

## Nutrient Management

### Phosphorus and Agriculture VII: Phosphorus Starter Demonstration Project. Results of the 2000 Growing Season

Karl Czymmek, PRO-DAIRY, Janice Degni, Area Extension Specialist CCTTS, and Quirine Ketterings, Department of Crop and Soil Sciences

Participating CCE agents: *Shawn Bossard (Cayuga Co), Kevin Gaoe (Mohawk Region Area Extension Specialist), Janice Degni (CCTTS Area Extension Specialist), Dale Dewing (Delaware Co), Pete Barney (St. Lawrence Co), Dayton Maxwell (Saratoga Co), Aaron Gabriel (Washington Co), Mike Dennis (Oneida Co, formerly Sullivan Co) and Mike Hunter (Lewis Co). New participants for 2001: Nate Herendeen (NWN Area Extension Specialist), Kathy Evans (Madison Co), Beth Spaugh (Clinton Co).*

Participating producers: *Steve Nemec (Moravia), Jerry Blumer (Weedsport), Joe and Kirk Schwasnick (Little Falls), Steve and Gary Natali (East Springfield), Maurice Stoughton (Newark Valley), David Post (Stamford), Gary Gaige (Mecklenburg), Mark Jahnke (Cooperstown).*

Other participants: *Ev Thomas (Miner Institute), Mark Ochs (consultant), Elaine Dalrymple (Schuyler Co SWCD).*

#### Agronomic P Recommendations

Agronomic soil tests are relative indices of plant available nutrients. Yield benefits from an applied nutrient are greatest for soils with a low agronomic soil test for that particular nutrient. Minimal to no yield response is expected for soils testing high to very high.

The Cornell Nutrient Analyses Laboratory rates soil test P (STP) levels of 9-39 and  $\geq 40$  lbs P/acre (Morgan extractable P) as "High" and "Very High", respectively. Soil test levels  $< 1$  lbs P/acre are considered "Very low", 1-3 is classified as "Low", and 4-8 lbs P/

acre constitutes "Medium". Once a high STP reading is reached, minimal P fertilizer is required to support optimum yields. For most field crops, Cornell recommends limited fertilizer additions to fields with STP levels of 40 or higher for two reasons: 1) P addition to these soils is not likely to result in yield gains (and hence an economically bad investment); and 2) over-application may lead to P losses to surface and ground waters and thus contribute to environmental degradation. P recommendations for soils with STP's  $< 40$  are presented in Figure 1. The solid line is the "average" recommended fertilizer P application. The dashed lines imply that recommendations are ranges rather than absolute values. Thus optimum economic recommendations fall with the dashed lines for each soil test P level. For P requirements  $< 25$  lbs  $P_2O_5$ /acre, the recommendation is to meet the requirement by banding starter fertilizer. For higher application rates and where manure is available, Cornell University recommends applying 25 lbs  $P_2O_5$ /acre in the fertilizer band and supplying the rest with manure.

#### Starter P Project in 2000

It is not uncommon for NY farms to apply more starter P to corn fields than recommended by Cornell University. To evaluate and demonstrate the value of P starter application on soils testing high for soil P, we initiated a state-wide, on-farm starter P project. Specifically targeted were soils with Morgan P levels in the high range between 20 and 30 lbs P/acre.

Demonstration plots were established at twelve cooperator farms across NY. Harvest data were obtained from ten. Out of the ten sites, six met the criterion of 20-30 lbs P/acre soil test P. Sites differed in soil type, hybrid and manure history (Table 1). At each location, two treatments were established: 1) N and K but no P addition in the fertilizer band ("without P"); and 2) N, P and K in the starter ("with P"). For eight of the ten sites, pre-mixed 10-10-10 and 10-0-10 fertilizers supplied by Agway were used at rates varying from 100 to 250 lbs/acre. At two sites, locally obtained fertilizer

was used. No additional inorganic P was applied beyond the starter at any of the sites. At several locations, additional N was added preplant or as a side-dress. Of the ten sites, four were harvested for grain corn and six for corn silage. Some fields had a manure history and/or received manure as recent as spring 2000 or fall 1999. Most plots were planted to corn between May 1 and 15. Silage samples from five sites were analyzed for total P.

Because at many of the sites treatments could not be replicated, statistical analyses were restricted to a mean comparison (comparison of the average yields with and without P in the fertilizer band).

