



Northern New York Agricultural Development Program FACT SHEET

How Manure Application Timing, Crop, and Soil Type Affect Phosphorus Leaching

Why Study the Factors Affecting Phosphorus Leaching?

Certain soils, crops and crop production practices may cause higher losses of phosphorus.

A three-year research project conducted at the Cornell Baker Research Farm in Willsboro in Essex County, NY, offers farmers insight into production practices that promote a well-balanced production-stewardship operation.

Principal Investigators: Harold M. van Es and Robert R. Schindelbeck, Department of Crop and Soil Sciences, Cornell University; Larry Geohring, Department of Biological and Environmental Engineering, Cornell University; and W.E. Jokela, Plant and Soil Science Department, University of Vermont

Introduction

Northern New York farmers, like farmers across the state, are working to balance high-yield, high quality crop production with conscientious environmental stewardship. Certain soils, crops and crop production practices may cause higher leaching losses of phosphorus (P) into soil, tile lines and then on to streams and lakes. A three-year (October 1997-October 2000) research project conducted at the Cornell Baker Research Farm in Willsboro in Essex County, New York, evaluated how manure application timing, crop choice and soil type affect P leaching into surface waters via tile lines. The conclusions drawn from this project offers farmers insight into production management practices that can help promote a well-balanced production-stewardship operation.

Objective:

The objective of this project was to measure the transport of manure-derived phosphorus into shallow ground water and tile lines as affected by two crop choices: corn and orchard-grass, by two soil types: clay loam and loamy sand, and by the timing of applications by seasons.

Methods:

The researchers working on this study began their work with the following earlier research conclusions in mind:

- P losses are primarily a function of soil P availability and the processes of runoff and erosion (Lemunyon and Gilbert, 1993)
- application of P fertilizer or manure at agronomically acceptable rates generally poses little concern for excessive P leaching (Sims et al., 1998)

For more information about phosphorus studies at NNY research stations and farms, go online to www.nnyagdev.org and click on Agricultural Environmental or contact the Cornell Cooperative Extension office for your county:

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- soils with a history of high P applications may easily exceed critical soil P levels and cause excessive P leaching (Hesketh and Brookes, 2000)
- artificially drained fine-textured soils that may not be P saturated may lose P through rapid movement through preferential flow paths to subsurface drains and on to surface waters (e.g., Gaynor and Findlay, 1995)
- management practices also affect nutrient leaching loss, e.g., P applications on perennial forage crops often show higher losses than annually cropped land (Culley et al., 1983; Sims et al., 1998)
- application timing may also affect nutrient loss (Sims et al., 1998; Goehring et al., 2001).

This study measured phosphorus (P) leaching losses from liquid manure applied to a clay loam and to a loamy fine sand soil from September 1997 to September 2000. Manure was applied to corn and orchardgrass on both soils over 16 plots. Soil test results prior to manure application for this project showed generally low-to-medium P levels.

Manure Application on Corn

Liquid manure obtained from storage on a nearby dairy farm was agitated before transport to the test plots at the Cornell Baker Research Farm. Manure was applied to the corn plots at an annual rate of 10,000 gallons per acre in one application for both fall and early spring applications and in two equal amounts of 5,000 gallons per acre for the spring split applications. The rates were selected to supply the corn nitrogen requirements from spring manure applications.

A Nuhn Industries manure applicator with 15 drop hoses set 23 cm apart was used to spread the manure that was disc-incorporated twice within three hours of application with the exception of the spring sidedressing that used a four-unit drop hose system with S-tine cultivators between crop rows for immediate incorporation. The corn was harvested as silage.

Manure Application on Orchardgrass

Manure was surface-applied by drop hose to orchardgrass plots in two equal applications of 5,000 gallons per acre. Three plots received manure in early spring (target date: April 15) and after the first cut in late spring (target date: June 15). Three plots received manure after the first cut and after the third cut in early fall (target date: October 1). Two plots received no manure, but were topdressed three times each year with ammonium nitrate. Cornell pest control and nutrient guidelines were followed. The grass was harvested three times based on forage quality in all three study years.

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The Northern New York Agricultural Development Program provided funding support for this study.

Principal Investigators

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For more information on this project, contact: Harold van Es, Department of Crop and Soil Science, Cornell University, 607-255-5629, hmv1@cornell.edu.

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The Northern New York Agricultural Development Program selects and prioritizes research the results of which can be practically applied to farms in the six-county region of Northern NY: Jefferson, Lewis, St. Lawrence, Franklin, Clinton and Essex counties.

To learn more about the Northern New York Agricultural Development Program, contact: Co-Chairs Jon Greenwood, 315-386-3231, or Joe Giroux, 518-563-7523; or R. David Smith, Cornell University, 607-255-7286; or visit www.nnyagdev.org. ♦



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