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INFLUENCE OF MAGNESIUM SILICATE, SODIUM SILICATE AND MAGNESIUM CARBONATE ON THE GROWTH AND YIELD OF RICE IN THE KUTTANAD SOILS OF KERALA

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It is well established that silica and magnesium play vital roles in the growth and yield of plants. Srinivasan (1930) obtained increased yields of rice with the application of silicates. Kolayashi and Shinagawa (1957) could not get any significant effect with magnesium on the yield of rice. Sluijsmans (1958) observed improvement !n the grain quality of barley by the application of magnesium fertilisers. Utagava and Kashima (1961) reported higher yields for upland rice by fertilising with silica. Datta *et al* (1962) recorded significant increases in the dry matter of wheat and rice by the application of sodium silicate. Mann and Gurmel Singh (1963) reported reduced grain yield and cob weight in maize by the application of sodium silicate, the suppresing effect being attributed to sodium. Shinde and Datta (1963) stated that application of silica in the form of sodium silicate increased the yield and the total phosphorus uptake significantly. Varghese and Money (1965) observed better growth and yield of rice in soils treated with magnesium. Padmaja and Varghese (1966) recorded increase in the grain and straw yields by the application of magnesium in combination with silica.

The effect of different forms of silica on the growth characters and yield of rice has not been studied in the acid soils of Kuttanad, an important rice growing tract of Kerala. Hence the performance of this element in the form of sodium and magnesium silicates and in combination with magnesium carbonate on the growth and yield of the crop was studied, the results of which are presented in this paper.

Material and Methods

The trial repeated in three seasons between 1964 and 1967 was conducted in the Regional Rice Research Station, Mancompu, Kerala State, a truly representative area of the Kuttanad rice tract. The soil was alluvial clay with a pH of 4.5. Fe and Al oxides accounted for about 40 percent in the clay fraction of the top 10 cm of the soil. Ca 0 and Mg 0 contents of the same layer of the clay were in traces and 1.20 per cent respectively. The details of the different treatments are given below :-

1. Control (no treatment)
2. Sodium silicate to suppy 26 kg SiO_2/ha
3. Sodium silicate to supply 50 kg SiO_2/ha
4. Sodium silicate to supply 25 kg SiO_2 and magnesium carbonate to supply 25 kg Mg/ha

5. Sodium silicate to supply 50 kg SiO_2 and magnesium carbonate to supply 25 kg Mg/ha
6. Magnesium carbonate to supply 25 kg Mg/ha
7. Magnesium silicate to supply 25 kg SiO_2/ha and
8. Magnesium silicate to supply 50 kg SiO_2/ha

The treatments were replicated four times in a Randomised Block Design. Ptb-10, a short duration strain of 110 days was used for the trials. The seed was sown in the nursery and the seedlings transplanted to the main field. Planting was done in doubles at a spacing of 15 x 15 cm in plots of size 9.45 x 4.88 square metres. The net plot harvested had an area of 9.14 x 4.57 square metres.

Nitrogen, P_2O_5 and K_2O were applied at 30, 40 and 30 kg per hectare respectively in the form of urea, superphosphate and muriate of potash in all the treatments. Half the doses of nitrogen and potash were applied before transplanting and the remaining as top dressing one month after planting. The entire quantities of phosphorus, magnesium silicate, sodium silicate and magnesium carbonate were applied as a basal dressing. Results were assessed in terms of plant height and the number of ear bearing tillers recorded of ten plants selected at random from each plot and in terms of the grain and straw yields per plot.

Results and Discussion

There was no appreciable difference between the different treatments in the production of grain.

Highly significant difference between magnesium and sodium silicates was observed in straw yield at 50 kg SiO_2 per hectare (The average straw yield in kg per plot was 39.97 for magnesium silicate and 34.13 for sodium silicate; SED 2.01 and CD (P as 0.01) 5.35). There was no significant difference between the two silicates at 25 kg SiO_2 per hectare. In the combined analysis of both the levels significant difference in straw yield between the silicates was in evidence (The average straw yield in kg per plot was 38.7 for magnesium silicate and 34.7 for sodium silicate, SED 1.42 and CD (0.05) 3.8).

No significant difference between the different treatments was in evidence in relation to production of ear bearing tillers.

Application of magnesium carbonate at 25 kg of magnesium per hectare markedly reduced the height of rice plants (Mean height in cm: control 119.3, at 25 kg magnesium per hectare 117.2: SED 0.72, CD (0.01) 1.85). The interaction between sodium silicate and magnesium carbonate was also highly significant in relation to height of plants (Table 1).

Table 1

Mean height in cm of rice plants as influenced by sodium silicate and magnesium carbonate

	Sodium silicate (SiO_2)			
	0 kg/ha	25 kg/ha	50 kg/ha	Mean
Magnesium carbonate (Mg)				
0 kg/ha	120.4	118.5	119.2	119.4
25 kg/ha	114.8	117.9	118.9	117.2
Mean	117.6	113.2	119.1	
SE.D. for comparing any one level of sodium silicate against levels of magnesium carbonate and vice versa			1.25	
CD (0.05)			3.2	

Application of magnesium reduced the plant height markedly at the 25 kg level of silica but at the 50 kg dose the effect was not significant (Mean height in cm at different doses of magnesium silicate: control 120.4, at 25 kg per hectare 117.0, at 50 kg per hectare 120.1: SED 1.25, CD (0.05) 3.20).

The observation that magnesium silicate at 50 kg SiO_2 per hectare increased the straw yield supports the similar observation of Padmaja and Vargbese (1966). This behaviour of the chemical appeared to be due to the combined influence of magnesium and silica.

The negative influence on plant height manifested by magnesium carbonate may be due to the liming effect of magnesium carbonate in the acid soils; it may liberate the fixed phosphorus which in turn may counteract the direct influence of nitrogen on the vegetative growth. Magnesium silicate at 25 kg SiO_2 per hectare reduced the plant height while at 50 kg SiO_2 per hectare there was no such effect; this might be due to silica playing its role by replacing phosphate in the plant or by exerting its solvent action on the soil phosphorus rendering it more easily available to plants (Toth 1939).

Summary

Studies conducted in the acid soils of the Kuttanad rice tract of Kerala showed that magnesium silicate and magnesium carbonate did not have any influence on the yield and tiller production in paddy (Ptb 10). Magnesium silicate increased the straw yield at higher doses (40 kg per hectare). Magnesium carbonate showed marked influence in suppressing the height of plants; this effect was nullified in the presence of sodium silicate. Magnesium silicate too suppressed the plant height at its lower doses.

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