



WATER QUALITY

Fact Sheet # 19

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The Maine Nitrogen Soil Test for Corn

Key to Economical, Environmentally Sound Nitrogen Fertilizer Use

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Higher energy costs and the potential for nitrate pollution of groundwater are two primary factors that have interacted to change nitrogen (N) management practices in corn production over the past 20 years. Prior to 1970, N fertilizer was relatively inexpensive, and efficient N management was not a high priority. However, both the rising cost of oil and nitrate contamination of groundwater have provided incentives to improve N fertilizer management.

To know how much N fertilizer a crop will need depends upon a complex interaction of environmental and soil-related factors that affect N availability. Corn requires a considerable amount of fertilizer N; for instance, a 20-ton silage crop will take up about 150 pounds of N/acre. In some cases, the soil can supply all the N the crop will need, depending on crop rotation or manure management practices. However, it is difficult to predict soil N availability based on management practices alone.

Nitrogen exists in several forms in soil, but only nitrate and ammonium are available to plants. There is also a large amount of N tied up in organic matter, forage legumes, and manure that may be converted to ammonium and nitrate through the course of the growing season. The amount of nitrate

in the soil at a particular time is dependent on the amount of N fertilizer you apply and by the activity of soil microorganisms. You can control the amount of N fertilizer applied, but microorganisms are responsible for releasing the N in decomposing forage legumes, manure, and/or organic matter.

Also, microorganisms are greatly influenced by environmental conditions. For instance, warm temperatures and moist soils are favorable for high soil nitrate levels. However, excessively wet soils may cause nitrate to be leached from the soil, potentially contaminating groundwater. The weather patterns within a given year greatly influence N availability to corn, especially in manured fields, or if corn is grown following a forage legume. Therefore, a soil N test is needed that can account for fluctuating weather conditions and predict how well a given soil would supply N to a corn crop.

Benefits of Splitting the Nitrogen Application

One of the best ways that you can efficiently produce corn and minimize the potential for nitrate contamination of groundwater is to split the N fertilizer application. Under most conditions, we recommend use of starter fertilizer, followed by an



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application of N at sidedress. If all the N fertilizer is applied at planting, N will be subject to loss during the first six weeks of development, when N uptake is slow. By applying most of the N just before the time of maximum plant uptake, more N is utilized by the plant, and the potential for N loss is reduced. In addition, by splitting the application, not only is the efficiency improved, but using the test may reduce the total amount of N applied, resulting in lower input costs without reducing yields.

Nitrogen Test Based on Research

The soil N test was developed in Vermont, and is now used regularly in a number of states in the Midwest and Northeast states. The soil test was evaluated in hundreds of field trials in these locations, and despite variation in soil and environmental conditions, the test has proven to be effective. The test has been evaluated in Maine over the past three years. In 1990, most of the fields tested had low soil nitrate, indicating that corn would respond to N; however, in the warm summer of 1991, more nitrate was released and made available for the corn crop. Many sites had no N fertilizer application recommended. This shows the importance of year-to-year variation, with the potential to reduce N application in some years. Research proves that if the test is not used, producers may apply too much fertilizer, potentially contributing to water quality degradation, or there may be insufficient N to produce adequate grain or silage yields.

How To Use the Maine Soil Nitrogen Test

Here is how to use the Maine soil test on your fields. *The timing and method of taking soil samples is different from those used for regular soil testing, so follow instructions carefully.*

1) Do not broadcast N fertilizer in the spring.

A small amount of nitrogen in starter fertilizer (10-15 lbs/ac) at planting is fine, however, follow standard procedures of manure application, using manure analysis and recording rates of application.

2) Sample fields for the Nitrogen Soil Test when the corn is 8 to 12 inches tall.

Take 15 to 20 cores per field and sample to a depth of 12 inches. This is deeper than recommended for most soil sampling. Sample corn fields every year because nitrate varies greatly from year to year.

3) Sample each field that is managed differently.

If a field is being rotated out of clover or alfalfa, or receives different types or rates of manure, do not take group samples; take separate samples from each field.

4) Dry the samples as soon as possible.

This is probably the most important step in the process. Mix the sample thoroughly and remove about one cup of soil. Spread the sample thinly on a cookie sheet and place in the oven at very low heat (200 degrees F). Microorganisms cannot change the level of nitrate in air-dry soil. Do not leave wet soil samples in plastic bags; dry the samples quickly.

5) Once thoroughly dry, place the sample in a plastic bag.

Fill out information on a standard soil test form. Write SOIL NITRATE TEST clearly on the sample.

6) Send the sample to the Plant and Soil Science Analytical Laboratory at the University of Maine, take the sample to the county Extension offices.

Two soil nitrate testing options are now available: the sample can be sent to the Plant and Soil Sciences Analytical Laboratory for analysis, or the sample can be sent to the county Extension office where a nitrate quick-test can be done (see page 3). Pennsylvania, Iowa and Vermont have had success with nitrate quick-test procedures, and in 1992, Maine will use the Penn State method. This will give the grower the opportunity to get immediate results, and to sidedress with any additional N required the next day. A short turn-around time is critical to the success of the test. However, if a grower would like to have the samples tested at the Plant and Soil Sciences Analytical

Laboratory, that service will still be available. The results will be returned to you within the week.

7) Apply the recommended rate of nitrogen fertilizer as a sidedress or topdress application.

A sidedress application may reduce burning from the applied fertilizer. Sidedress N application can be done in conjunction with herbicide activities: the N fertilizer appears to enhance herbicide effectiveness. Recommended nitrogen rates vary with corn yield goal, so a realistic yield goal is important. See the fact sheet, "Fertilizer Choices for use with the Maine Soil Nitrate Test (FS# 18)," available through your county Extension office.

8) Consider not applying manure to fields with very high nitrate levels the following year.

Consult your extension educator or specialist with questions.

The Quick-test Method

As mentioned previously, the quick-test method has proven to be an effective, accurate means of measuring the nitrate status of soils. Over the past three years, the test has been evaluated at Penn State University for accuracy.

The key to the quick-test procedure is a nitrate sensitive test strip, which develops color in the presence of nitrate. A hand-held reflectometer measures the degree of color development, which is related to the amount of nitrate in the soil sample. The kit comes with specific instructions for use.

This quick-test procedure can be done by an extension staff person at a county office, or may be done at the farm. The test involves extracting the soil sample in a weak salt solution. The solution extracts the nitrate and also causes the soil to sink to the bottom of the extraction vial. A nitrate sensitive test strip is placed into the solution and allowed to develop for a period of one minute; then the strip is placed in the hand-held reflectometer. The meter measures the color development, which is directly related to the amount of nitrate in the soil sample. Two strips are used in each sample.

Extensive research in this area has shown the test strips to be accurate indicators of the level of nitrate in the soil sample, and provide fast turn-around time. See your local county extension office for more information.

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