



Title: N- vs. P-based manure applications and water quality impact

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Theme: Animal Waste Management

Situation: Animal manure is an important source of nutrients for growing crops, but applications must be matched to the crops' uptake. If manure is applied at rates in excess of crop needs, nutrients can be lost into the environment in runoff and leaching, with the potential for causing pollution of water bodies. This project is to assess the impact on ground and surface water of dairy manure applied at N- vs. P-based rates to different crops. The information will be valuable to agricultural professionals, students in training, and dairy producers.

Objectives: Our broad goal is to develop and validate nutrient management strategies for reduced N and P losses to waters. Specifically, we are investigating how N- vs. P-based manure application to annual vs. perennial crops affects nitrate and P leaching, N and P losses in surface runoff, and crop removal and soil accumulation of the nutrients. The measurable parameters are: 1) mass and concentration of nitrate and P lost in leachate, 2) mass and concentration of N and P lost in runoff, 3) changes of nitrate and P distributions in soil profiles, 4) crop yield, nutrient removal, and forage quality.

Methods: The field experiment has been underway since 1998 to quantify N and P losses in leachate and runoff from crops commonly grown on dairy farms in the Mid-Atlantic region. Research results have been presented at scientific meetings and are integrated into students' education at Univ. of Pennsylvania's School of Veterinary Medicine. Field demonstrations have been given to agricultural professionals, nutrient management specialists, veterinary students and state legislators.

Partnerships: Collaborations and partnerships have been established with specialists in dairy production, animal nutrition, soil science, bioresource engineering, environmental chemistry and hydrology at Penn State Univ., Univ. of Pennsylvania, Univ. of Delaware and the Stroud Water Research Center.

Research: Summaries of research findings have been provided to state nutrient management regulatory agencies and have been presented at professional meetings. Educational materials and presentations have been given at the Pennsylvania Farm Show, attended by many of the state's agricultural producers. Veterinary students are introduced to concepts of nutrient management in dairy production in the classroom and hands-on at Univ. of Pennsylvania's Marshak Dairy, and field data is incorporated into computer modeling using the dairy ration formulation software CPM-Dairy.

Resources: The initial field setup was supported by a CSREES special grant and the Center for Animal Health and Productivity, U. Penn. Since 2001, an NRI grant has been providing much of operation cost. U. Penn continues to provide in-kind contributions including partial salary, lab, equipment, and computing.

Results: Nitrate in leachate has remained above the 10ppm drinking water standard in manured corn, alfalfa and grass, and above 10ppm in runoff from manured corn. Soil test P declined in treatments receiving no manure, but increased significantly if the crops received manure at rates based on crop N needs. In presentations to producers, ag professionals and students we emphasize that to maintain farm sustainability while protecting water quality, it is of paramount importance to tailor nutrients input into the system from animal feeds and moving through animal manures to crop requirements.



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