

ENVIRONMENT

Title: Meta-Analysis of Swine Manure and Commercial Fertilizer on Environmental Endpoints and Soil Health - NPB: #17-209

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Abstract

Swine manure contains substantial amounts of nitrogen, phosphorus, and potassium capable of supplying nutrients to crops. There are published research studies that compare crop yields between swine manure and commercial fertilizer. The results vary among these studies and the results are often confusing to interpret the effect across locations. To address this problem, a meta-analysis was conducted to quantify the differences between swine manure and commercial fertilizer on crop yield, nitrous oxide emissions, phosphorus runoff, and soil organic matter changes. Meta-analysis provides a non-biased methodology to statistically compare studies that meet a given set of requirements for inclusion. It was found that over all of the studies, swine manure was not significantly different from commercial fertilizer in crop yields. There were differences in this response related to soil type (crop yields in lighter textured soil were more responsive to swine manure than heavier textured soils), application method (surface application had lower yields than commercial fertilizer potentially due to volatilization, or inability of the crop to extract nutrients at the soil surface, or uneven application of manure onto the soil surface), crops (corn, wheat, and forage showed no difference in yield when swine manure was used), climates (temperate climates were the most responsive to swine manure), and country (the United States had the largest positive response of crop yield to swine manure application because most the US are in temperate regions). Swine manure can be effectively used as a nutrient source for crop production and awareness to the areas and practices that provide the greatest response can increase the economic return compared to commercial fertilizer. Observations on nitrous oxide emissions showed no difference between swine manure and commercial fertilizer while observations on water quality, phosphorus runoff or nitrate leaching was dependent upon the weather conditions during the study and the application rate. To reduce water quality problems, application of swine manure at the recommended rate is required. Swine manure does have a positive effect on soil properties, e.g., soil organic matter, aggregate stability, bulk density, water infiltration and storage, and nutrient cycling. These changes increase the capability of effectively using swine manure or other organic sources to increase the capability of the soil withstand weather variation. A note of caution in all of these studies and their interpretation, crop yield differences in a given study may not be directly related to the source of fertilizer and studies utilizing swine manure may not have been of sufficient duration to evaluate changes in soil properties.

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