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Soil Fertility Management

SFM-2
Revised April 2010

MAKING DECISIONS FOR NITROGEN FERTILIZATION OF CORN USING THE PRE-SIDEDRESS SOIL NITRATE TEST (PSNT)

The Pre-Sidedress Soil Nitrate Test (PSNT) has become a valuable and widely-used tool for optimizing the nitrogen (N) fertilizer use efficiency for corn production in Maryland. The rationale for use of the PSNT has been presented in Maryland Cooperative Extension Fact Sheet 559, "Nitrogen Recommendations for Corn Using the Pre-sidedress Nitrate-Nitrogen Soil Test." The PSNT is based on a timely measurement of the recently mineralized soil nitrate in the top foot of soil just prior to the corn crop's period of rapid N uptake. The PSNT is most useful for soils with high N mineralization capacities.

As our understanding of soil nitrogen dynamics has advanced, and as we use the PSNT under many different field conditions, we are able to refine and update the use of this nutrient management tool. The data set used to develop these PSNT recommendations was derived from 58 site-years of field research conducted in 15 Maryland counties (7 – Eastern Shore; 5 – Central & Western Maryland; 3 – Southern Maryland). The purpose of this publication is to revise the existing decision-making process when using the PSNT to determine optimum sidedress N application rate for corn.

What is the PSNT and when should I use it?

The PSNT should be used as a tool that is both complementary to and an integral part of a nutrient management plan for N fertilization of corn. Figure 1 on page 3 outlines the logical decision making process for appropriate use of both the PSNT and the information generated using this tool.

The PSNT is highly recommended on fields that have received manure, sewage sludge, or other organic residual products or have grown a forage legume (alfalfa or clover) or a legume cover crop. Use of the PSNT is appropriate if the manure or sludge was applied recently (this year) or if it has been several years since application. The PSNT is not recommended on fields where commercial fertilizer N is, and historically has been, the only source of N for corn production.

In order for the PSNT to be a reliable tool for determining corn sidedress N rate, the total fertilizer N application prior to sidedress must not be greater than 50 lb N/acre. This total maximum of 50 lb N/acre includes preplant

broadcast and starter band applied N.

How do I take a PSNT sample?

The PSNT should be conducted when the corn measures 6 – 12 inches tall from the soil surface to the top of the leaf canopy. The PSNT soil sample should be collected from 0 – 12 inches and represent areas of the field that have similar soil properties and past management histories. One composite PSNT sample should contain 30 – 40 soil cores. Soil nitrate nitrogen (NO_3-N) should be determined in strict accordance with the instructions provided with the particular test kit being used.

How do I interpret the PSNT?

A critical level of soil NO_3-N measured by the PSNT has been established above which corn yield response to sidedress fertilizer N is not expected. If PSNT NO_3-N concentrations are greater than or equal to 21 parts per million (ppm or mg N/kg soil) do not apply sidedress N fertilizer. The PSNT critical level of 21 ppm NO_3-N is a revised value that is lower than the critical level previously used for the PSNT (which was 25 ppm). This revision is the result of continuing research and PSNT calibration in commercial corn fields. Future revisions will be made as dictated by new research results.

What if the PSNT is below 21 ppm?

If the PSNT NO_3-N concentrations are less than 21 ppm, refer to the existing nutrient management plan. If the measured PSNT NO_3-N concentrations are less than 21 ppm and the nutrient management plan recommends sidedress N fertilization, then apply the sidedress N rate recommended in the nutrient management plan.

What if the PSNT is below 21 ppm and the nutrient management plan does not recommend any sidedress N application?

First, review the nutrient management plan and determine if the data used, field history, available N supply and crop N requirement calculations are accurate and reliable. If the site specific data and field history information used for the original calculation of the nutrient management plan N recommendations are inaccurate, questionable, rough approximations, or guesses, recalculate the N fertilization recommendation using the most accurate available data, including conservative estimates for crop available N from organic sources. If the new, recalculated nutrient management plan recommends sidedress N application, apply the sidedress N rate recommended by the revised nutrient management plan.

What if the PSNT is below 21 ppm and I am confident that the nutrient management plan is reliable, but the plan still does not recommend any sidedress N application?

If PSNT NO_3-N concentrations are less than 21 ppm and, after critical review, the nutrient management plan still does not recommend any sidedress N application, then the sidedress N fertilizer rate should be determined as follows:

1) If the nutrient management plan does not forecast a need for sidedress N fertilization, and PSNT NO_3-N concentrations are 15 – 21 ppm, apply 0 – 40 lb N/acre sidedress (Figure 1).

2) If the nutrient management plan does not forecast a need for sidedress N fertilizer and PSNT NO_3-N concentrations are less than 15 ppm, there are two different sidedress N recommendations depending on whether or not an alfalfa crop preceded the corn:

a) If the nutrient management plan does not predict a need for sidedress N fertilization, and PSNT NO_3-N concentrations are less than 15 ppm and alfalfa was growing on this soil within 6 months of the PSNT sample collection, then apply 0 – 40 lb N/acre sidedress (Figure 1).

b) If the nutrient management plan does not predict a need for sidedress N fertilization, and PSNT NO_3-N concentrations are less than 15 ppm and alfalfa was not growing on this soil within 6 months of the PSNT sample collection,

then apply 40 – 80 lb N/acre sidedress (Figure 1).

How should I interpret the ranges in N recommendations given in Figure 1?

