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Phosphorus Starter Project – Results of the 2001 Growing Season

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Participating producers:
John Hourigan (Jordan), Steve Nemec (New Hope), Rick Holdridge (Bloomville), Wayne Wood (Northumberland), Mike McMahon (Homer), Maurice Stoughton (Newark Valley), Gary Gaige (Mecklenburg), Dudley French (Chemung), Greg Coller (Dekalb), Clark Decker (Stockholm), Dave Fisher (Madrid), Lou Ann King (Madrid), Jon Greenwood (Canton), Les Hargrave (Depeyster), Paul and Tim Heiden (Madrid), Ken Pemberton (Lisbon), Charlie Roberts (Fort Jackson), Kevin McCollum (Canton), Glenn and Larry Taylor (Cassville), Randy Brouillette (Waterville), Rob Williams (Waterville), David and Andrew Kross (Earlville), Mark Jahnke (Cherry Valley), Steve Natalie (East Springfield), and Joe and Kirk Schwasnick (Little Falls).

Participating CCE agents:
Pete Barney (St. Lawrence Co.), Shawn Bossard (Cayuga Co.), Janice Degni (CCTTS Area Extension Specialist), Mike Dennis (Oneida Co.), Dale Dewing (Delaware Co.), Kevin Ganoe (Mohawk Region Area Extension Specialist), and Dayton Maxwell (Saratoga Co.).

Other participants:
Elaine Dalrymple (Schuyler Co. SWCD) and Mark Ochs (Consultant).

Sponsors:
NRCS (project funding), Agway's Lyon blend plant (fertilizer) and Pioneer International (seed).

Background

The NY starter phosphorus (P) project was initiated in 2000 to evaluate and demonstrate the value of P starter applications for corn on soils testing high in P. That year, ten on-farm demonstration trials were established on soils ranging in soil test P (STP) levels from 14-118 lbs P/acre (Cornell soil test). Trials were conducted in seven different counties: Cayuga (2), Delaware (1), Clinton (1), Herkimer (1), Otsego (3), Schuyler (1), and Tioga (1). Cornell recommendations for P_2O_5 use on each of these sites amounted to 20 lbs/acre or less. At each location two P application rates were tested: 200 lbs 10-0-10 (without P) and 200 lbs 10-10-10 (with P). The results of these trials showed that on average no yield increase was obtained by adding starter P in a 2" by 2" band to soil testing high to very high in P, even in a cool spring (see What's Cropping Up? 2001, Volume 11, no 3). There was some variation in the data but the number of trials was not large enough to assess whether planting date, recent manure applications and or soil type (slowly warming clay versus quickly warming sandy soils) could have made any difference.

In 2001, we expanded the number of treatments per farm and the number of farms and added three replicated trials at Cornell experimental stations to address four main questions:

1) How big a difference in yield do we need to have to account for field variability and make sure that what we measure is a real difference (LSD or Least Significant Difference)?
2) Do we need the N and K in the starter?
3) Does the effect of starter P application vary depending on planting date, recent (last year) manure application or soil textural class?
4) Can we reproduce small-scale experimental plot results at the farm field-scale?

Replicated Research Trials (experimental stations)

Replicated trials were established at Batavia's New York Crop Research Facility (STP=21 lbs P/acre), the Musgrave Research Farm in Aurora (STP=10 lbs P/acre), and Cornell University's Willsboro Research Farm in Essex Co. (STP=14 lbs P/acre). The Cornell guide recommended no more than 20 lbs P_2O_5/acre at each of the sites. There were in each location four replicates of three treatments: 200 lbs/acre of 10-0-10 (no P_2O_5), 200 lbs of 10-10-10 (20 lbs P_2O_5), and 200 lbs of 10-20-10 (40 lbs P_2O_5). These fertilizers are blends of urea, diammonium phosphate (DAP), potash and a filler, mainly limestone. A 99-day corn (Pioneer 37M34) was planted at all sites.

Field days were held on August 15th in Aurora, August 2nd in Willsboro, and on August 23rd in Batavia. To test if it was possible to visually differentiate treatments, participants were asked to evaluate the plots. The results of this evaluation showed that 60 participants (75%) could not correctly identify the treatments applied to 8 or more out of 12 plots. Five of these 60 were mistaken in all 12 plots. Only one participant out of 80 was able to correctly identify the treatments in all 12 plots. Many participants had expected visual differences but survey results showed that it was impossible to identify treatments by eye.

Plant height measurements from planting until tasseling confirmed visual observations as did yield. The yield results are shown in Table 1. The low yields at Batavia reflect drought conditions during the growing season. During 2001, April through August precipitation was 50 percent of normal at Batavia, 77 percent of normal at Willsboro and 88 percent of normal at Aurora. The near record amounts of March precipitation in 2001 recorded at Aurora (226 % of normal) and Willsboro (325 % of normal) may further account for the higher yields at these two locations compared to Batavia where March precipitation was 70 percent of normal.

At all three locations, yields were not significantly affected by adding P. An increasing trend was observed in Willsboro. However, damage caused by deer, birds, raccoons and a bear resulted in a large LSD. The results showed that for our sites an increase of about 1 ton/acre was needed to determine if starter P response was statistically significant and not just a result of random variability within the field.

Grain yields varied from 54 bu/acre in Batavia and 91 bu/acre in Willsboro to 124 bu/acre in Aurora. The plot results showed that on average, 5.9 bu grain (15% moisture) equaled 1 ton of silage (35% dry matter). Maturity, as expressed by the moisture content at harvest, was also not affected by the amount of P in the starter. All trials were harvested at 30-33% moisture content for silage and 22-25% moisture for grain yields. An investigation of treatment effects on forage quality is underway.

