillering stage, significant decrease was observed at panicle initiation stage. This could be attributed to increased Si content of plant due to added silicate materials. Subbarao and Perraju (1976) reported similar findings in another borer pest, rice stem borer. The findings could be further supported by the negative correlation obtained between the incidence of gallmidge and Si content in plant at panicle initiation stage ($r = -0.432^{**}$).

Addition of silicate materials significantly reduced the incidence of *C. medinalis* in rice crop at panicle initiation stage. This could be further confirmed by the negative relationship between the incidence of leaf folder and Si content in plant at panicle initiation stage ($r = -0.683^{**}$). The above findings derive support from the earlier works of Maxwell *et al.* (1972) and Tayabi and Azizi (1984) with *Chilo* sp.

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