



Nitrogen Management Strategy Must Include:

- 1) Predicted yield goal
- 2) Application timing
- 3) Potential sources of available N such as manure, crop residues, N contribution from previous legume crop
- 4) Crop rotation
- 5) Cover crop utilization
- 6) Soil properties

Introduction

Nitrogen is often the most limiting nutrient in producing crops. Often times, farmers tend to over apply this nutrient due to an increase in its cost, concerns about environmental pollution and demands for mandatory nutrient management planning, farmers should have a comprehensive knowledge of N management strategies and develop a detailed management plan for optimal nitrogen use.

Nitrate (NO_3^-) is the common form of nitrogen in soil and the form which plants can assimilate into energy. Since NO_3^- is a negatively charged ion, it will not be held by soil particles, which are also negatively charged. Therefore, N can easily leach as rainwater flows through the soil. In sandy soils, N leaching occurs even more rapidly. This is because of the soil's structure, which has low water holding capacity. Deep channels developed by water flow patterns and fauna in the soils allow for faster leaching of soluble N in water. N is also readily leached through the process of decomposition of organic matter. Due to the increased availability of air in sandy soils, microbes quickly degrade plant residues, releasing N into the soil. If not utilized properly, the N released will be leached before being useful to the next crop planted.

Any N management strategy must include:

1. Predicted yield goal
2. Application timing
3. Potential sources of available N such as manure, crops residues, and N contribution from previous legume crop
4. Crops rotation
5. Cover crop
6. Soil properties

How much N does corn require?

Soil mineral N content is very sensitive to environmental factors including rainfall and temperature. Therefore, testing the soil before or at the planting time cannot predict how much N will be available when crop enters its rapid growth stage. UMass extension strongly recommends that on manured fields little or no nitrogen starter be applied. A Pre-sidedress Soil Nitrate Test (PSNT) should be used to determine if organic sources of N in the soil such as manure and crop residues are adequate to meet the needs of the crop. Details on PSNT can be found in CDLE Pub. 08-12

[http://www.umass.edu/cdl/BMPs/PreSidedress%20Nitrate%20Test%20\(PSNT\)%2008-21.pdf](http://www.umass.edu/cdl/BMPs/PreSidedress%20Nitrate%20Test%20(PSNT)%2008-21.pdf).

In general, there is potential to reduce N rates by 20% if farmers sidedress rather than apply N at planting. For example if the recommendation on a clay loam soil is 125 lbs of N as broadcast prior to planting then a rate of 100 lbs N/acre is recommended if it is going to be sidedressed. Reduction in fertilizer application rate will be even higher when soil contains more sand. For grain corn production, using 1.1 pounds of N per bushel of expected yield and then subtracting all of the appropriate credits for nitrogen is recommended

The following table (Table 1) shows N fertilizer recommendations in Massachusetts for silage and grain corn with various expected yield levels.

Table 1. Nitrogen recommendation for silage and grain corn production in Massachusetts

Silage corn:						
Expected yield (ton/acre)	17-20	21-24	25-28	29-32	>33	
Nitrogen Recommended N (lb/acre)		100	130	160	180	200
Grain corn:						
Expected yield (bushel/acre)		100	125	150	175	>200
Nitrogen Recommended N (lb/acre)		100	130	160	190	220

When to apply?

The goal of a good N management program is to have maximum nitrate in the soil when plants are rapidly growing and minimum residual nitrate in the soil at harvest. The young corn plants produce little amount of dry matter and pick up only small amounts of N, P₂O₅ and K₂O. Because corn plants start growing rapidly in mid June, delaying N fertilizer application until plants reach 12 inches tall (6-8 weeks after planting) can significantly reduce N leaching and reduce cost of purchased fertilizer. When corn is planted into a field high in residual N because of previous manure or legume crops, often no yield advantage can be found by fertilizing the crop at planting.

Nitrogen Sufficiency Tests

Pre-sidedress Soil Nitrate Test (PSNT) is a useful testing method for confirming whether the N credit from organic sources such as manure and cover crops are adequate to meet the needs of the corn crop.

Evaluation of the color of the leaves determined by using a handheld chlorophyll meter is also a pre-sidedress test that predicts if remobilization of N from soil organic matter is sufficient for optimum yield production.

The end-of-season test for cornstalk NO₃-N is an effective indicator of optimal and above-optimal supplies of available N for silage corn. Details on using end-of-season cornstalk NO₃-N test (CSNT) as a N management tool can be found in CDLE Pub. 08-22 [http://www.umass.edu/cdl/BMPs/End%20of%20Season%20Corn%20Stalk%20Nitrate%20Test%20\(CSNT\)%2008-22.pdf](http://www.umass.edu/cdl/BMPs/End%20of%20Season%20Corn%20Stalk%20Nitrate%20Test%20(CSNT)%2008-22.pdf).

Determination of N application rate should be based on the price of corn and the cost of N fertilizer. The “most economical rate of nitrogen” or “optimal rate” is not the N rate that generates the highest corn yield but the rate that produces the highest economic return. Nitrogen rates for corn should be reduced when either

N fertilizer prices are unusually high or corn prices are unusually low. For example, traditionally in grain corn production N rate recommendations have been calculated at price ratio 5, which means that the value of a pound of N is 5 times greater than a pound of corn. So, when N fertilizer was \$0.30 per pound, at price ratio 5 the value of corn was assumed to be \$0.06 per pound or \$3.36/bu. The value of corn is based on the expected selling price with drying, storage and handling costs.

Resources

Bandel, Allan V., et al. “Nitrogen Recommendations for Corn Using the Pre-Sidedress Nitrate-Nitrogen Test.” Factsheet 559. University of Maryland Cooperative Extension Service.

<http://extension.umd.edu/publications/PDFs/FS559.pdf>

Beegle, D. and P. Durst. 2003. *Nitrogen Fertilization of Corn*. Agronomy Facts 12. Penn State University Cooperative Extension Service.

<http://cropsoil.psu.edu/extension/facts/agronomy-facts-12>

Wolkowski, R.P., et al. “Nitrogen Management on Sandy Soils.” Publication number A3634. University of Wisconsin-Extension.

<http://www.soils.wisc.edu/extension/pubs/A3634.pdf>

For more information visit www.umass.edu/cdl

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