Table 1: Effects of P starter rate (0, 20 or 40 lbs P_2O_5/acre) on corn silage yields. Results from replicated trials at Cornell experimental stations in Aurora, Batavia and Willsboro, NY.

	Corn Silage Yield (tons/acre 35% dry matter)				
	Soil test P (lbs P/acre)	200 lbs 10-0-10	200 lbs 10-10-10	200 lbs 10-20-10	LSD* (α=0.05)
Aurora	10	16.6	16.9	17.1	1.0
Batavia	21	12.7	12.5	12.2	1.0
Willsboro	14	15.9	16.3	17.3	5.4
Average	15	15.1	15.3	15.5	1.6

* Least Significant Difference.

On-farm Demonstration Trials

In 2001, the starter P project included 27 separate trials among 24 cooperators in 12 NY counties (Cayuga, Chemung, Chenango, Cortland, Delaware, Herkimer, Oneida, Otsego, Saratoga, Schuyler, St. Lawrence, Tioga Co.). The trials were conducted on soils ranging in soil test P from 4 to 155 lbs P/acre. Soils in 4 trials fell in the "medium" range (4-8 lbs P/acre); 14 in the "high" range (9-39 lbs P/acre); and soils in 9 trials were in the "very high" range (≥40 lbs P/acre). Of the 27 trials, 20 received applications of solid or liquid manure ranging from eight to 40 tons/acre and from 3,000 to 10,000 gallons/acre in 2001. At five locations, sidedress N was applied. Soil types were widely variable in pH, texture, parent material, position on the landscape, etc.

The number of treatments varied among the trials. Most typically they included comparisons of yields obtained without starter fertilizer (16 trials), with starter fertilizer containing no P (25 trials), with starter containing 25 lbs of P_2O_5/acre or less (24 trials), and with starter P application of >25 lbs P_2O_5/acre (14 trials). The latter category consisted of the producer's fertilizer blends and rates. The amounts of P added in the producer blend and rate varied from 10 to 91 lbs P_2O_5/acre. Producer application of P exceeded recommended levels by 10 lbs or more at 12 of the 14 farms.

Drought severely affected some parts of NY in 2001. There were large yield differences among counties and farms that, at least partly, resulted from the uneven distribution of rainfall during the growing season. The drought did reduce yields but did not change the effects of P starter application. Nine trials were harvested for grain corn while 21 were harvest for silage. For trials where no silage was harvested, grain yields were converted to a silage equivalent by

assuming that 1 ton of silage equals 5.9 bu/acre of grain. Treatment means for silage yield are given in Table 2.

Table 2. Corn silage yields as affected by use of starter fertilizer and amount of P in the starter band. These results are averages of 27 on-farm demonstration trials.

Treatment	Corn silage yield (tons/acre 35% dry matter)	Significant? (α=0.05)
No starter	16.7	B
No P in starter	19.3	A
10-25 lbs P_2O_5 in starter	19.9	A
>25 lbs P_2O_5 in starter	19.8	A

The three A's for the different P treatments in the "significant?" column mean that yields were unaffected by P application. These results are consistent with the results of the replicated trials at the research farms. Recent manure history, actual soil test P level, textural class and planting date did not affect the results in Table 2.

The "B" for significance in Table 2 implies that the yields obtained without starter fertilizer application were significantly lower than those obtained where N and K were added. Thus, we do see a statistically significant response to starter N and K application. Because N and K were always added together, we cannot separate their individual contributions in this experiment, though the literature indicates that for fields where K levels are adequate, the response is very likely due to N alone.

When considered alone, the economic advantage per acre for reducing P_2O_5 is not large. The cost of 200 lbs of 10-0-10 is $13.00 versus $13.50 for 200 lbs of 10-10-10 and $16.00 for 200 lbs of 10-20-10. However, reducing starter P levels to the recommended range protects crop yield and reduces the unnecessary and potentially costly accumulation of P on dairy and livestock farms.

Conclusions

On average, corn grain and silage yields on the 27 trials showed no response to additions of P in starter fertilizer applied to soils falling mostly in the high and very high STP categories. We recommend the application of N in the starter band. No yield penalty is expected when P starter levels are dropped to 25 lbs/acre or less for soils testing high or very high in P, especially when manure is applied.

The NY Starter P Project in 2002

The starter P project will be continued in 2002. Replicated trials will be established at the Musgrave Farm in Aurora, Willsboro Farm, Mt Pleasant Farm, Morrisville College, Empire Farm Days, and Ron Stutzman's research farm. We are looking for farmer participation for the on-farm trials. Participation includes the establishment of at least a 2-row and 100 feet long strip of each of the following 4 treatments: 1) no starter; 2) 200 lbs of 10-0-10 (i.e. no P in the starter); 3) 200 lbs 10-10-10; and 4) the producers' own blend and application rate. We will provide the 10-0-10 and 10-10-10. For more information contact Quirine Ketterings (qmk2@cornell.edu or 607 255 3061), Karl Czymmek (kjc12@cornell.edu or 607 255 4890) or Tim Byron (tmb29@cornell.edu or 607 255 9875).

Figure 1: Field days were held on August 15th in Aurora, August 2nd in Willsboro, and on August 23rd in Batavia. Oneida County field days that included a tour of the on-farm P starter demonstration trials were held on September 6 and 7, 2001.