Assessment of swine manure sources on nutrient losses and use efficiency under controlled environmental conditions

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ABSTRACT

Swine manure supplies essential nutrients, especially nitrogen (N) and phosphorus (P), to Canadian croplands, but improper management can lead to soil P accumulation, nitrous oxide (N_2O) emissions and nutrient runoff. This study evaluates swine slurry from two feeding trials. Trial 1 included four diet N-P levels (Low-N-Low-P, Low-N-Normal-P, Normal-N-Low-P, Normal-N-Normal-P), and Trial 2 included six enzyme-additive diets (positive control with normal soybean meal, fat and protein; negative control (NC) with their reduced levels; NC+protease; NC+xylanase; NC+protease+xylanase; and NC+encapsulated protease+xylanase). Three sets of experiments assess impacts on greenhouse gas emissions, nutrient run-off, and wheat crop growth: (1) Incubation experiments assess N_2O, CH_4, and CO_2 fluxes; (2) Intact soil columns simulate snowmelt runoff to quantify N and P losses; and (3) A pot experiment with two soil types evaluates wheat nutrient uptake and use efficiencies. Preliminary analysis showed significantly higher phosphate concentrations in manures from normal P diets (0.63%, 0.56%) compared to low P diets (0.34%, 0.33%). Enzyme-additive treatments showed no significant effects on phosphate concentration, ranging from 0.26% to 0.39%. Manure inorganic N levels ranged from 0.42% to 0.5% in Trial 1, and from 0.25% to 0.39% in Trail 2, with no diet effects. Results will provide sustainable manure management practices that improve nutrient efficiency while mitigate environmental risks in Canadian cropping systems.

Key words: N_2O emission, P and N runoff, What crop growth, Sustainable manure management, Nutrient use efficiency