



Rapid transport and transformation of phosphorus species during the leaching of poultry manure amended soil

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The loss of phosphorus (P) from soils due to leaching is a major concern in heavily fertilized agricultural regions. The mobility and transformation of P species will depend on the source of manure fertilizer, leaching regime, and the extent of soil P saturation within the soil profile. We investigate spatial and temporal changes in the distribution of P species within a poultry manure-amended soil at two depths (0-5, 10-15 cm) as well as leachate P fractions during 10 weeks of leaching. Leachate P was primarily composed of dissolved fractions (soluble reactive P; dissolved unreactive P) and reached a maximum in the fourth week of leaching. In soils, the degree of P saturation (80%) and water extractable P (9 mg kg⁻¹) were also greatest in week 4. ³¹P NMR spectra of the 0-5 cm depth indicate that surface soils were most similar to the poultry manure in week 4. During peak leaching, the proportion of orthophosphate (OrthoP) at the soil surface (0-5 cm; 80%) was greater than that from the lowest depth (10-15 cm; 72%), which contained relatively larger proportions of monoester-(17%) and diester-P classes (10%). Poultry manure likely contributed to the mobile pool of P species, including OrthoP, myo-inositol hexakisphosphate (myo-IHP), and nucleic acids. The appearance of neo- and D-chiro-IHP, as well as phospholipid signals during the leaching period indicate possible short-term (<10 week) contributions of organic P to the generation and leaching of OrthoP, under P-saturated conditions. Further work is needed to determine how fertilization and leaching will affect the mobility and transformation of P species across a wider range of soil types.

Keywords: Phytate, organic phosphorus, degree of phosphorus saturation, soil, leachate, poultry manure