All sidedress N recommendations are given as ranges of application rates (e.g. 40 – 80 lb N/acre). Selection of a sidedress N rate in the lower or higher portion of the recommended range should be based on specific site characteristics. Site specific factors that would favor choosing a lower or higher sidedress N rate within a recommended range appear in Table 1 on page 4. These factors include soil physical characteristics, recent weather conditions, manure analysis and application practices, and farm management practices.

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Figure 1. Nitrogen fertilization of corn using the pre-sidedress soil nitrate test (PSNT).

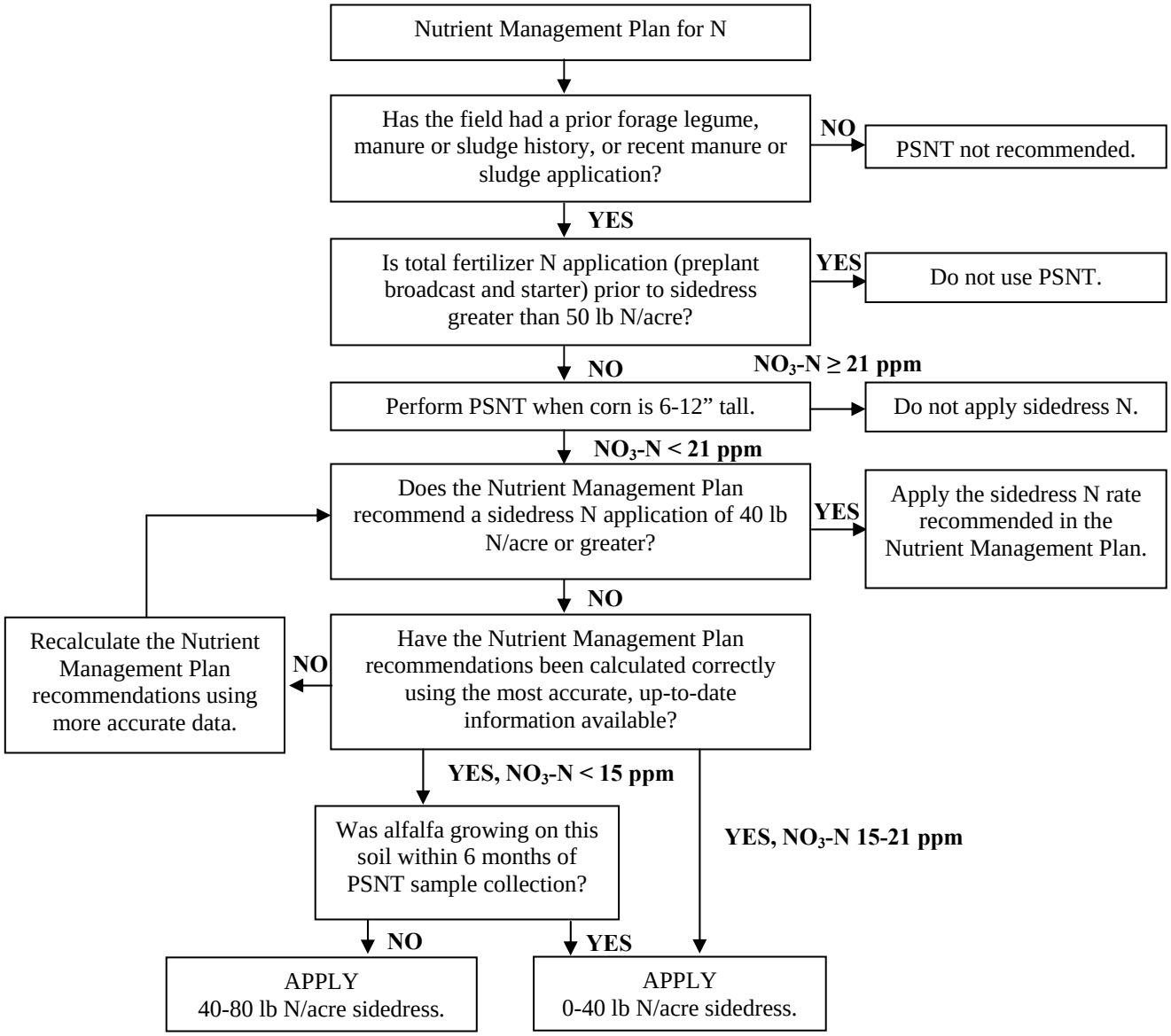

Table 1. Site specific factors that would favor choosing a higher or lower sidedress N rate within the recommended ranges based on the pre-sidedress soil nitrate test (PSNT).

Factors that would favor choosing a lower sidedress N rate within the recommended range	Factors that would favor choosing a higher sidedress N rate within the recommended range
Well drained soils	Poorly drained & excessively well drained soils
Silt loam & loam soils	Loamy sands, sands & sandy loam soils
Manure applied 0 – 3 months before PSNT	Most recent manure application was more than 3 months before PSNT
Reliable, recent manure sampling & analysis	Uncertain, old (several years), questionable manure sampling & analysis
Manure spreader calibrated; uniform application	Manure spreader not calibrated; uneven application
Less than 4” of rain within the last 30 days	More than 4” of rain within the last 30 days
Alfalfa was the prior crop	The prior crop was not alfalfa
Legume winter cover crop was grown	Rye, small grain winter cover crop
Ammonium was not credited when calculating the manure application rate	Ammonium was credited when calculating the manure application rate, but may have volatilized
The measured ppm NO_3-N was near the high cutoff value in one of the above ranges (i.e almost 15 ppm or almost 21 ppm)	The measured ppm NO_3-N was greater than, but near the lower cutoff value of 15 ppm
Soils with a relatively low yield potential	Soils with a relatively high yield potential