**Nitrogen and Corn Production**
Nitrogen (N) is important for optimum corn production. The total N requirement can be met in a number of ways. First, soils supply N by organic matter decay. In Pennsylvania, manure and N added to the soil by legumes like alfalfa are also important sources of N. Finally, N can be supplied in fertilizers. In most situations the total N requirement of the corn crop is supplied by a combination of these sources. When the only sources of N are the soil and fertilizer, N fertilizer recommendations have been successfully estimated by basing them on realistic expected crop yield. However, the contributions of manure and legume N are variable and difficult to estimate reliably. Thus, it is difficult to make economically and environmentally sound N recommendations on many farms in Pennsylvania.

**Nitrogen Behavior and Soil Testing**
Soil testing has been used effectively for years to determine the availability of phosphorus (P) and potassium (K) in agricultural soils and fertilizer recommendations for these nutrients. Unfortunately, due to the complex behavior of N in the soil, development of a reliable soil test for N availability has been more difficult.

As is evident in the N cycle diagram, N behavior in soil is very complex. More than 98 percent is relatively unavailable because it is tied up in soil organic matter. However, regardless of the form of N originally in the soil or added to it, soil N undergoes many changes that determine whether it becomes available to the corn crop primarily as nitrate-N or is lost to the environment. Most of these changes are carried out by microorganisms in the soil and thus are very sensitive to rainfall, temperature, soil drainage, and soil organic matter levels. Because of this sensitivity to environmental factors, changes in N availability and losses of N are generally highest during the spring and fall of the year—seasons when the crop is not actively taking up N. The result is greater potential for leaching and denitrification.

This behavior has several important implications for managing N for optimum corn production and determining availability of soil N. Corn has the greatest need for N in the spring, starting about 30 to 45 days after plant emergence, following the period of greatest change in soil N availability.

**Efficiency of N utilization** can be improved if the N is applied after the spring wet season and near the time of greatest need by the crop. A soil test at that time should more accurately reflect the actual availability of soil N for the corn crop. Sidedressing N in June, when the corn is 10 to 20 inches tall, has become a common practice for Pennsylvania corn growers.

**Nitrogen Soil Test**
A new approach to N soil testing whereby samples are taken during the growing season has been under study by researchers across the country, including a major effort in Pennsylvania. This test is called the presidedress soil nitrate test (PSNT). The basis for this new N soil testing approach is taking soil samples just before sidedressing—after the spring wet period but before the period of major N demand by corn—and determining the nitrate-N available in the soil at that time. The results are then used to make sidedress N recommendations.

Research has shown that when the soil nitrate-N level is above 21 ppm, there is little chance of an economic response to adding additional N to the field. At soil nitrate-N levels below 21 ppm, sidedress N will be required to achieve optimum economic yield. The table below can be used to estimate an appropriate N recommendation in this situation.

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A similar test, called the chlorophyll meter test, is used to estimate the nitrogen status of the growing corn crop based on the color of the corn leaves. This test is also a pre-sidedress test, run at the critical time just before the major demand by the crop. The color of the leaves is read directly on the plant in the field with a handheld meter. Thus, no samples need to be collected and analyzed and the results are available immediately. However, it is necessary to have a high-N-fertilized check area in the field to calibrate the meter. This area must be established well ahead of when the meter readings will be made. Details on using the chlorophyll meter test and making recommendations based on the readings can be found in Agronomy Facts 53: The Early Season Chlorophyll Meter Test for Corn.

Both of these tests are recommended for use primarily on fields where there are significant organic N contributions such as a history of manure applications or a use of forage legumes in the crop rotation cycle. These tests have limited value on most fields without organic N contributions since these fields generally have low N levels and thus the standard recommendations are suitable.

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### Nitrogen Soil Test Sampling Procedure

1. **Calculation to Obtain Presidedress Soil Nitrate Test Recommendation**

   **Soil nitrate-N** ppm \( (1) \)

   >>>> If the soil nitrate level is \( \geq 21 \) ppm, the N recommendation is zero; otherwise, continue the calculations below.

   **Yield factor:**
   \[ \text{Expected yield (bu/A)} \] \( (2) \)

   **History factor:**
   \[ \text{Manure since last harvest} \]
   \[ \text{None} = 0.75 \]
   \[ \text{Any} = 3.5 \]
   \[ \text{Manure history (past 3 years)} \]
   \[ \text{None} = 0 \]
   \[ \text{Any} = 1.75 \]
   \[ \text{Previous crop} \]
   \[ \text{Corn} = 0 \]
   \[ \text{Soybeans} = 1.0 \]
   \[ \text{Forage Legume} = 3.5 \]
   \[ \text{Other} = 0 \]

   **Recommendation:**
   \[ \text{(2) Yield factor \ [ (3) History factor} \ X \ (1) \text{ Soil nitrate-N} \] \( \text{lb/acre}^a \)

   \( a \) If the calculated recommendation is less than 30 lb/A, a zero recommendation is suggested.

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