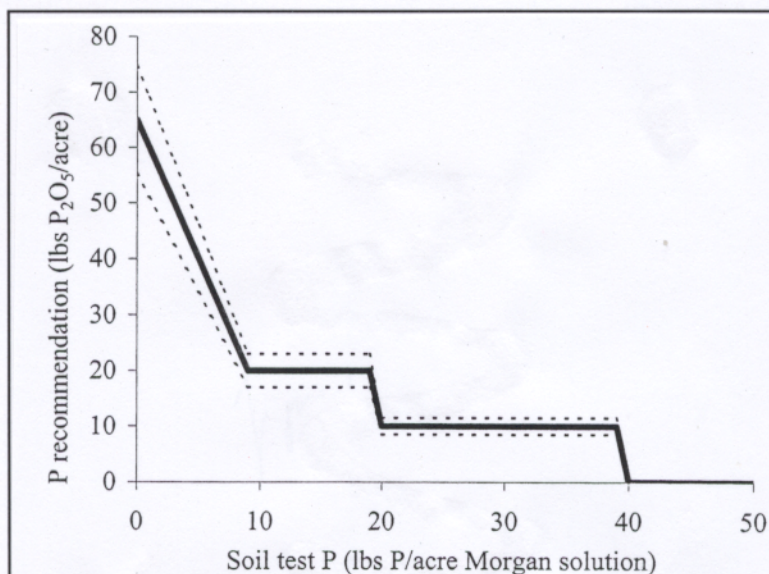


Figure 1: Cornell recommendations for P application. The solid line is the recommendation derived from fertilizer-response curves. Recommendations are optimal when between the dashed lines.



Table 1: Characteristics of the sites at which the starter demonstration trials were established in 2000.

Producer	Cooperator	Location	Soil Type	Soil Test P*	Corn Hybrid	Manure History
Gary Gaige	Mark Ochs, Janice Degni, Elaine Dalrymple	Mecklenburg, Schuyler Co	Conesus, Silt Loam	40	Not known.	Manure applied in the past.
Steve Nemec	Shawn Bossard	New Hope, Cayuga Co	Conesus, Silt Loam	21	38K06	No manure applied.
Jerry Blumer	Shawn Bossard	Weedsport, Cayuga Co	Ontario, Loam	118	BS440	Manure history but no application in the 2000 growing season.
Miner Institute	Ev Thomas	Chazy, Essex Co	Mohawk, Silt Loam	28	Novartis NK 446	80-50-100 applied as slurry in the fall of 1999.
Maurice Stoughton	Janice Degni	Newark Valley, Tioga Co	Howard, Gravel	14	38PO5	No manure applied.
David Post	Dale Dewing	Stamford, Delaware Co	Lewbeach, Silt Loam	19	NK4187	Some manure applied. Amount not available.
Steve and Gary Natali	Kevin Ganoe	East Springfield, Otsego Co	Wassaic, Silt Loam	22	Not known.	Not known.
Joe and Kirk Schwasnick	Kevin Ganoe	Little Falls, Herkimer Co	Mohawk, Silt Loam	21	Not known.	Not known.
Mark Jahnke	Kevin Ganoe	Cherry Valley, Otsego Co	Chenango, Gr. Silt Loam	24	Not known.	Some manure applied in 2000.
Mark Jahnke	Kevin Ganoe	Cooperstown, Otsego Co	Chenango, Gr. Silt Loam	24	Not known.	No manure applied in 2000.

\* = soil test P in lbs P/acre Morgan solution.

Thus, we can observe individual differences at a specific location but not draw conclusions with regards to the cause of these differences.

### Results and Discussion

Yields for each of the ten sites are listed per fertilizer treatment in Table 2. The average yield in the "without P" starter treatment (assuming 100 bushels of grain equal 17 tons of silage) was 19 tons/acre. The same average was found for the plots that did receive starter P.

Although we cannot draw conclusions for individual sites, several observations

are noteworthy. The site at New Hope in Cayuga Co exhibited a 10 bu/acre yield response to starter P. This difference in yield was large enough to cover P fertilizer costs and leave the producer with a marginal additional profit. This is the only site where an economic yield increase was obtained. Seeding depth may have had an impact on the need for starter P as the planting depth was about 3 inches. It is interesting to see that a neighboring plot that received an application of 36 lbs  $P_2O_5$ /acre yielded only 2 bu/acre more than the corn that had received a 10 lbs  $P_2O_5$ /acre application. Thus, it seems that 10 lbs of  $P_2O_5$  in the starter may have been enough to achieve maximum eco-

nomie yield, even when the corn was planted excessively deep.

