

DETERMINATION OF PHOSPHORUS REQUIREMENT OF RUBBER SEEDLINGS USING PHOSPHATE SORPTION ISOTHERM

Phosphorus has been identified as one of the most deficient nutrient element in tropical soils (Abn, 1970; Russel, 1973). Response of rubber seedlings to P fertilization has been reported in Nigerian soils (Onuwaje and Uzu, 1982). Many extractants for estimating P availability have been recommended. However, these estimations were limited only to the amount of P in the soil and not the amount of P needed by plant.

The use of P sorption isotherm based on the principle that P requirement is directly related to its concentration in standard supernatant solution offers a direct approach to assess P requirement of crops. A standard supernatant solution P concentration of 0.2 ppm, suggested by Beckwith (1965), has been found to be adequate for some arable crops (Fox and Kamprath, 1970; Sobualo *et al.*, 1975; Mahmood-ul-Hassan *et al.*, 1993). A critical value of 0.16 and 0.17 ppm was reported by Nnadi and Haque (1985), for the Ethiopian clover. Reports are rather rare on P requirement of rubber seedlings and P sorption in the rubber growing soils of Nigeria. This study therefore, evaluates the P sorption characteristics of the soils in the rubber plantation of the Rubber Research Institute of Nigeria.

Surface and sub-surface (0-15 and 15-30 cm) soil samples were collected from different locations within the rubber plantation. The soil was bulked, air dried and sieved through 2 mm mesh. Physical and chemical properties of the soil were analysed using the standard laboratory procedures.

The sorption isotherm curves were determined by equilibrating 3 g soil in 30 ml 0.01 M CaCl_2 containing various levels of P in 50 ml centrifuge tubes for five days at room temperature (Fox and Kamprath, 1970), shaken twice daily for 30 min. Phosphorus in the supernatant solution after the equilibration period was determined by the Murphy and Riley (1965) method. P rates required to give 0, 0.1, 0.2, 0.3 and 0.5 μg per g were calculated from the isotherm curve. These values were equivalent to 0, 37, 54, 69 and 91 kg per ha P_2O_5 respectively. These levels were supplied to the rubber seedlings in polybags. The treatments were replicated four times in a completely randomized design. Nitrogen and potassium were applied at the rate of 50 and 35 kg per ha respectively. Growth parameters (girth and height) were measured after nine months.

Physical and chemical properties of the soils used for the study are shown in Table 1. The texture was sandy loam in the top and sandy clay loam in the sub-surface soil. The available P content was 6.65 and 6.31 μg per g and organic carbon content 7.8 g per kg and 0.9 g per kg in the top and sub-surface soil respectively.

Figure 1 indicates the phosphorus sorption isotherms for the surface and sub-surface soils. From the isotherm, the standard P requirement (SPR) of the soils were calculated. The SPR was taken as the quantity of P required to attain a standard P concentration of 0.2 μg per g in equilibrium solution. The values were 54 and 96 mg per kg for the top and subsoil respectively.