RESEARCH ABSTRACT
ENVIRONMENT

Title: Manure-Phosphorus in Soil: Detection and Mobility of Phytate – **NPB #05-140**

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Date Submitted: May 31, 2007

Industry Summary

Annual swine effluent application in western Oklahoma for 11 consecutive years did not lead to significant accumulation of soil phosphorus. Similar trend was shown in a century-old field experiment in central Oklahoma. Although phytate is the main phosphorus form in animal feeding stuff, it has little nutritional value for monogastric animals and was suspected to be responsible for high P levels in animal manures. Laboratory studies showed that phytate added to soil did not remain in the solution and had limited mobility in soil columns that were constructed with acidic or alkaline soil. Therefore, solution phosphorus levels in soils were not increased appreciably by the addition of phytate to soil and manure-phosphorus would have limited mobility in the environment. Application of manure, however, enhanced soil biological activities and the capacity of soil to retain or cycle nutrients. Long-term manure application in central and western Oklahoma sustained agricultural production and did not result in P accumulation to levels close to those in inorganic P fertilizer-treated soils.

Abstract

Annual swine effluent application in western Oklahoma for 11 consecutive years did not lead to significant accumulation of soil phosphorus. Similar trend was shown in a century-old field experiment in central Oklahoma. Although phytate is the main phosphorus form in animal feeding stuff, it has little nutritional value for monogastric animals and was suspected to be responsible for high P levels in animal manures that may lead to P accumulation and contamination in the environment. Laboratory extraction, incubation and leaching studies indicated that mobility of phytate in soil was low and addition of phytate to soil did not appreciably increase extractable soil P. Phytate P also had limited mobility in soil columns that were constructed with acidic or alkaline soils. Therefore, solution phosphorus levels in soils were not increased appreciably by the addition of phytate to soil. This implies that manure-phosphorus would have limited mobility in the environment and leaching potential of phytate-P or phytate degradation intermediates would be limited. These findings suggest that phytate-P would likely accumulate in soil. However, significant P accumulation trend was not detected in two long-term field experiments located in central and western Oklahoma. On the other hand, application of swine effluent reduced microbial biomass C and P contents in soils, suggesting a reduction in the driving force of nutrient conversion in the soil ecosystem. High rates of swine effluent slightly reduced

These research results were submitted in fulfillment of checkoff funded research projects. This report is published directly as submitted by the project's principal investigator. This report has not been peer reviewed

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microbial biomass C/P ratios, suggesting microbial composition shifted toward a more bacterial dominating community with a greater proportion of P accumulated in the microbial biomass. When compared with the control soils, activities of alkaline phosphatase and inorganic pyrophosphatase were significantly greater in soil treated with swine effluent. Moreover, activity of acid phosphatase was not affected, and activity of phosphodiesterase was significantly lower in soils treated with swine effluent. In both long-term manure-applied field experimental sites, application of manure enhanced soil biological activities and the capacity of soil to retain or cycle nutrients. Long-term manure application in central and western Oklahoma sustained agricultural production and did not result in P accumulation to levels close to those in inorganic P fertilizer-treated soils.