Studies on the Effect of Calcium magnesium carbonate and Sodium magnesium silicate on Paddy in *Kayal* Lands at Vellayani

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Though a large number of fertilizer experiments have been carried out in this State and elsewhere on paddy, only very little information is available on the specific effects of elements like Ca, Mg and Si on the growth and yield of this crop. Some initial trials carried out in this Institute have shown that the application of these elements results in appreciable increase in rice yields. Padmaja and Verghese (1966) have reported on the beneficial effects of Ca, Mg and Si on rice in the red loam soils of Vellayani. In a pot culture experiment using a Vellayani *Kayal* soil, Sadanandan (1965) obtained appreciable increase in paddy yields by the application of silicon. Sodium magnesium silicate was also found to give increased yields of paddy in the fertilizer trials in the Aranur *Yela* near Trivandrum.

Statistically laid out experiments using Ca, Mg and Si have, however, not been conducted in Kerala under field conditions. Therefore, this study was undertaken to determine the effect of two products containing these nutrients, calcium magnesium carbonate and sodium magnesium silicate on paddy in the clay loam soils of the *Kayal* lands of Agricultural College and Research Institute, Vellayani.

Review of Literature

The effect of calcium on the yield of alt crops, especially rice, has been reported by several workers. Sethi *et al* (1952) found that the rice crop in the slightly acidic soils of Pattambi responded excellently to liming. Bhavappa and Rao (1956) reported that liming resulted in increased paddy yields in South Kannara. Chakraborthy *et al* (1961) opined that liming was beneficial for paddy in states like Mysore, Andhra, Madras, Bihar and Kerala. However, liming was found to result in depressed crop yields by Prierre *et al* (1935) and an absence of response to liming was noticed by Mandal *et al* (1955).

Magnesium application was found to increase the yield of various crops by Hashimoto and Kava guchii (1955) and Stenut and Piot (1958). Nagai (1959) obtained significant improvement in plant growth, yield and magnesium content of rice by the application of this element.

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Sadapal and Das (1961) have reported that vegetative growth, number of grains per ear and thousand grain weight were all increased by Mg application on wheat. However, Kobayashi *et al* (1956) found that Mg application had little effect on the yield of rice.

Contradictory results were obtained by different workers for the effect of silicon in ncreasing crop yields. Okamoto (1957) ınd Azuma *et al* (1961) reported an increase n dry matter production and length of :arhead and roots by silicon application. Hosoda and Takata (1957) obtained in-:rease in grain yield in a soil having a low SiO_2/R_2O_3 ratio. Yoshida (1959) and Dutta *t al* (1952) also reported increased yield by ilicon even though Ganssman (1962) could ıot get any response to silicon.

Materials and Methods

A field experiment consisting of 8 treat-nents was laid out in a 2^3 factorial randomi ed block design with four replications for hree years during the *Punja* season from 964 to 1966 in the *Kayal* lands of the ıgricultural College and Research Institute, 'ellayani. These lands are under flood ondition from June to December and the ultivation is carried out by dewatering the rea during the month of December. The 'eatments were the following :

, Control - No manure

N P K

Calcium magnesium carbonate

Sodium magnesium silicate

NPK+Calcium magnesium carbonate

NPK+Sodium magnesium silicate

Calcium magnesium carbonate+ Sodium magnesium silicate

8. NPK+Calcium magnesium carbonate +Sodium magnesium silicate.

The Calcium magnesium carbonate and Sodium magnesium silicate were applied as basal dressing at the rate of 250 kg/ha and 50 kg/ha respectively. The NPK fertilizers were given at the rate of 30 : 40: 30 kg/ha. The entire dose of P, K and half the dose of N were applied as basal dressing. The other half of N was given as top dressing one month after sowing.

The variety used was *Kochuvithu,* a local variety (duration 90 days). Germinated seeds were sown broadcast at the rate of 0.25 kg seed per plot. The gross plot size was 6.40 m X 6.13m (21′ x 20′) and the net size was 6.13 m X 5.76 m(20′ × 19′).

The soil was clay loam in texture. Its relevent chemical characteristics are given in Table I.

