Nitrogen Needs of 1st Year Corn

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. Finding the right balance is tricky. The nitrogen needs of a corn crop can be met with N fertilizer, with manure, and through decomposition of organic nitrogen sources such as soil organic matter or plant roots and top growth. The production of N fertilizer is an energy intensive process (requiring a large amount of fossil fuels) and this has lead to rapidly increasing and unstable N fertilizer prices in recent years. Thus, to minimize both the potential environmental and economic impacts of excess N fertilizer use, it is important to locate the fields that need extra N fertilizer and those that do not (Figure 1). In this fact sheet, we discuss N needs for corn following hay fields in the rotation (1st year corn fields).

Figure 1: For optimum corn silage production, adequate N is needed. Insufficient N results in low and/or poor quality yields. However, not all nitrogen needs to come from fertilizer.

N Credits from Sod

First year corn fields are produced following sods in the rotation. When a sod is killed, microbes begin to decompose the residue that leads to the release of N and other nutrients back into the soil. Corn that is grown in rotation with an alfalfa, mixed alfalfa/grass, or grass sod can benefit from the N supplied by sod, especially in the first year. More alfalfa in the stand at the time of turnover means more overall N is released to the next crop. Yet, pure grass stands can also release large amounts of N (Table 1).

Table 1: Expected nitrogen availability for corn from sods in years following sod turnover.

% legume	Total N pool	Year 1	Year 2	Year 3
	lbs N/acre			
0	150	83	18	8
1-25	200	110	24	10
26-50	250	138	30	13
50 or more	300	165	36	15

Soil microbes are primarily responsible for the decomposition of sod in the soil. These microbes thrive in warm moist soils so to reduce potential winter losses of N from a killed sod, the sod should be turned over only when soil temperatures have dropped below 45°F in the fall.

Yield

The research station trials showed that although sods can supply a large amount of N, 1st year corn will still benefit from a small application (30 lbs N/acre) of banded starter N fertilizer (Table 2).

Table 2: Addition of a small N starter (30 lbs N/acre) was sufficient for optimum corn silage yield.

Starter N	Side-dress N	Corn silage yields (35% DM)*		Moisture content*	
lbs N/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.

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 3).

Table 3: Additional N beyond a small starter N application was not needed for 1st year corn silage production.

Side-dress N	Corn silage yields (35% DM)*		Moisture Content*	
lbs N/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 and 2006.

Forage Quality

When corn is grown for silage the emphasis is not only on yield but also on forage quality. Common forage quality indicators are crude protein (CP), soluble protein (SP), neutral detergent fiber (NDF), digestible neutral detergent fiber (dNDF), lignin and starch. To assess overall forage quality, researchers in Wisconsin developed "milk2006" a software program that integrates quality indicators and predicts estimated milk production per ton of silage. The New York State study with 16 corn silage trials showed that a starter N application was sufficient to deliver optimum forage quality; NDF, dNDF, lignin and starch content of corn silage were not affected by leaving out sidedress N. Applying side-dress 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 forage quality measured as milk per ton (Table 4). So, no additional N beyond a small starter is needed for optimum yield and quality, independent of sod composition or turnover time (late fall versus spring).

Table 4: 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*.

Side-dress N	Milk per ton	CP	SP	NDF	dNDF	Lignin	Starch
lbs N/acre	lbs/ ton	----------% of dry matter----------					
0	3193	7.1 c	1.3 b	45.4	62.6	3.2	30.8
50	3234	7.5 b	1.4 a	44.4	63.1	3.2	31.3
100	3214	7.7 a	1.4 a	44.5	62.5	3.2	30.9
150	3211	7.8 a	1.4 a	44.6	62.6	3.2	30.8

*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 pre-sidedress nitrate test (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 1st year corn fields than on fields that are in their 2nd year or beyond. In addition, since 1st year corn does not show a yield or forage quality benefit to side-dressing of N, it is a waste of time and money to take a PSNT on 1st year corn sites.

Summary Remarks

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 starter N application of no more than 30 lbs N/acre is sufficient (Figure 2).

Figure 2: A banded starter N application of about 30 lbs N/acre is sufficient for 1st year corn.

Additional Resources:

- Cornell Guide for Integrated Field Crop Management: http://www.fieldcrops.org.
- Cornell Nutrient Guidelines for Field Crops: http://nmsp.css.cornell.edu/nutrient guidelines.
- Cornell University Agronomy Fact Sheet #2 (Nitrogen Basics – The Nitrogen Cycle), #3 (Pre-sidedress Nitrate Test), #4 (Nitrogen Credits from Manure), and #11 (The New York Nitrate Leaching Index). http://nmsp.css.cornell.edu/publications/factsheets.asp.

For more information

Cornell University Cooperative Extension

Nutrient Management Spear Program
http://nmsp.css.cornell.edu

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