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动物粪液中可溶性磷在土壤中的吸附和迁移特性研究

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Adsorption and transport characteristics of liquid animal manure-derived dissolved phosphorus in four soils

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摘要 农田土壤施用动物粪肥引入了大量的可溶性有机物、有机磷和无机磷，了解这些可溶性物质在土壤中的相对移动性及它们之间的相互作用有助于指导农田养分管理。本研究从粪液中分离获得含水溶性无机磷、有机磷和有机物（碳）的溶液，选择了具不同质地和有机质含量的4个土壤（含高量有机质的黄筋泥、含低量有机质的黄筋泥、淡涂泥和清水沙），应用等温吸附和土柱模拟淋洗方法研究了可溶性有机碳、无机磷和有机磷共存条件下，粪液中可溶性有机态磷和无机态磷在土壤中的吸附和迁移特性。吸附试验表明，可溶性有机物（碳）的存在大大降低了土壤对有机态磷和无机态磷的吸附，表明施用液态有机肥比施用化肥具有更大的磷流失风险。供试土壤对无机态磷的吸附强度高于有机态磷，但对二者的吸附量大小为：黄筋泥>淡涂泥>清水沙；并与粘粒含量、氧化铁含量呈正相关。有机质较高的土壤对有机磷的吸附明显低于有机质低的土壤。淋洗试验表明，在供试土壤中，这3种可溶性物质在土壤中吸持(包括生物吸持)的顺序为：可溶性无机磷>可溶性有机碳>可溶性有机磷；有机态磷比无机态磷更易在土壤中迁移。

关键词： 动物粪液 可溶性有机质 可溶性无机磷 可溶性有机磷 吸附 迁移 动物粪液 可溶性有机质 可溶性无机磷 可溶性有机磷 吸附 迁移

Abstract：

High concentrations of dissolved organic matter (OM), dissolved organic phosphorus (P) and inorganic P can be input into agricultural soils in the form of applied animal manure. Understanding the relative mobility and interactions of those dissolved matter in the soils is necessary to manage P in agricultural system. In this study, solution containing dissolved OM, dissolved organic P and inorganic P was separated from an liquid animal manure, four soils (two samples of quaternary red clay, one sample of desalted muddy polder soil, and one sample of fluvio-sand ridge soil) with different texture and OM were collected. The isotherm adsorption and leaching experiments were carried out to study the adsorption and transport characteristics of the liquid animal manure-derived dissolved inorganic and organic P in the soils under the co-existence of dissolved OM, dissolved organic P and inorganic P. The adsorption experiment showed that the existence of dissolved OM in high concentration decreased the soil capacity to adsorb inorganic and organic P, suggesting that application of liquid animal manure posed a greater risk of P losses from the soils than application of chemical fertilizers. The adsorption capacity of the soils to adsorb inorganic P was larger than that to organic P. However, the adsorption capacities of the soils to adsorb either inorganic P or organic P decreased in the order of quaternary red clay > desalted muddy polder soil > fluvio-sand ridge soil, and were related to contents of clay and iron oxides. The soil with a high content of OM had lower capacity to adsorb organic P than the soil with low content of OM. Leaching experiment showed that preferential adsorption sequence of the three dissolved matter in the soils was dissolved inorganic *P*>dissolved organic carbon >dissolved organic P, organic P had higher mobility than inorganic P in the soils.

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