Northern New York
Agricultural Development Program

FACT SHEET

#5 in a series on Phosphorus

The Impact of Starter P on Corn Silage Quality

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Achieving Yield and Quality with Less P

Are band-applications of fertilizer P needed to achieve optimum yield and quality of corn for silage on fields that test high or very high in P?

Researchers working with Northern New York farms have answers for this question.

Introduction:
Optimizing Silage Yield and Quality

Due to increasing pressure on dairy producers to reduce the amount of phosphorus (P) applied to soils in the form of fertilizer, Cornell researchers conducted on-farm and research station trials from 2002 through 2004 to determine if band-applications of fertilizer P are needed for optimum yield and quality of corn for silage on fields that test high or very high in P.

Excess phosphorus in field runoff into nearby surface waters can cause eutrophication, an algae bloom that disturbs the aquatic habitat. If farmers can reduce the amount of P applied to fields without losing crop yield or quality, the risk of this environment disturbance decreases.

Methods

From 2000 to 2004, sixteen trials set on Northern New York farms were analyzed. Trials were set on fields testing high or very high (more than 8 lbs P/acre Morgan extractable P/acre) for P. Plots were harvested for corn silage.

Soil samples were analyzed for each plot at planting and at PSNT time when corn reached 6 to 12 inches tall. Application for the on-farm trials included 1) no starter applied, 2) no P in the starter (N+K only), 3) low or recommended P in starter (10-25 lbs of P_2O_5 per acre) and 4) producer's starter blend and rate.

The four methods evaluated for research station trials were:

- no starter applied
- no P in the starter (200 lbs of 10-0-10)
- 20 lbs of P_2O_5 in the starter (200 lbs of 10-10-10)
- 40 lbs of P_2O_5 in the starter (200 lbs of 10-20-10).

See Fact Sheet #4: Limiting Phosphorus Use for Corn Growing in NNY for more details on when less P is better for growing corn

All research station trials were done in four replicates. Most on-farm trials were conducted in two replicates. Replications, or repeated measurements in the same field, are important to improve confidence in test results.

Results:

Impact on Silage Yield

Research results indicate that applying starter P on sites that test very high and when manure is applied to sites that test high is unlikely to result in a yield response, so starter P can be safely eliminated on these sites. On sites that test high and have no manure applications P starter levels can be reduced to less than 25 lbs P_2O_5/acre without affecting yield. See Table 1 for silage yields (tons/acre 35% dry matter) for on-farm trials conducted in 2001-2003.

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

# of trials	2001 (27)	2002 (16)	2003 (22)	3-Year Average High P	3-Year Average 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_2O_5/acre	19.9 a	16.5 a	21.7 a	19.2 a	21.4 a
N(+K) + > 25 lbs P_2O_5/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 (α=0.05)

Impact on Silage Quality

Table 2 shows the results of the quality analyses for the study. Bottom line is that differences were not significant and were well within laboratory analytical uncertainty, indicating that leaving P out of the starter fertilizer in high or very high P soils did not impact silage quality.

Conclusions

With increased attention directed toward P non-point source pollution, it makes little sense to use more starter P than is necessary to support optimum yields, especially on fields where significant amounts of manure nutrients are regularly applied. Corn responds to nitrogen (N) in the starter band more often than P and we continue to recommend 20-30 lbs of banded starter N, even where P is eliminated.

We suggest corn growers test fields for soil fertility status at least once in three years, apply manure to low and medium P fields, and adjust starter P application rates accordingly (Table 3).

Want to know more about phosphorus use?

The following Fact Sheets are available from the Northern New York Agricultural Development Program and 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

Table 2. Effect of starter P addition on corn silage quality in New York State.

	Research Station Trials (9)				On-Farm Trials (62)			
Quality parameter	No Starter	200 lbs 10-0-10*	200 lbs 10-10-10*	200 lbs 10-20-10*	No Starter	N(+K) only	N(+K)+ 10-25 lbs P_2O_5/acre	N(+K)+ > 25 lbs P_2O_5/acre
	---------- % of dry matter ----------							
Moisture content	64	65	64	64	60	60	60	59
NDF+	43.5	42.3	43.4	42.8	42.1	42.6	42.7	41.6
	---------- % of NDF ----------							
Digestibility of NDF	62.2	62.2	62.2	62.6	62.3	60.8	61.7	61.6
	---------- lbs ----------							
Milk/ton of silage	3692	3699	3700	3703	3734	3652	3683	3712
	---------- % of dry matter ----------							
Crude protein	7.4	7.3	7.3	7.5	7.6	7.5	7.7	7.6
P	0.21	0.21	0.20	0.20	0.23	0.23	0.23	0.23
K	0.83	0.88	0.85	0.84	1.09	1.09	1.10	1.11
Ca	0.21	0.20	0.19	0.20	0.17	0.18	0.18	0.18
Mg	0.19	0.17	0.17	0.18	0.14	0.14	0.14	0.1
	---------- % of dry matter ----------							
Zn	16.4	16.6	16.0	15.6	17.6	17.9	17.3	16.5
Cu	4.3	4.3	4.2	4.3	3.8	3.9	3.7	4.1
Mn	17.6	16.9	16.2	16.8	13.3	13.7	13.6	13.7

*Key: * per acre; + NDF: Neutral Detergent Fiber (48hr)*

Table 3. Phosphorus fertilizer guidelines for corn in New York State.

	lbs P_2O_5/acre	
Soil Test P	**With manure**	**No manure**
Very Low	20-30	60-70*
Low	20-30	50-60*
Medium	20-30	25-50*
High	0	0-25
Very High	0	0

Key: ** Put ~25 lbs P_2O_5/acre in the starter fertilizer band; balance may be included in the band or broadcast.*

New York Starter P Project Sponsors

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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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