TABLE I

Chemical characteristics of the soil

1. pH	4.5	
2. Total N	0.015	per cent
3. Available N	0.03	,,
4 Total P_2O_5	0.03	,,
5. Available P_2O_5	0.0013	,,
6. Total K_2O	0.18	,,
7. Available K_2O	0·0059	,,
8. Total CaO	0.04	,,
9. Total MgO	0.03	,,
10. Acid soluble silica	4.35	,,
11. Water soluable silica	trace	
12. Base exchange capacity	6 me/100g	

Results and Discussion

The yield data of paddy grain and straw are presented in Tables II and III.

TABLE II

Mean yield of paddy (kg/ha)

No.	Treatment	Year 1964	Year 1965	Year 1966
1.	Control	1447	1540	963
2.	N P K	1824	1733	1444
3.	Calcium magnesium carbonate	1499	1573	1124
4.	Sodium magnesium silicate	1740	1717	1172
5.	NPK + Calcium magnesium carbonate	1795	1926	1597
6.	NPK + Sodium magnesium silicate	2148	2231	2071
7.	Calcium magnesium carbonate + Sodium magnesium silicate	1737	1669	1043
8.	NPK + Calcium magnesium carbonate + Sodium magnesium silicate	1854	1830	1846
	C.D (0.05)	N. S.	N. S.	98

TABLE III

Mean yield of straw (kg/ha)

No.	Treatment	Year 1964	Year 1965	Year 1966
1.	Control	2176	3323	2359
2.	N P K	3008	3885	3612
3.	Calcium magnesium carbonate	2689	3852	3563
4.	Sodium magnesium silicate	2725	3660	3628
5.	NPK + Calcium magnesium carbonate	2548	4109	3981
6.	NPK + Sodium magnesium silicate	3450	4559	5554
7.	Calcium magnesium carbonate + Sodium magnesium silicate	3291	3403	3186
8.	NPK + Calcium magnesium carbonate + Sodium magnesium silicate	3291	3949	4077
9.	C.D (0.05)	N. S.	N. S.	367

The results presented in Tables II and III show that the treatment NPK + Sodium magnesium silicate has given the maximum yield of grain and straw. The increase in grain yield, is however, significant only in one year. This indicates that Sodium magnesium silicate has some benefical influence in increasing the yield of rice under Vellayani conditions. The response obtained by the application of magnesium and silicon may be due to the low magnesium and silicon status of the soil under study. Chemical analysis (Table I) of the soil shows that it contains only traces of soluble silica and a very low level of magnesium. Therefore it is possible that the application of these nutrients might have contributed to an increase in yield. Though silicon is not accepted as an essential element, the benefical effect of this element on the growth and yield of rice has been reported by several workers (Yoshida, 1959 ; Asuma *et al*, 1961 ; Dutta *et al*, 1962). Verghese (1965) got similar results by the application of Mg in Vellayani soils. Padmaja and Verghese (1966) have reported that the application of Mg + Si resulted in increased yields in the red loam soils of Vellayani. It has been suggested that the application of Mg + Si results in increased absorption of the nutrients, such as N, P, K, Mg and Si (Padmaja, 1965). An increased and extensive root growth as observed by Padmaja and Verghese (1966) also might have contributed to this increase in yield.

The application of Calcium magnesium carbonate, either alone or in conjunction with Sodium magnesium silicate, has not had much effect on the yield of grain and straw in all the three years. The absence of response to Calcium magnesium carbonate can be explained as due to the insufficient dose of calcium applied. It is possible that an application of 250 kg/ha of Calcium magnesium carbonate does not have any appreciable effect in improving the acid soil conditions and increasing the crop yield. The absence of response to combined application of these fertilizers may be due to the formation of the less available Calcium silicate by the reaction between Sodium magnesium silicate and Calcium magnesium carbonate.

Summary and Conclusions

A field experiment using a 2^3 X 4 factorial randomised block design was carried out to study the effect of Calcium magnesium carbonate and Sodium magnesium silicate on paddy in the *Kayal* lands of the Agricultural College and Research Institute, Vellayani, in three seasons during 1964-1966. The findings are summarised beiow:

Sodium magnesium silicate gave the maximum yield of grain and straw in all the three years. The increase in grain yield was statistically significant only in one year.

The application Calcium magnesium carbonate, either alone or in combination with Sodium magnesium silicate, did not have any significant effect on the yield of grain and straw in any of the three years.

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