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AVAILABILITY AND UPTAKE OF CALCIUM AND MAGNESIUM BY RICE

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ABSTRACT

Field experiments in a black clay loam soil with rice IR60 as test crop showed that addition of mussooriephos either with green leaf manure at 10t/ha or with diammonium phosphate en hanced the availability of calcium and magnesium, while diammonium phosphate at 50kg P_2O_5/ha recorded the highest grain and straw yield and thereby enhanced the uptake of calcium and magnesium.

The total reserve of low rock phosphates occurring in India is estimated to be around 165 million tonnes. The rock phosphate deposits occurring at mussorie are exclusively of sedimentary origin and more reactive than other deposits occurring in India. Mussooriephos besides total phosphorus also contain appreciable amounts of calcium and magnesium. Very meagre information is available on the effect of Mussooriephos on the exchangeable calcium and magnesium and also their uptake. Hence, an investigation was conducted to know the fate of exchangeable calcium upon the application of Mussoorie rockphosphate (MRP).

MATERIALS AND METHODS

A field study was undertaken in black clay loam soil (Noyyal series) with rice (IR.60) in Tamil Nadu Agricultural University, Coimbatore. The soil was low in N (181 kg/ha) and P (7.0 kg/ha) and high in available K (582 kg/ha) with a pH of 8.2 and exchangeable Ca and Mg of 33.5 and 18.10 m.e./100g of soil respectively. Nitrogen and potassium were applied as per soil test recommen dation uniformly to all the plots in the form of urea and muriate of potash respectively. The experiment was conducted with 14 treatments (Table 1) replicated thrice in randomised block design.

The soil and plant samples were analysed for calcium and magnesium as per the procedure of Jackson (1973)

RESULTS AND DISCUSSION

The analysis of Mussoorie rock phosphate sample for its nutrient content revealed that it contains 20.5 per cent total P_2O_5, 38.5 per cent of CaO and 5.3 per cent of MgO.

EXCHANGEABLE CALCIUM

The mean exchangeable calcium content of the post - harvest soil ranged from 22.7 to 42.5 m.e./ 100g of soil (Table 1). It was found to increase under rock phosphate treatments due to the presence of higher amount of calcium in the rock phosphate sample itself and also due to slow solubilisation of MRP. This agrees with the findings of Symth and Sanchez (1982). The treatments which received diammonium phosphate (DAP) alone, green leaf manure (GLM) alone at $10tha^{-1}$ and control recorded lower exchangeable calcium content due to the crop uptake. This is in line with the findings of Venkateswara Rao (1985).

EXCHANGEABLE MAGNESIUM

The mean exchangeable magnesium content of the soil ranged from 11.77 to 13.50 m.e./100 g of soil at post - harvest stage (Table 1). Application of MRP to supply 75kg $P_2O_5ha^{-1}$ with GLM $10tha^{-1}$ recorded the highest exchangeable magnesium content and it was found to be on par with various mussoorie rock phosphate treatments with green leaf manure and diammonium phosphate with mussoorie rock phosphate treatments (1:3)

GRAIN AND STRAW YIELD

Application of DAP at 50 kg P_2O_5/ha recorded the highest grain (5815 kg/ha) and straw yield (7937 kg/ha) (Table 2) which is due to the higher availability of P and N under these treatments. The combined application of DAP and MRP in the ratio of 1:3 also recorded significant yields compared to MRP + GLM and MRP alone. The lower yield obtained by rock phosphate treatments is attributed to the slow release of P in available form. This confirms with the findings of Rabindra *et al.* (1986).

CALCIUM AND MAGNESIUM UPTAKE

The mean total calcium and magnesium uptake ranged from 64.24 to 101.25 and 28.89 to 54.19

Table 1. Exchangeable calcium and magnesium content in post harvest soil (m.e./100g of soil) Mean of three replications

Treatment	Exchangeable Calcium	Exchangeable Magnesium
DAP to supply 25kg $P_2O_5ha^{-1}$	22.90	11.83
" 50 "	23.10	11.93
" 75 "	23.00	12.03
MRP to supply 25kg $P_2O_5ha^{-1}$	36.43	12.50
" 50 "	37.10	12.73
" 75 "	37.70	13.07
1/3 DAP + 2/3 MRP to supply 25kg $P_2O_5ha^{-1}$	38.80	12.07
" 50 "	39.63	13.13
" 75 "	40.17	13.27
MRP to supply 25kg $P_2O_5ha^{-1}$ + GLM @ 10 tha^{-1}	39.93	13.20
" 50 "	41.40	13.43
" 75 "	42.50	13.50
GLM alone @ 10 tha^{-1}	23.27	12.10
Control	22.77	11.77
CD	0.93**	0.46*

DAP : Diammonium phosphate MRP : Mussoorie Rock phosphate GLM : Green leaf manure

Table 2. Effect of different sources of Pon grain, straw yield and total Ca and Mg uptake (Mean of three replications)

Treatment	Grain yield (kg/ha)	Straw yield (kg/ha)	Total Calcium uptake (kg/ha)	Total Magnesium uptake (kg/ha)
DAP to supply 25kg $P_2O_5ha^{-1}$	5552	7300	87.99	44.47
" 50 "	5815	7937	101.25	54.19
" 75 "	5778	7855	93.47	50.19
MRP to supply 25kg $P_2O_5ha^{-1}$	4771	5857	72.75	36.42
" 50 "	4784	5924	75.58	37.48
" 75 "	4795	5976	77.33	39.65
1/3 DAP + 2/3 MRP to supply 25kg $P_2O_5ha^{-1}$	5320	6936	85.59	43.44
" 50 "	5439	7112	90.87	46.48
" 75 "	5602	7291	94.36	46.56
MRP to supply 25kg $P_2O_5ha^{-1}$ + GLM @ 10 tha^{-1}	4928	5988	80.93	37.14
" 50 " "	4995	6018	86.35	39.06
" 75 " "	5012	6052	82.92	40.40
GLM alone @ 10 tha^{-1}	4705	5830	70.61	33.14
Control	4587	5710	64.24	28.29
CD	28.3**	30.9**	2.93**	2.32**

** : Significant at 1% level * Significant at 5% level

kg/ha respectively (Table 2). The enhanced uptake of calcium and magnesium in DAP treatments is ascribed to higher yield. Balasubramanian *et al.*, (1980) also reported better translocation of calcium induced by P application.

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