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COMPARISON OF DISSOLUTION PATTERN OF ROCK PHOSPHATES

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An incubation experiment was conducted to study the dissolution pattern of three sources of rockphosphates *viz.*, Maton rock phosphate (MARP), partially acidulated Maton rockphosphate (PAMARP) and Mussoorie rockphosphate (MRP) using an acid soil from a typical rubber growing tract in Kerala. The three sources of rock phosphates, at three levels of phosphorus equivalent to 100, 200 and 300 kg P_2O_5 per ha, were mixed with one kilogram of soil and incubated at field capacity for a period of 90 days. Available phosphorus status of the soil was estimated at 15, 30, 45, 60, 75 and 90 days interval using Bray II extractant. The dissolution pattern at the different time intervals showed similar trend among the sources. However, MRP had significantly higher availability up to the 45th day of incubation in the 1st and 3rd levels respectively compared to the other two sources. After the 45th day of incubation, the available P content of all the sources decreased which might be due to the fixation of the released phosphorus into iron and aluminium phosphates. During the later periods of incubation, all the three sources were comparable with respect to available phosphorus.

INTRODUCTION

The direct application of rock phosphates as P source in acid soils offer a substantial economic advantage over manufactured phosphatic fertilizers, provided rock phosphate is agronomically effective. The rock phosphates representing important deposits in the world have been reported to differ in their reactivity and effectiveness as P sources for plants (Engelsted *et al.*, 1974, Chein and Hammond, 1978). Mussoorie rockphosphate (MRP) is reported as a suitable P fertilizer for application in rubber growing soils. (Karthikakuttyamma *et al.*, 1978). Recently, low grade ores from different rockphosphate deposits in India have become available for direct application, but little is known about their reactivity and effectiveness in rubber growing soils. Maton rock phosphate (MARP) is one of the sources which occur in the Aravali sediments of sedimentary phosphate. It is a substituted fluroapatite which contains 21.46 per cent P_2O_5. The present study was taken up to compare the reactivity and effectiveness of MARP and partially acidulated Maton rockphosphate (PAMARP) with MRP in rubber growing soils.

MATERIALS AND METHODS

Phosphate rocks from Mussoorie in UP (MRP) and Maton in Rajastan (MARP) and partially acidulated form of MARP were used for the study. Phosphate content of the three sources taken for the study was determined (Table 1).

Table 1. Phosphorus content of the P sources

Source	% P_2O_5
Maton rock phosphate	21.46
Partially acidulated Maton rock phosphate	20.61
Mussourie rock phosphate	18.00

For the incubation experiment, soil was collected from the RRII farm. The physico-chemical properties of the soil were determined by standard procedures (Table 2). Three levels of each source *viz.*, 100, 200 and 300 kg P_2O_5/ha were mixed with 1 kg soil for the study. The experimental design was CRD with three replications. The moisture content of the soil was maintained at field capacity throughout the experimental period. The soil samples were incubated for 90 days. After the incorporation of the rockphosphates, soil samples were drawn at 15, 30, 45, 60, 75 and 90 days interval and analysed for available P and pH. The available P was estimated by Bray and Kurtz method (Jackson, 1958) and pH by the glass electrode method using a soil:water ratio of 1:2.5

RESULTS AND DISCUSSION

The soil used for the incubation study was acidic with a pH of 5.1 and was low in available P status (Table 2). The dissolution pattern of the three sources at three levels *viz.*, 100, 200 and 300 kg P_2O_5/ha are given in Fig. 1, 2 and 3 respectively. At the lowest level (100 kg P_2O_5/ha) the highest availability was noted for MRP, 45 days after incubation. MARP and PAMARP maintained almost steady level of available P up to the 60th day of incubation. Dissolution pattern of all the sources showed similar trend at level 2 (200 kg P_2O_5/ha). At this level PAMARP registered a slightly higher availability from the 45th to 90th day of incubation, closely followed by MRP and MARP and after the 75th day, availability increased for all the sources. At level 3, (300 kg P_2O_5/ha) MRP registered the highest availability up to the 45th day of incubation, later the availability decreased for all the three sources up to the 75th day. Fixation of the released P

Table 2. Physico-chemical properties of the soil

Organic carbon	Available nutrients (mg/100 g soil) P	K	Mg	pH	Texture
1.42	0.01	18.75	1.28	5.1	Clay loam

