Phosphorus Retention and Release from Bh and Bt Horizons of Manure-Impacted Soils in Florida

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Excessive phosphorus (P) fertilization can lead to eutrophication of surface water. Sandy soils have higher risk of P loss because of limited P retention capacity. Vertical movement of P through the soil profile results in its contact with Bh (spodic) horizons of Spodosols and Bt horizons of Ultisols which may act as P sinks. Compositional differences between Bh and Bt horizons result in contrasting P sorption behavior and P loss risks with excess P application. Environmental risk of P loss from soil horizons can be evaluated from phosphorus saturation ratio (PSR; molar ratio of P to [Al+Fe]) and safe phosphorus storage capacity (SPSC). A threshold PSR ("change point") above which release of P from soil to solution abruptly increases can be determined for a given population of soils. SPSC is a calculation of how much P can be added to a soil before reaching this critical PSR threshold. The objectives of this study were to i) compare P sorption-desorption characteristics of Bh and Bt horizons; and ii) determine effectiveness of PSR and SPSC for predicting risk of P loss. Phosphorus sorption capacities are similar for Bh and Bt horizons but desorption is greater and PSR threshold is lower for Bh horizons. Disparity in desorption is likely attributable to organic- versus inorganic metal complexation in Bh versus Bt. Also, appreciable crystalline Fe in Bt horizons could contribute more to P sorption than indicated by oxalate-extractable metals. PSR and SPSC can be efficiently used for predicting environmental risk of P loss.