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Short Communication

Effect of Organic Sources on Phosphorus Fractions and Available Phosphorus in Typic Haplustept

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Phosphorus (P), as an essential plant nutrient for crop production, acts as energy currency in plant, cell elongation, respiration, promotes root growth, early plant maturity and stalk strength, and imparts resistance to stress conditions. Apart from its importance in crop production, it is also a costly input across the globe. The use efficiency of P rarely exceeds 20 per cent because of P-fixation often due to iron (Fe) and aluminium (Al) in acid soils and calcium (Ca) in alkaline soils. Use of organic materials such as crop residues and by-product of sugarcane industries have a positive response on labile P in soil. Decomposition of organic materials produces different organic acids, which help in mobilizing non-labile P in soil into labile P. Phosphorus uptake is enhanced by the addition of organics due to production of organic acids like citric, lactic, gluconic and oxalic, which in turn, transform P from non-utilizable form to plant utilizable form (Ivanova *et al.* 2006). Thus, incorporation of organic materials improves soil health and crop yield (Dotaniya 2012). The exudation of low molecular weight carboxylates is an important P acquisition strategy by plants, particularly in strongly P-fixing soils. The enhancing properties of P availability of citric acid are not only due to acidification of the plant rhizosphere, but also for its Al and Fe complexing capacity (Drouillon and Merckx 2003). The objective of the present study was to investigate the effect of organic residues on P fractions mainly Al–P, Ca–P, and available P in soil during a one year incubation period.

A laboratory incubation experiment was conducted at Indian Agricultural Research Institute, New Delhi for one year under controlled condition to study the effect of different organic residues on P fractions and available P. Bulk soil sample was collected from the research farm (Block No. MB-8) of the institute. It was air-dried, ground, passed through a 2–mm sieve, mixed thoroughly for homogenization and analyzed for initial physicochemical properties. The experimental soil was silt loam in texture and belongs to Typic Haplustept. The initial soil had pH 8.2, EC 0.24 dS m^{-1}, organic C 3.1 g kg^{-1}, and available N, P and K contents 180, 19.2 and 302 kg ha^{-1}, respectively. For incubation study, a series of 80 g processed soil samples were taken into 100 mL plastic beaker. Organic residue was prepared by mixing pressmud (sulphitation pressmud), bagasse and chopped rice straw in the ratio of 1:1:1 (w/w). The mixed organic residues had 1.1% N, 0.2% P and 0.3% K on dry weight basis. The treatments consisted of three levels of organic residues (0, 2.5 and 5 g kg^{-1} soil) and two levels of P (0 and 10 mg P_2O_5 kg^{-1} soil) with three replications in a completely randomized design. Initial field capacity of soil was determined by pressure plate apparatus, thereafter a composite sample was taken and the moisture content was measured and maintained at field capacity (1/3 bar) level. The temperature was maintained at 25±1 °C throughout the incubation period. Samplings were drawn at an intervals of six months and analyzed for Ca–P and Al–P (Williams *et al.* 1971) and 0.5 *M* $NaHCO_3$–P (Olsen *et al.* 1954). Data obtained from the incubation experiments were subjected to analysis of variance (ANOVA). The least significant difference (LSD) at $P = 0.01$ was used to test the differences between the means of individual treatments as outlined by Gomez and Gomez (1984).

Results revealed that the mean Al–P content in soil increased with increasing levels of P application (Table 1). However, the mean Al–P content decreased with the increasing levels of organic residue during

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