



Northern New York Agricultural Development Program

FACT SHEET

6 in a series on phosphorus

Phosphorous Runoff: Calibrating the P Index for NNY

Principal Investigators: Dr. Quirine Ketterings, Assistant Professor of Crop & Soil Sciences, Cornell University; Karl Czymmek, Senior Extension Associate, ProDairy, Department of Animal Science, Cornell University; Larry Geohring, Senior Extension Associate, Department of Biological and Environmental Engineering, Cornell University; Jason Kahabka, Project Coordinator, Crop and Soil Sciences, Cornell University.

Phosphorus Runoff and Rain

Rainfall directly affects the transfer of soil nutrients to nearby surface waters...

As P levels in soils increase, farmers will need to adjust their P application rates to avoid soils becoming saturated, thus increasing the risk of runoff.

Researchers used a specially-engineered rainfall simulator to test runoff on three NNY farms in 2004.

Over time, researchers will be able to apply rainfall simulation-P loss results to further calibration of the New York P Index, a management tool designed to rank fields based on their potential to create runoff P losses.

Introduction:

Why Study Phosphorus Runoff in NNY?

Phosphorus (P) from agricultural soils, fertilizer and manure can contribute to the eutrophication of lakes if it moves from fields into surface waters. While many of the processes that drive P losses are physical, the inherent chemical properties of different soil series might affect how tightly P is bound to soil particles. If this is true, the differences in chemical properties can be a significant source of variability in determining the risk associated with P loss.

The current NY Phosphorus Index (NY-PI) uses the agronomic soil test P (Cornell Morgan P) as predictor for the contribution of the soil to P runoff and indicator of past management practices (the amount of P applied versus the amount of P removed by the crop).

Soils and agricultural practices differ greatly from region to region across New York State. To help minimize agricultural nutrient losses in Northern New York Cornell University researchers are working to calibrate the New York P Index specifically for Northern New York soils. Funds to support this work are being provided by the Northern New York Agricultural Development Program.

Beginning in 2004, researchers conducted runoff assessments on three Northern New York farms using a specially-engineered rainfall simulator to assess how well soil test P levels can be used to predict phosphorus release from agricultural soils.

Want to know more about phosphorus use in NNY?

To see county soil summaries for Northern New York counties, visit the website at <http://nmsp.css.cornell.edu>

These Northern New York Agricultural Development Program Fact Sheets are available from your local Cornell Cooperative Extension office:

- Why is Phosphorus an Issue for New York State Farms?
- Trends in Soil P Status
- Limiting P Use for Corn Growing in NNY Without Sacrificing Yield
- Developing a P Index for NNY Soils
- The Impact of Starter P on Corn Silage
- P Runoff: Calibrating the P Index for NNY Using Rainfall Simulation

“Although laboratory studies are essential, validation and improvement of the P Index for Northern New York requires direct field measurements of P loss,” says Dr. Quirine Ketterings, the Cornell Crop and Soil Sciences assistant professor leading the phosphorus research in the Northern New York region.

Methods:

Measuring Runoff Volume & P Concentrations

Beginning in 2004, rain simulation studies were used to determine actual P concentrations in runoff water from Northern New York farm fields with different soil types and different management systems. A simulation approach was developed and first used in 2004 to ensure that all test sites receive identical precipitation rates and to reduce dependence upon weather.

The protocol for the rain simulation was developed by the National Phosphorus Project to characterize the relationship between soil test P and surface runoff P. This protocol was chosen because it is designed to facilitate data collection on all major land resource areas in the US that receive manure and it allows New York data to be pooled with other research data for additional comparisons.

Three test farms were selected based on their soil test P levels, soil type, proximity to surface waters and farmer interest in on-farm research. Field crop educators from the Cornell Cooperative Extension offices in Jefferson, Lewis and St. Lawrence counties assisted selection.

Initial research plots were established at each site. Plots consisted of a 2x2 meter frame, bisected by a divider that split the main plot into two equal-sized subplots. The downslope end of each subplot contained a runoff collection trough where water was collected for measurement and further laboratory testing.

Simulated rainfall was applied to the plots during carefully controlled sessions over three consecutive days. Water samples and other data were collected from the plots on days 2 and 3 during simulated rain events. The volume and phosphorus content of runoff was measured.

Field Day Outreach

In fall 2004, the rainfall simulator was demonstrated at three field days: one at each test farm in Northern New York - attracting more than 250 students participating in an FFA Land Judging competition and 33 other participants in total. Farmers attending the field days indicated interest in both the agricultural and environmental aspects of this research.

Major Conclusions:

Several major conclusions from phosphorus research studies in Northern New York are:

- Northern New York soils are steadily increasing in soil test P levels
- The increase of P in Northern New York soils correlates to the intensity of dairy farming; with the most rapid increase in Clinton County where milk production per acre has increased most over the past 20 years
- The major soil series in Northern New York differ in chemical composition, i.e., extractable iron (Fe), aluminum (Al) and calcium (Ca) and these differences are likely to cause soils to react differently to P application
- On-farm rainfall simulations will provide valuable information for understanding the risk of P loss and for refining P Index measurement techniques
- Strong response to outreach efforts demonstrates increasing farmer interest in managing farms from both an environmental and an agricultural perspective.

2005 Research Plan

- Whole farm nutrient balance assessment on 6-10 Northern NY farms
- Lab studies to quantify increase in soil test P and P saturation with the addition of fertilizer and manure P
- Investigation of the role of extractable Fe, Al and Ca as predictors of saturation risk with major soil series sampling in NNY and incubation studies in the lab
- Lab studies relating soil test Fe, Al and Ca to total sorption capacity, P saturation and P release (this may lead to development of a tool that could replace soil test P for P Index measurement)
- Continuation of on-farm runoff assessments on three farms in Northern NY

NNY Starter P Project Sponsors

This Northern New York phosphorus research was funded by the Northern New York Agricultural Development Program.

Principal Investigators

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Participating Farmers

St. Lawrence County: Jon Greenwood, Canton; Lewis County: John Williams, Deer River; Jefferson County: Porterdale Farms, Inc., Watertown

Participating Educators and Research Institute Representatives:

Cornell Cooperative Extension of Jefferson County: Mike Hunter, 315-788-8450; Cornell Cooperative Extension of Lewis County: Jennifer Beckman, 315-376-5270; Cornell Cooperative Extension of St. Lawrence County: Peter Barney, 315-379-9192; Cornell Baker Research Farm at Willsboro: Mike Davis, 518-963-7492.

For more information on the NNY P project, contact: your local Cornell Cooperative Extension office; Dr. Quirine Ketterings, Nutrient Management Spear Program, Cornell University, qmk2@cornell.edu, 607-255-3061, <http://nmsp.css.cornell.edu>; or Karl Czymmek, kjc12@cornell.edu, 607-255-4890.

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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