Mobility of Phosphorus from Fertilizer Source to Soils under Submerged Condition

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Plant available P remains low in rice-grown paddy soils regardless of phosphorus fertilizer application. Mobility of P from fertilizer source to soils under submerged condition is not well understood. We investigated the availability and mobility of P from triple super phosphate (TSP) and Eppawala rock phosphate (ERP) in three soils, Alfisol, Entisol and Ultisol under submerged conditions using soil columns. Fertilizer granule/pellet equivalent to 10 mg of P was incorporated at the middle 1 cm below the surface of soil column. (A control without fertilizer incorporation was maintained for each soil.) The soil columns were submerged for five weeks with 1 cm water head. The redox potential (Eh) of the soils were measured weekly. At the end of the submergence period, soil samples were collected at 0-1, 1-2 and 2-3 cm away from the point of P application horizontally and at the same depths. Soils were analyzed for pH, soil P fractions extracted by distilled water, 0.5M $NaHCO_3$, 0.1M NaOH and 1M HCl, and residual. The Eh was -150, 265 and 465 mV at the end of submergence for Ultisol, Alfisol and Entisol, respectively. Entisol and Ultisols had similar amount of labile P (~30%) and Alfisols had the lowest amount of labile P (24%) released / mobilized from TSP within 3 cm depth. The labile P fraction was less than 5% in ERP-added soils. Labile P concentrations within/at the three depths were not significantly different. During submergence, Fe associated P reduced and Ca associated P increased in all three soils regardless of P source, and it was more prominent in Ultisol. About 70-76 % of P in TSP and >95 % in ERP were either remaining in the fertilizer source without releasing to the soils or immobilized in soil. Developing methods to increase mobility of P from fertilizers and soils is crucial to increase P fertilizer use efficiency.

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