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A rainfall simulation study on the relationships between soil test P versus dissolved and potentially bioavailable particulate phosphorus forms in runoff

Keywords phosphorus, bioavailability, erosion, rainfall simulation,

Abstract

Runoff from clayey soils often contains abundant particulate phoshorus (PP), part of which may solubilize in surface waters. Monitoring losses of potentially bioavailable forms of PP is expensive, calling for other ways to predict them. Such predictions could be based on soil loss and available soil P indices, e.g., agronomic P status. To study correlations between P pools in runoff versus soil P saturation (by Mehlich 3 extraction; DPSM3) and acetate soil test P (PAc), 15 clayey soils of south Finland were subjected to laboratory rainfall simulation. Runoff from these simulations was analyzed for concentrations of suspended soil (TSS), dissolved molybdate-reactive P (DRP), total P (TP), and, as normalized to soil loss, potentially bioavailable forms of PP: desorbable (anion exchange resin-extractable, AER-PP/TSS) and redox-labile PP (bicarbonate- dithionite-extractable, BD-PP/TSS). Correlation coefficients (r2) between DPSM3 and DRP, AER-PP/ TSS, and BD-PP/TSS equaled 0.92, 0.77, and 0.45, respectively. Runoff P forms were also correlated to soil PAc with r2 values of 0.84, 0.56, and 0.58 for DRP, AER-PP/TSS, and BD-PP/TSS, respectively. Prediction of soil loss-normalized concentrations of potentially bioavailable PP by the agronomic PAc test was considered possible. However, such predictions have a high degree of uncertainty, evidenced by comparison to published field data. Acceptably accurate predictive equations would require a large material as a basis for their construction, and soils should probably also be grouped according to other soil properties that would account for variation in P sorption capacity.

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[Full text] (PDF 208 kt)

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