Quantitative Approach for Assessment of Phosphorus Loss Risk from Alaquod and Paleudult Soil Profiles

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Phosphorus (P) transported from agricultural fields can be a major contributor to eutrophication of aquatic systems. Alaquods and Paleudults are soils of extensive occurrence in SE US coastal plain. Compositional differences between Alaquod- E and Bh, and Paleudult- E and Bt horizons affects subsurface P transport in these soils. Environmental risk of P loss from soil horizons can be evaluated from phosphorus saturation ratio (PSR; molar ratio of P to [Al+Fe]) and soil phosphorus storage capacity (SPSC). The change-point amounts to a threshold PSR value above which runoff or leaching risk increases precipitously. SPSC is a calculation of how much P can be added to a soil before reaching this critical PSR. The objectives of this study were to i) relate P sorption characteristics to compositional differences in Alaquod and Paleudult subsurface horizons and ii) evaluate the environmental risk of P loss from these soils using PSR and SPSC. Results indicate greater desorption potential of Bh in comparison to Bt which is likely due to weaker bonding of P with organically-complexed Al. Clayey soils (Bt) have high P retentive capacity due to presence of inorganic metal oxides along with crystalline Fe and phyllosilicates. However, the components responsible for tenaciously binding P are noncrystalline metal oxides. Water-soluble P and equilibrium P concentration (EPC_0) are minimum when SPSC is positive and begin to increase when SPSC becomes zero. Pedological, compositional and hydrologic distinctions between Paleudults and Alaquods result in greater risk of P loss for the latter under comparable P loadings.