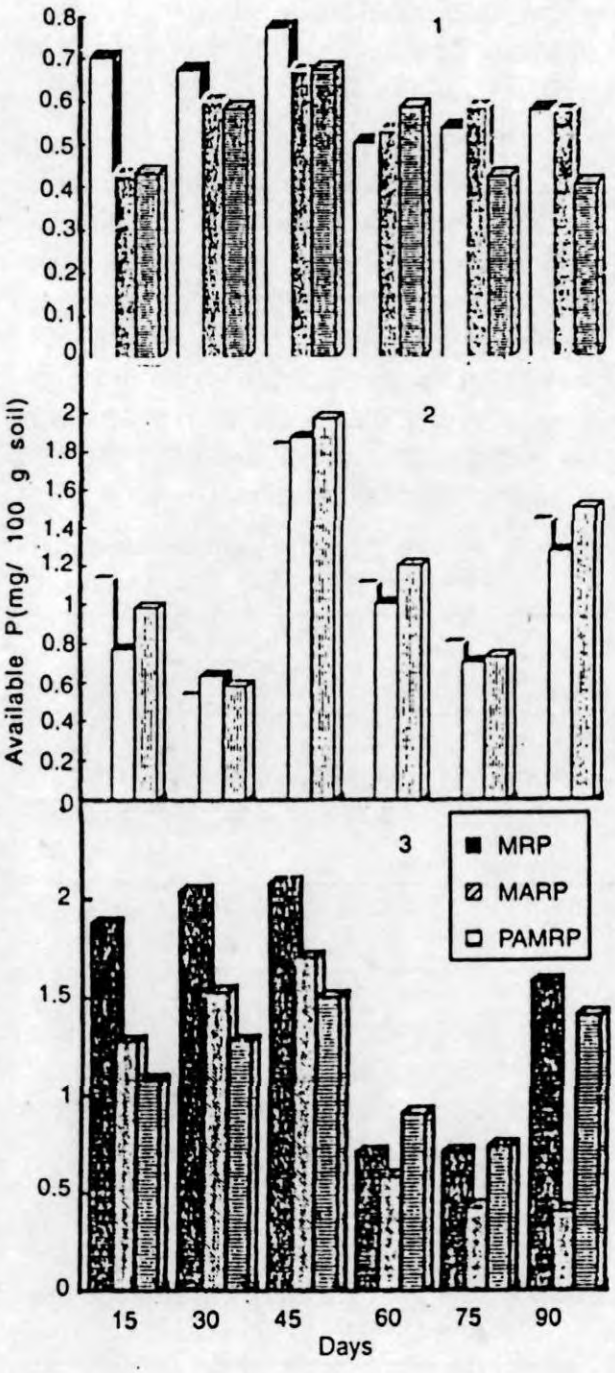

Fig. 1.3. Available P (mg/100g. soil) at different incubation periods with application of (1).100kg P_2O_2/ha; (2):200 kg P_2O_5/ha; (3).300 kg P_2O_2/ha.

into freshly formed aluminium and iron sesquioxides could be the reason for a decrease in available P as the period of incubation progresses (Anjos and Rowell, 1987).

The three sources of rockphosphate at three levels were compared with respect to the available P content at different time intervals. Table 3 shows the results of comparison done after 15 days of incubation. At the lowest and the highest levels (100 and 300 kg P_2O_5/ha) MRP was significantly superior to the other two sources. But at the middle level, MRP was on par with MARP. MARP and PAMARP were comparable at all the stages.

Table 3. Available P (mg/100 g soil) estimated after 15 days of incubation

	P_2O_5 (kg/ha)		
Source	100	200	300
MARP	0.43	0.77	1.27
PAMARP	0.43	0.98	1.07
MRP	0.70	1.13	1.86
Control	0.01	0.01	0.01
CD	0.12	0.20	0.18
SE	0.03	0.06	0.05

Table 4 shows the results of available P after 45 days of incubation. Here, no significant difference was noted between the different sources except at level 3 (300 kg P_2O_5/ha). At the 75th day of incubation, all the three sources were comparable at all the three levels (Table 5).

Table 4. Available P (mg/100 g soil) estimated after 45 days of incubation

	P_2O_5 (kg/ha)		
Source	100	200	300
MARP	0.67	1.87	1.70
PAMARP	0.67	1.97	1.50
MRP	0.77	1.83	2.07
Control	0.01	0.01	0.01
CD	0.24	0.66	0.30
SE	0.07	0.19	0.09

Table 5. Available P (mg/100 g soil) estimated after 75 days of incubation

	P_2O_5 (kg/ha)		
Source	100	200	300
MARP	0.58	0.70	0.63
PAMARP	0.42	0.73	0.73
MRP	0.53	0.80	0.70
Control	0.01	0.01	0.01
CD	0.17	0.15	0.25
SE	0.05	0.04	0.07

The incubation study indicated that the three sources *viz.*, MRP, MARP and PAMARP had similar dissolution patterns and MRP had slight superiority over the other two during the initial periods of incubation. Higher availability of MRP during the initial period has been demonstrated by Narayanaswamy *et al.* (1981), based on X-ray analysis. The mineralogical studies conducted by them revealed that deposits in Rajasthan contain fluorapatite, while that in Mussoorie contain carbonate apatite.

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