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DIRECT AND RESIDUAL EFFECT OF DIFFERENT FORMS AND LEVELS OF MAGNESIUM ON YIELD AND MAGNESIUM UPTAKE IN RICE

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Abstract: A potculture experiment was conducted using rice as the test crop grown continuously for two seasons to study the direct and residual effect of added Mg under rice culture in waterlogged condition. The performance of the rice plant with respect to yield and Mg uptake was better in karappadam soil during the first crop season; while in the second crop season, it was higher in laterite soil. Different sources and levels of Mg applied did not have any significant influence on yield and Mg uptake of the rice plant. There was no marked difference in total Mg uptake between the two seasons, indicating a substantial release of Mg from added sources during the second crop season also.

INTRODUCTION

Extensive fertility surveys carried out in Kerala have shown that the majority of soils of this state are highly acidic and extensively deficient in Mg. Potculture experiments on rice conducted by Varghese and Money (1965) with Vellayani sandy clay loam and by Padmaja and Verghese (1966) with Vellayani red loam indicated that Mg either alone or in combination with Ca and Si appreciably improved crop growth and significantly increased grain yield. But the studies conducted by Nayar and Koshy (1966) showed that the form and level of Mg had no significant effect on tillering and yield of rice. Based on the light of above results, the present study was carried out with a view to compare the direct and residual effect of magnesite, dolomite and magnnesium sulphate on yield and Mg uptake by rice at different levels of application.

MATERIALS AND METHODS

A potculture experiment was conducted with two acid rice soils of Kerala, viz., karappadam and laterite, three sources of Mg (magnesite, dolomite and magnesium sulphate) and two levels of Mg (25 and 50 kg MgO/ha) using rice (variety Annapoorna) as the test crop grown continuously for two seasons without the application of Mg during the second crop season to study the direct and residual effect of added Mg under rice culture in waterlogged condition. The experiment was laid out in a completely randomised design with eight replications. The treatment combinations used are given in Table 1.

The soil and plant samples were drawn regularly at 15 days intervals for chemical analyses. Magnesium analysis was done by versenate (EDTA) titration method.

RESULTS AND DISCUSSION

1. Effect of Mg sources on yield characters of rice yield of straw

For the first crop, mean straw yield on Mg application was 35.59 g/pot. But during the second crop season it increased to 38.88 g/pot (Table 2). It may be due to the slow dissolution of the added Mg fertilizers so that Mg availability would have been more during the second crop season.

During the first crop season, straw yield was significantly higher from karappadam soil, while during the second crop it was higher from laterite soil. This may be correlated with the pH of the soils. Due to the relatively low pH of the karappadam soil, Mg added might have dissolved more readily making Mg available during the first crop season itself. While in laterite soil, because of the less acidic reaction, dissolution of Mg fertilizer might have taken place more slowly making more of the Mg available during the second crop season only.

There was no significant difference between the various Mg sources used with regard to the straw yield in both the seasons. But magnesium sulphate (38.41 g/pot) was found to perform better closely followed by magnesite (37.54 g/pot) and then dolomite (30.82 g/pot) during the first crop season (Table 2), while for the second crop, carbonate forms of Mg were found to perform better. The increase in straw yield during the second crop season was most pronounced for samples supplied with dolomite (30.82 to 37.95 g/pot); while for magnesite, this was from 37.54 to 39.94 g/pot. This indicates a slower solubility for dolomite than the magnesite. In pots supplied with magnesium sulphate, straw yield was almost the same for both the seasons (38.41 and 38.75 g/pot) which may be due to the presence of readily water soluble Mg in magnesium sulphate.

There was no significant difference between the two levels of Mg applied with regard to the straw yield; may be due to the low levels of Mg (25 and 50 kg MgO/ha) tried in this experiment (Table 3).

Yield of grain

In karappadam soil, grain yield was higher during the first crop season than the second crop season. This may be attributed to the faster dissolution of Mg fertilizers in that soil making large amount of Mg available in the first crop season itself. But in laterite soil grain yield was higher during the second crop; probably due to the slower release of Mg for the sources in that soil.

With regard to the grain yield, magnesite was found to be the best source in both the seasons. This was in line with the reports of Shich *et al.* (1965), Vasileva (1965) and Jokineu (1982) that the carbonate forms of Mg were more effective on acid soils than the soluble ones.

Mean grain yield decreased from 35.51 to 33.02 g/pot during the second crop season. This reduction in yield was not marked in the case of plants supplied with magnesite and dolomite, may be due to the relatively higher residual effect of the carbonate forms of Mg than the soluble forms.

There was no significant difference between the two levels of Mg applied with respect to the grain yield (Table 3).