On the contrary, yields at the Stamford site in Delaware Co were almost 3 tons lower when P was added to the starter. This yield boost in the "without P" plot was surprising at first. However, plant populations differed greatly between the plots: 25,200 plants/acre (with P) versus 28,700 plants/acre (without P) possibly as a result of differences in planter seed units.

The site in Newark Valley (Tioga Co) also presented an interesting situation. No yield increase in response to P was recorded despite the fact that the STP was

## Nutrient Management

only 14 lbs P/acre and the field had not received manure in >20 years!

Silage samples from five sites were tested for nutrients. Average P concentrations in these silage samples (on a dry matter basis) were 0.24% P ("without P") and 0.25% P ("with P"). The "without P" plots removed 49-74 lbs  $P_2O_5$  (an average of 3.9 lbs  $P_2O_5$ /ton of corn silage) while the "with P" plots removed 49-82 lbs  $P_2O_5$  (average of 4 lbs  $P_2O_5$ /ton).

### Conclusions

There was variation in the yield data among the sites most likely as a result of differences in cultural practices, growing conditions, and manure histories. Averaged among all fields, no yield increase was obtained by adding starter P to soils with initial STP's of 20 lbs P/acre or higher. These results support the current recommendation of a banded P starter of not more than 10 lbs  $P_2O_5$ /acre for soils with a STP of 20 to 39 lbs P/acre (Morgan solution).

### Starter P Project in 2001

The starter P project will be continued

Table 2: Fertilizer treatments and yields (grain yields at 15% moisture, silage yields at 65% moisture) of the P starter demonstration trials in 2000.

Producer	Planting Date	No P	With P
Gary Gaige et al.	May 10 2000	188 lbs 21-0-0 18 tons	188 lbs 15-13-10 19 tons
Steve Nemec and Shawn Bossard	May 8 2000	100 lbs 10-0-10 124 bu	100 lbs 10-10-10 134 bu
Jerry Blumer and Shawn Bossard	May 31 2000	250 lbs 10-0-10 15 tons	250 lbs 10-10-10 14 tons
Ev Thomas, Miner Institute	May 17 2000	250 lbs 10-0-10 18 tons	250 lbs 10-10-10 18 tons
Maurince Stoughton and Janice Degni	May 3 2000	200 lbs 10-0-10 167 bu	200 lbs 10-10-10 166 bu
David Post and Dale Dewing	May 4 2000	225 lbs 21-0-0 16 tons	200 lbs 20-10-10 13 tons
Steve and Gary Natali and Kevin Ganoe		250 lbs 10-0-10 12 tons	250 lbs 10-10-10 12 tons
Joe and Kirk Schwasnick and Kevin Ganoe		250 lbs 10-0-10 18 tons	250 lbs 10-10-10 20 tons
Mark Jahnke and Kevin Ganoe	May 1 2000	250 lbs 10-0-10 167 bu	250 lbs 10-10-10 171 bu
Mark Jahnke and Kevin Ganoe	May 11 2000	250 lbs 10-0-10 85 bu	250 lbs 10-10-10 83 bu

this summer. Demonstration efforts will focus on monitoring recommendations for STP levels between 9-19 and  $\geq 40$  lbs P/acre, and identifying past management and environmental factors that may affect when and how much starter P is needed. The treatments for these demonstration trials will be standardized and extended to include: 1) no starter; 2) 200 lbs of 10-0-10; 3) 200 lbs of 10-10-10; and 4) the producer's usual starter blend and application rate.

In 2000 several producer field days were held to view the plots and discuss oppor-

tunities for P management. Those field days will be continued in 2001. Added will be a survey among participants in the project and producers that visit the field days to assess impact of the project.

Demonstration plots will be supplemented this year with replicated trials on experimental stations at Batavia's New York Crop Research Facility, Cornell University's Willsboro Farm and the Musgrave Research Farm in Aurora. These replicated trials will focus on STP levels between 9 and 19 lbs P/acre and involve three treatments: 200 lbs per acre of 10-0-10, 10-10-10, or 10-20-10 in four replicates. Field

days are planned at all three locations.

### Acknowledgments

This project was funded in 2000 and will continue to be funded in 2001 by grants from NRCS. The starter fertilizers were donated by Agway's Lyons blend plant. We owe many thanks to all the cooperators that assisted with this project, especially Garret Waldron of Agway's Lyons blend plant.