USDA-CSREES 2006 National Water Quality Conference

Phosphorus uptake and soil accumulation following N- vs. P-based dairy manure applications

Animal manures can be an important source of nutrients for crop plant growth, as well as providing a means to recycle feed-derived nutrients in the on-farm agroecosytem. Farm manure management guidelines are frequently based on meeting crop requirements for nitrogen (N) or phosphorus (P). If animal manure is applied to meet the N requirement of a crop, P will generally be in excess and thus accumulate in the surface soil. Beginning in 1998, we have conducted an experiment applying dairy manure slurry to replicated crop strips of silage corn (*Zea mays* L.), alfalfa (*Medicago sativa* L.) or orchardgrass (*Dactylis glomerata* L.), at rates meeting either N or P needs of the crops, with plots receiving no N or P inputs or fertilizer serving as controls. We monitor N and P in subsurface leaching and surface runoff, crop nutrient uptake and soil P accumulation resulting from nutrient input treatments. Over all years, crop total P concentrations as a function of nutrient input treatment did not differ statistically at the 5% level. Four-year mean annual P inputs in the N-based manure treatment were 132, 62 and 103 kg ha^{-1} for alfalfa, silage corn and orchardgrass, respectively; corresponding P inputs for the P-based manure treatment were 38, 46 and 34 kg ha^{-1} for the same crops. Compared to annual P uptake of 40, 22, and 24 kg ha^{-1} by alfalfa, silage corn, and orchardgrass, the N-based manure treatment oversupplied P by 3.3, 2.8 and 4.3 fold; the P-based manure treatment resulted in a small amount of excess P (7, 30 and 16 kg ha^{-1} , respectively). After four years' manure applications, plant-available soil test P (Mehlich-3 method) in the surface 5 cm of soil increased by 56% over pre-experiment soil P levels in the N-based treatment and 16% in the P-based treatment. Long-term dairy manure applications at agronomically acceptable rates (based on crop N

requirements) can lead to soil P buildup and increase the potential for P losses into the environment.

Author: Zhengxia Dou