



# Northern New York Agricultural Development Program

## FACT SHEET

# 4 in a series on phosphorus

### **Limiting Phosphorus Use for Corn Growing in NNY**

Principal Investigator: Dr. Quirine Ketterings,  
Assistant Professor of Crop & Soil Sciences,  
Cornell University; Karl Czymmek, Senior Extension  
Associate, PRO-DAIRY Program, Cornell University

#### **Phosphorus: When is less better?**

**Research into the  
minimum amount  
of phosphorus  
necessary to  
produce high corn  
yields benefits  
farmers and the  
environment.**

**... reducing or  
eliminating  
phosphorus use on  
qualified fields can  
save a farmer as  
much as \$15 per  
acre.**

**75 on-farm trials  
and 13 research  
station trials  
evaluated four  
starter P  
application rates.**

#### **Introduction:**

##### **Why Study Phosphorus Use on Corn in NNY?**

Corn is grown on 126,785 acres\* across the Northern New York region. Most of that corn receives phosphorus fertilizer at the time of planting to give young seedlings a boost and help ensure high yields. Research conducted on farms and at research stations from 2000 to 2004 has provided insight into the amount of phosphorus needed to produce high corn yields and how to meet economic needs while minimizing unwanted environmental impacts.

Reducing or eliminating phosphorus use on qualified fields can save a farmer as much as \$15 per acre, says Ron Robbins, past president of the New York State Corn Growers Association and a Northern New York Agricultural Development Program committee member. Reducing the amount of phosphorus in fields can also limit phosphorus runoff into nearby waters where it can cause algae blooms and degradation of the aquatic environment.

To evaluate the necessity of starter phosphorus (P) on soils testing high or very high for soil P, researchers with the Nutrient Management Spear Program of Cornell University initiated an on-farm Starter P Project in 2000.

#### **Methods:**

##### **Four Starter P Application Rates Applied**

From 2000 to 2004, sixteen field trials were set on Northern New York farms with fields testing high or very high (more than 8 lbs P/acre Morgan) for phosphorus. Soil samples were analyzed for each plot at planting and when corn reached 6

\* 2002 Census of Agriculture data

**The soil test classification shows:**

- **that on sites that test high in P and have no manure applications planned for the season, no yield penalty is expected when starter P levels are reduced below 25 lbs. P<sub>2</sub>O<sub>5</sub>/acre.**
- **for very high P soils, P can be eliminated from corn starter mix.**

**To learn more about P fertilizer use on farms,**

contact the Cornell Cooperative Extension office for your county:

- **Clinton-Essex** ●  
Anita Deming  
518-962-4810
- **Franklin** ●  
Carl Tillinghast  
518-483-7403
- **Jefferson** ●  
Mike Hunter  
315-788-8450
- **Lewis** ●  
Jen Beckman  
315-376-5270
- **St. Lawrence** ●  
Pete Barney  
315-379-9192

to 12 inches tall. Each of the on-farm trials included the following treatments:

- no starter applied
- no P in the starter (N+K only)
- low or recommended P in starter (10-25 lbs of P<sub>2</sub>O<sub>5</sub> per acre)
- producer's starter blend and rate.

Plots that were located on research stations included the following four treatments:

- no starter applied
- no P in the starter (200 lbs of 10-0-10)
- 20 lbs of P<sub>2</sub>O<sub>5</sub> in the starter (200 lbs of 10-10-10)
- 40 lbs of P<sub>2</sub>O<sub>5</sub> in the starter (200 lbs of 10-20-10).

Plots were harvested for corn silage. All research station treatments were repeated four times in each field. Each repetition is called a "replication." Replications at each site increase the confidence that any measured difference is the result of the treatment applied and not some other factor.

On-farm trials were unreplicated in 2000 and 2001, while most trials in 2002 were replicated; and all trials in 2003 were conducted in two replicates.

## **Field Day Observations**

Numerous field days were held at both research stations and farms. At each event audiences broadly agreed that the "no P" plots could NOT be visually identified. In other words, observers could not identify the different treatment methods side by side by observation. A key question remained: would the harvest weights tell us the same thing that our eyes observed?

## **Results**

Yield measurements from the trials showed no significant response to P application on soils testing high or very high in P in 2001 and 2002. The 2003 results suggest a response to a small amount of starter P, i.e., less than 25 lbs P<sub>2</sub>O<sub>5</sub>/acre on very high P soils. No additional yield was obtained with higher amounts.

