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Nitrogen Savings for First Year Corn

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Nitrogen is essential for the proper growth and development of all field crops including corn. Without sufficient N, both corn yields and silage quality can be impacted. Too much N can be a waste of money and leads to environmental losses. Producers and consultants asked if additional N was needed for corn following legume and/or grass sods in the rotation (first year corn) and if the answer to this question depended on sod composition and/or timing of sod turnover. With funding from the Northern New York Agricultural Development Program (NNYADP) and the New York Farm Viability Institute (NYFVI), we set out to answer this question.

First Year Corn Project

Data were collected from a total of 16 sites (3 research station trials and 13 on-farm trials). The trial locations were chosen based on the following criteria:

- Corn grown for silage in the 1st year following alfalfa, alfalfa/grass or grass sod;
- Field received no manure following the last harvest of the previous crop;
- Received no more than 30 lbs N/acre in the starter fertilizer.

Four sites were turned over in the fall while 12 were spring-killed; sod compositions varied from pure grass stands to legume/grass mixtures with up to 70% legume in the stand.

Producers were asked to plant the corn as they would normally do (no more than 30 lbs starter N) and when corn was 6 to 12 inches tall, 16 plots (4 treatments, 4 replications) were outlined in each field. Sidedress treatments of 0, 50, 100 and 150 lbs N/acre were used at the on-farm trials. In the 3 research station trials a no starter/no sidedress treatment was included as well. So, the on-farm trials allowed us to determine if the corn responded to the sidedress N beyond starter N application while the research station trials could be used to answer the question if starter N was needed in the first place.

Soil samples (8 and 12 inch depths) were taken at sidedress time and again at harvest. A standard soil fertility analysis was performed on the 8 inch samples while the 12 inch samples were analyzed for nitrates only (PSNT and end-of-season soil nitrate test).

Corn was harvested for silage at a target dry matter (DM) of 35%. Forage samples were analyzed for crude protein (CP), soluble protein (SP), neutral detergent fiber (NDF), digestible neutral detergent fiber (dNDF), lignin and starch. "Milk 2006" was used to estimate the effects of starter and sidedress N on milk production potential.

What Did We Find?

Yield

The research station trials showed that although sods can supply a large amount of N, first year corn will still benefit from a small application (30 lbs N/acre) of banded starter N fertilizer (Table 1). These results were similar to what we had seen with on-farm starter phosphorus trials in 2001-2003. Yet, additional fertilizer beyond the small starter application did not increase the yields of 1st year corn regardless of tillage, the timing of sod kill, or the amount of grass or legume in the sod (Table 2).

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Research Station Trials

Table 1: Addition of a small N starter (30 lbs N/acre) was sufficient for optimum corn silage yield.

Starter N	Side-dress N	Corn silage yield (35% DM)*	Moisture Content*
lbs/acre		tons/acre	%
0	0	19.6 b	58.8 a
30	0	21.1 ab	58.6 a
30	50	21.5 a	58.2 a
30	100	22.6 a	58.8 a
30	150	22.1 a	58.6 a

*Average values with different letters (a,b,c) are statistically different (α = 0.05). Results are based on 3 New York trials conducted in 2005 and 2006.

On Farm + Research Station Trials

Table 2: Additional N (beyond starter N) was not needed for 1st year corn silage production.

Side-dress N	Corn silage yield* (35% DM)	Moisture Content*
lbs/acre	tons/acre	%
0	21.7 a	62.1 a
50	22.2 a	61.9 a
100	22.4 a	62.3 a
150	22.4 a	62.1 a

*There were no significant (α=0.05) differences as indicated by identical letters (a) for each treatment. Results are based on 16 New York trials conducted in 2005, 2006.

Forage Quality

A starter N application was sufficient to deliver optimum forage quality (Table 3); NDF, dNDF, lignin and starch content of corn silage were not affected by leaving out sidedress N. Applying sidedress N and increasing the N rate did cause a slight increase in the CP and SP content of the silage but this did not impact the overall expected milk production per ton of silage(milk per ton of silage).

Table 3: Additional N beyond a small starter N application increased crude and soluble protein (CP and SP) of 1st year corn but did not impact other quality parameters and overall silage quality*.

N sidedress rate	Milk per ton	Crude protein	Soluble protein	NDF	NDF 48	Lignin	Starch
lbs N/acre	lbs/ton	---------- % of dry matter (DM) ----------					
0	3193 a	7.1 c	1.3 b	45.4 a	62.6 a	3.2 a	30.8 a
50	3234 a	7.5 b	1.4 a	44.4 a	63.1 a	3.2 a	31.3 a
100	3214 a	7.7 a	1.4 a	44.5 a	62.5 a	3.2 a	30.9 a
150	3211 a	7.8 a	1.4 a	44.6 a	62.6 a	3.2 a	30.8 a

*Average values with different letters (a,b,c) are statistically different (α = 0.05). Other quality parameters such as milk per ton silage were not impacted by N treatment. Results are based on 16 New York trials conducted in 2005 and 2006.

Soil Testing for N

Currently the PSNT is the most commonly used test for assessing whether corn fields need N fertilizer beyond a small starter N application. However, this test is considerably less accurate on first year corn fields than on fields that are in their second year or beyond. This was evident in results of the 1st year corn trials (Table 4).

Table 4: Pre-sidedress nitrate test (PSNT) values for the 16 first year corn sites. None of these sites were responsive to sidedress N application.

Site ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PSNT (ppm)	41	21	12	25	25	21	30	27	23	14	44	4	32	11	6	6

Current NYS guidelines suggest that you sidedress if the PSNT value is below 21 ppm while a PSNT of 25 or higher suggests that no additional N is needed. If the PSNT is 21 to 24, there is a 10% chance of a yield response and one could consider sidedressing 25-50 lbs N/acre if you do expect a response. In this data set 6 sites were below 21 ppm, while an additional 3 sites had PSNT values between 21 and 24 ppm. This could have resulted in unnecessary N applications for 6-9 of the sites. Other work by colleagues in Connecticut indicates that a critical PSNT value of 14 ppm should be used for first year corn. Using this cutoff, 6 of the 16 sites would still have called for sidedress N without resulting in a yield

response. Since the PSNT has not performed well on first year corn and first year corn does not show a yield or forage quality benefit to sidedressing of N, taking a PSNT on first year corn sites is not recommended; it is a waste of time and money.

What Do We Conclude?

Independent of field history adding N beyond a small starter application to 1st year corn will not result in a yield or silage quality increase and can lead to substantial environmental losses. A simple starter N application of no more than 30 lbs N/acre is sufficient for these fields.

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Nutrient Management Spear Program
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