

Understanding phosphorus in soils is vital to proper management

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Phosphorus is one of the key nutrients that can cause algal blooms and related water quality problems in lakes, rivers, and estuaries worldwide. Phosphorus entering waters originates from a variety of sources. Agricultural land receiving long term applications of organic by-products such as animal manure is one of the major contributors. Such soils often become enriched with P, leading to elevated P loss through erosion and runoff. Information on the chemical characteristics of P in these soils is essential to improving our understanding of how P behaves in soils and how it is transported in runoff to devise better management practices that protect water quality.

A group of scientists in the USA and Australia have identified the chemical forms of P, using ^{31}P nuclear magnetic resonance (NMR) spectroscopy, in soils receiving organic by-products for at least eight years (treated) as compared with soils not receiving P application (untreated). Results from the study were published in the January-February issue of the *Soil Science Society of America Journal*.

Regardless of the type of organic materials applied (dairy, swine, poultry, or spent mushroom compost), orthophosphate (inorganic P) was the single dominant P form, more so in treated soils (79-93% of total P) than in untreated soils (33-71%). Orthophosphate was also the only P form that differed dramatically between paired soils, three to five times greater in treated than untreated soils. Other P forms included condensed inorganic P and various organically bound P groups; however, their amounts were relatively small and differences between each paired soils

were insignificant.

Surprisingly, the study revealed no evidence of phytate-P accumulation in any of the soils receiving organic wastes. Phytate is an organic storage form of P that is known to be present in animal manures, in particularly large proportion (up to 80% of total P) in poultry manure. Phytate-P is generally considered to be recalcitrant in the agroecosystem because of its chemical structure. However, the lack of phytate-P accumulation in several soils receiving poultry manure in this study indicates that manure-derived phytate-P may not be biologically and environmentally benign.

Zhengxia Dou, the lead author, stated "in terms of potential P loss in the long run, organic materials containing large amounts of phytate-P such as poultry manure may not differ from other material containing mainly inorganic P". Andrew Sharpley, a collaborating scientist, further explained "when the soils' P sorption capacity was nearly saturated after years of manure application, phytate or other organic P forms could be exposed to breakdown and potential loss". Therefore, it is important to strive towards balancing P inputs with outputs and to prevent P from building up in soils to which manure is applied.

More information: View the abstract at soil.sci.journals.org/cgi/content/abstract/73/1/93 .

Source: Soil Science Society of America

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