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MOVEMENT OF APPLIED PHOSPHORUS IN RUBBER (*HEVEA BRASILIENSIS*) GROWING SOIL

Phosphorus, unlike nitrogen and potassium is generally considered to be immobile in soil. Crop removal of P is low, and the utilization of surface-applied P by the crop depends on the extent of its translocation to the root zone (Malhi *et al.*, 1992). In the acid soils of the traditional rubber(*Hevea brasiliensis*) growing areas of India, P fixation is reported to be high due to the presence of large proportion of Fe and Al oxides and hydroxides (Karthikakuttyamma *et al.*, 1991). Hence rock phosphates are recommended as the major phosphorus fertilizer for *Hevea*. Phosphorus in rock phosphate is water insoluble, and is reported to be slowly available under the acid pH of rubber growing soils (Khasawneh and Doll, 1978; Syamala *et al.*, 1999).

Surface broadcasting in between two rows of trees is the general method of fertilizer application in mature rubber plantations. There are conflicting reports about the movement of surface-applied P into the subsoil. Guertal *et al.* (1991) studied the P retention characteristics of Ohio soils cultivated with corn and reported that P accumulates in the surface layer of non-tilled soils. Fertilizer P applied to an acidic, medium textured soil cropped with Timothy grass for 26 years could penetrate into the subsoil even when applied at low rates, and the rate of translocation was related to the rate of P application (Richards and Belanger, 1989). On black chernozem soils of Alberta, most of the surface-applied P could be recovered from soil as extractable P remained in the top 5 cm layer, and the depth of movement increased with P application rate, but no P was recovered below 15cm (Malhi *et al.*, 1992). In oxysol under arecanut, annual application of superphosphate enriched subsoil P level up to 1 m depth (Mohapatra, 1991). White (1996) studied the effect of surface-banding on the movement of P into a Vienna loam soil and observed rapid downward movement of P in the field. However in compacted laboratory columns, most of the applied P was retained in the upper 4cm segment. The present study was undertaken to quantify the availability of P at different depths of the soil, in a mature rubber plantation, at fixed time intervals after P fertilizer application.

An experiment was conducted using PVC columns, 60cm long and 8 cm diameter. Sixteen columns were filled with a sandy clay loam soil from a mature rubber plantation in Koney Estate, Kerala State. The soil was sampled depth-wise and filled in the proper depth order into the columns. Considering 20 per cent of the area as the effective area of fertilizer application, rock phosphate at the rate of 30kg P_2O_5 per ha (420mg/kg soil) was applied on the top of the soil column. Deionised water was added from the top to maintain the soil moisture at field capacity. Four columns each were withdrawn on 5, 10, 15 and 30 days after fertilizer application. The columns were segmented at every 10cm, soil samples collected, processed and analyzed for available P by Bray II method (Bray and Kurtz, 1945).

Soil samples were collected from two field experiments, on rate of P application in mature rubber, conducted in sandy clay loam soils belonging to the ultisol order. Experiment 1 located at Koney Estate, Koney, in Pathanamthitta district in Central Kerala was initiated in 1986 and the treatments were applied continuously for 14 years. The treatments included four levels of broadcast application of P_2O_5, *viz.*, 0, 15, 30 and 45 kg per ha with five replications in a randomized block design. Experiment 2 located at Boyce Estate, Mundakayam, in Kottayam district in Central Kerala was initiated during 1997 and the P treatments were supplied for 4 years. Treatments included five levels of broadcast application of P_2O_5, *viz.*, 0, 10, 20, 30 and 40 kg per ha, replicated four times in a randomised block design.

Soil samples were collected during