

## Fractionation of inorganic phosphorus in some acid soils of West Bengal (India)

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### ABSTRACT

Soil samples (0-0.15m) collected from the four different soil series of West Bengal (India) were subjected to detailed characterization with respect to important physico-chemical properties (pH, EC, CEC, organic carbon, clay, free iron oxide, exchangeable Ca, Mg, Na, K, exchangeable Al, extractable Al, and amorphous Al) and fractionation of inorganic P by the standard procedure. The physico-chemical properties of the soils showed that the soils were acidic (pH: 4.21 to 5.67) in nature with moderate to high in organic carbon content. A wide variation was observed in extractable P, extractable Al, amorphous Al and exchangeable cations. The different inorganic forms of soil P, in general, decreased in the order, Al-P > Fe-P > reductant-soluble P > Ca-P > occluded P > saloid P.

**Key words :** Fractionation, Soil Phosphorus, Free iron oxide.

The inorganic forms of phosphorus (P) vary in their solubility, but with time, transform from sparingly soluble to increasingly insoluble crystalline forms from which the P becomes unavailable to plants. The compounds formed depend on the chemistry of a particular soil, and the solubilization-precipitation reactions involving insoluble compounds are dependent on pH. Several chemical methods have been used so far to identify the inorganic forms of phosphorus in soil. The method introduced by Chang and Jackson (1957) for extracting aluminium phosphate was criticized by several workers. Fife (1959) carefully evaluated  $\text{NH}_4\text{F}$  as a selective extractant for aluminium phosphates and finally recommended a direct alkaline extraction by  $\text{NH}_4\text{F}$  at high dilution, the initial alkalinity of the solution being such as to give a final pH of soil suspension at 8.5. This observation was supported by Pratt and Garber (1964). Soil inorganic phosphorus is most conventionally divided into two categories; insoluble and readily soluble. The chemistry of soil inorganic phosphorus is complex and has been extensively reviewed (Larsen *et al.*, 1959).

Measurement of Al-phosphate ion products in solution equilibrated with acid soils by a number of workers (Coleman *et al.*, 1950; Lindsay *et al.*, 1959), when expressed in terms of the function  $(\text{pAl} + \text{pH}_2\text{PO}_4 + 2 \text{pOH})$ , was found to range from 28 to 33. They are close to the solubility product of variscite (29.5) as reported by Kittrick and Jackson (1955). Apatite has been reported

as a common soil mineral (Shipp & Matelski, 1960). Hydroxy apatite has been reported to be a stable form over a wide range of pH. The presence of octacalcium phosphates has been reported in soils, which have limed and fertilized with phosphates. Octacalcium phosphate is structurally related to hydroxyl apatite to which it can be converted under basic conditions.

Tomar *et al.* (1986) showed that recovery percentage of the total inorganic P into saloid-P, Al-P, Fe-P, and Ca-P was only 27-53% and the remaining fractions were either in occluded form and/or fixed in lattice. Adequate attention has been paid on the distribution of various inorganic P fractions under different edaphic, biotic and climatic conditions (Tomar, 2000).

In some tea growing soils of Himachal Pradesh, Rao and Chakroborty (1994) found that the mean relative abundance of inorganic P fractions followed the order of RSP (reductant soluble P) > Fe-P > Ca-P > Al-P > saloid-P in both surface and sub-surface horizons.

In some acid soils of West Bengal, Adhikari & Si (1994) found that the P fractions in soils increased in the order saloid-P < occluded-P < active-P. Inactive form i.e. reductant soluble-P was 9.2 -16.8% of total P and the active forms was in the order Fe-P > Ca-P > Al-P.

Significant correlation of phosphate sorption parameters with clay content has been reported by several workers (Fox and Kamprath, 1970) and this may be a more reflection of the effect of specific surface area (Sanyal and De Datta, 1991)

The nature of reaction products of P in soils chiefly depend upon physico-chemical properties, nature of