2. Effect of Mg sources on Mg uptake by rice

Magnesium uptake by the straw was found to increase with the advancement of crop season till the fourth stage of sampling, may be due to the increase in dry matter production. During the harvesting stage, there was a decrease in Mg uptake by the straw, may be the result of translocation of Mg to the grain (Fig.1)

There was a marked increase in Mg uptake by the grain on Mg application in both the seasons. This may be correlated to the increased grain yield on Mg addition, which emphasises the

Table 1. Details of treatments

Treatment notation	Forms and levels of MgO, kg/ha	Soil
T1	No Mg (control)	Karappadam
T2	Magnesite 25	Karappadam
T3	Magnesite 50	Karappadam
T4	Dolomite 25	Karappadam
T5	Dolomite 50	Karappadam
T6	Magnesium sulphate 25	Karappadam
T7	Magnesium sulphate 50	Karappadam
T8	No Mg (cotrol)	Laterite
19	Magnesile 25	Laterite
T10	Magnesite 50	Laterite
T11	Dolomite 25	Laterite
T12	Dolomite 50	Laterite
T13	Magnesium sulphate 25	Laterite
T14	Magnesium sulphate 50	Laterite

Table 2. Mean values of straw yield, grain yield and total Mg uptake (g/pot) as influenced by Mg sources and soil

	Soil type	Control	Magnesite	Dolomite	Magnesium sulphate
		First Crop			
Straw yield at harvest	Karappadam	37.08	41.33	36.02	45.91
	Laterite	44.98	33.74	25.61	30.90
Grain yield	Karappadam	35.75	42.79	39.89	36.11
	Laterite	43.20	32.43	25.60	36.25
Total uptake at harvest	Karappadam	0.150	0.329	0.180	0.242
	Laterite	0.056	0.183	0.121	0.177
		Second Crop			
Straw yield at harvest	Karappadam	34.85	37.50	41.78	32.79
	Laterite	38.05	42.38	34.11	44.70
Grain yield	Karappadam	31.63	35.63	32.01	28.98
	Laterite	32.20	36.67	31.32	32.47
Total Mg uptake at harvest	Karappadam	0.087	0.161	0.190	0.127
	Laterite	0.162	0.224	0.193	0.259

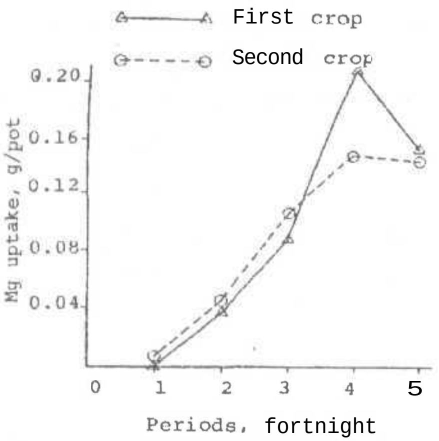

Fig. 1. Magnesium uptake by the rice plant as influenced by the period of crop growth

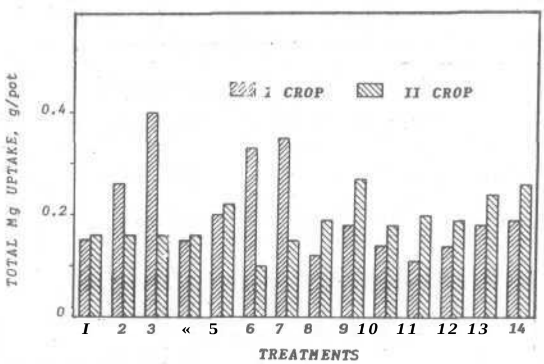

Fig. 2. Total Mg uptake at harvest as influenced by fertilizer treatments

Table 3. Mean values of straw yield, grain yield and total Mg uptake (g/pot) as influenced by levels of Mg application

	Levels of MgO, kg/ha	Soil		Sources of Mg		
		Karappadam	Laterite	Magnesite	Dolomite	Magnesium sulphate
		First crop				
Straw yield	25	44.41	31.21	40.13	32.12	41.19
	50	37.75	28.95	34.94	29.15	35.62
Grain yield	25	42.75	32.04	42.46	31.48	38.25
	50	36.44	30.81	32.75	34.01	34.11
Total Mg uptake at harvest	25	0.126	0.081	0.112	0.097	0.100
	50	0.147	0.075	0.124	0.093	0.115
		Second crop				
Straw yield	25	35.39	39.78	40.68	34.18	37.89
	50	39.32	41.02	39.20	41.70	39.60
Grain yield	25	33.22	33.06	37.05	30.37	31.99
	50	31.19	33.91	35.24	32.96	29.45
Total Mg uptake at harvest	25	0.138	0.238	0.214	0.178	0.172
	50	0.180	0.213	0.171	0.205	0.214

importance of Mg on grain nutrition. Similar observations were made by Sheng and Yuan (1963) and Narayana and Rao (1982).

There was no marked difference in total Mg uptake by the first and second crop, though a slight decrease from 0.205 to 0.193 g/pot was noticed. This shows that a substantial amount of Mg has remained in the soil for uptake in the second crop season.

Total Mg uptake decreased from 0.225 to 0.142 g/pot in karappadam soil, while in laterite soil it increased from 0.160 to 0.210 g/pot, from the first crop to the second crop (Fig.2). These changes may be attributed to pH of the soils. In karappadam soil due to low pH, Mg fertilizers added might have dissolved quickly, making Mg available in sufficient quantities during the first crop season itself. But in laterite soil due to relatively higher pH, dissolution may have taken place slowly prolonging the release of Mg. Similar results were observed in the case of straw Mg uptake as well as grain Mg uptake.

There was no significant difference between the different Mg sources with regard to the Mg uptake.

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