The soil test classification impacted results on farms: for fields testing high in P, an increase in yield was seen with modest P application (less than 25 lbs P<sub>2</sub>O<sub>5</sub>/acre); corn grown in fields testing very high in P responded to starter N+K only. No significant yield differences due to P application were noted for any of the research station trials.

**Table 1. Silage yields (tons/acre 35% dry matter) for on-farm trials conducted in 2001-2003.**

# of trials	2001	2002	2003	3-Year Average	
	(27)	(16)	(22)	High P	Very High P
No starter	16.7 b	15.7 a	20.6 b	17.7 b	19.5 b
N(+K) only	19.3 a	16.2 a	20.7 b	17.9 b	20.6 ab
N(+K) + 10-25 lbs P <sub>2</sub> O <sub>5</sub> /acre	19.9 a	16.5 a	21.7 a	19.2 a	21.4 a
N(+K) + > 25 lbs P <sub>2</sub> O <sub>5</sub> /acre	19.8 a	16.0 a	21.1 ab	18.2 ab	21.2 a

*Key: a, b = average values within columns are statistically different ( $\alpha=0.05$ )*

**Conclusions:**

Researchers conclude that on sites that test high in P and have no manure applications planned for the season, no yield penalty is expected when starter P levels are reduced below 25 lbs P<sub>2</sub>O<sub>5</sub>/acre.

On sites that test very high in P or when manure is applied to high testing sites, there is a low probability of a starter P response and P could be eliminated from the starter without a yield penalty. Corn does respond to nitrogen (N) in the starter band so researchers continue to recommend 20-30 lbs of banded starter N, even where P is eliminated.

**Guidelines for Applying Phosphorus to Corn in NNY**

Table 2 shows P application recommendations for fields of varying soil test P levels and where manure is or is not used.

**Table 2. Phosphorus guidelines for corn in New York State.**

Soil Test P	Lbs P <sub>2</sub> O <sub>5</sub> /acre	
	Fields w/manure*	without manure#
Very low	20-30	60-70
Low	20-30	50-60
Medium	20-30	25-50
High	0	less than 25
Very High	0	0

Key: \* Assumes 10 tons manure/acre  
+ Put 25 lbs/acre in starter fertilizer band; balance may be included in band or broadcast.

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

**Want to know more about phosphorus use?**

The following 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
- Developing a P Index for NNY Soils
- Limiting Phosphorus Use for Corn Growing in NNY Without Sacrificing Yield
- The Impact of Starter P on Corn Silage
- P Runoff: Calibrating the P Index for NNY

## Starter P Project Sponsors

The New York State Starter Phosphorus Project was funded by a research and extension grant from the Northeast Sustainable Agriculture and Education Program. Other contributors include the Natural Resources Conservation Service, the Northern New York Agricultural Development Program Program, Agway's Lyon blend plant, Carovail, Pioneer Hi-Bred International, Inc., and Agri-Culver Seeds.

## Principal Investigators

Dr. Quirine Ketterings, Assistant Professor, Nutrient Management Spear Program, Department of Crop and Soil Sciences, Cornell University; and Karl Czymmek, Senior Extension Associate, ProDairy, Department of Animal Science, Cornell University.

**Project Coordinator:** Sheryl Swink, Program Support Specialist, Nutrient Management Spear Program, Department of Crop and Soil Sciences, Cornell University.

## Participating Farmers

Canton: Jon Greenwood, Kevin McCollum; Carthage: John Williams; Chase Mills/Waddington: Gary Tiernan; Lisbon: Ken Pemberton; Madrid: David Fisher; Paul, Tim and Mark Heiden; and Lou Ann King.

## Participating Educators and Research Institute Representatives:

Jefferson County: Mike Hunter, 315-788-8450; Lewis County: Jennifer Beckman, 315-376-5270; St. Lawrence County: Peter Barney, 315-379-9192; William H. Miner Institute: Everett Thomas, 518-846-7121; Willsboro Research Farm: Michael Davis, 518-963-7492.

**For more information on the Starter 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](http://www.nnyagdev.org). ♦



Northern New York  
Agricultural Development Program

Northern New York  
Agricultural Development  
Program  
162 Morrison Hall  
Cornell University  
Ithaca, NY 14853  
607-255-7286  
[www.nnyagdev.org](http://www.nnyagdev.org)