Presidedress Soil Nitrate Testing (PSNT) for Corn

FACT SHEET

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WHY TEST?

While nitrogen is a critical nutrient for corn production, it is also a major contributor to the high cost of production. In addition, since nitrogen is mobile in the soil, it can move into surface or ground waters, which is an environmental and water quality concern. Nitrogen rates should be fine tuned to maximize economic returns and limit environmental impacts associated with inefficient uses of nitrogen fertilizer.

The behavior of nitrogen in the soil is complex. Nitrogen is plant available as either ammonium (NH_4) or nitrate (NO_3). Ammonium has a positive charge and can attach to the surface of soil particles. This prevents much of the ammonium from being removed from the soil profile by leaching. However, a number of processes in the soil naturally convert ammonium into nitrate. Nitrogen in the nitrate form has a negative charge and does not attach to soil particles. Therefore, nitrate can be lost as water moves through the soil profile. In addition to losses by leaching, nitrate can also be lost in situations where oxygen is limiting, such as in saturated soils. In this situation, nitrates are converted into gasses that are not plant available and can be lost to the atmosphere.

Since nitrogen is generally not retained by the soil in the same manner as other plant nutrients, excess nitrogen applied to a crop is generally not available to subsequent crops. However, in situations of limited rainfall, nitrate may be carried over from the previous growing season and reduce the need for nitrogen fertilizer.

Organic materials in the soil can also be a significant source of nitrogen for plant growth. Nitrogen is continually being released from organic sources such as applied manure, crop residues, and soil organic matter as these materials decompose (mineralize). Since this process is highly dependant on a number of factors, it is not possible to predict the amount of nitrogen that will be released by mineralization.

The PSNT is most beneficial in situations where manure has been applied to a field, or where a recent legume forage crop, such as alfalfa, has been grown. These practices generally provide higher levels of potentially available nitrogen to the growing crop, Since the contribution of available nitrogen from these sources is variable due to several factors, the PSNT can be a useful tool for assessing the actual nitrogen contribution from these sources.

SAMPLING

Time: Take samples in the spring when the corn is 6-12 inches tall or at least a week before a planned sidedress application to allow adequate time for laboratory analysis and interpretation of the data.

Depth: Samples should be collected to a depth of 12 inches. All of the interpretative guidelines presented in this fact sheet are based on 12 inch sample depth. Take at least 10 to 15 cores per sample unit.

Place: Since the PSNT measures the nitrate released by mineralization of organic materials, factors that affect mineralization should be considered when determining the sampled area. Factors such as soil type and slope, as well as differences in management, including intensity of artificial drainage, rates of manure application, and cropping history, should be considered when determining sampling areas. Avoid starter bands or other unusual areas. In addition, **if high rates of nitrogen fertilizers have been applied pre-plant or at planting, PSNT values may not provide an accurate assessment of the nitrogen status of the soil.** A general guideline is that one sample should represent no more than 15 – 20 acres.

Handling: The soil from all cores should be crushed and thoroughly mixed before a 1-2 cup subsample is removed for analysis. Samples should be shipped immediately after collection so that they may be analyzed within 2 days. Samples may be refrigerated, frozen, or dried for preservation if they cannot be shipped immediately. Do not exceed a temperature of 250°F in drying.

Shipping: Ship via UPS or courier for best results. Moist samples sent Monday - Wednesday should arrive without weekend delays, which could affect results.

INTERPRETATION OF RESULTS

Not all states have recommended nitrate sampling programs. Interpretative guidelines for several states are outlined below:

ILLINOIS

For a discussion of interpreting PSNT results in Illinois, refer to the *Illinois Agronomy Handbook,* p. 119-120.

INDIANA*

Soil NO_3-N (ppm)	Corn Yield Potential (Bu/A)					
	80	100	120	140	160	180
	——— pounds additional fertilizer N to apply per acre ———					
0-10	75	100	125	145	170	200
11-15	45	75	100	125	145	170
16-20	30	55	80	110	125	150
21-25	0	10	35	55	80	110
>25	0	0	0	0	0	0

*AY-314-W, *The Presidedress Soil Nitrate Test for Improving N Management in Corn, Purdue University*

IOWA*

Corn after Soybeans and Corn after Corn:

Recommended N Rate (lb. N/acre) = (Critical N Concentration[1] - ppm NO_3-N) x 8

Manured[2] Soils and Corn after Alfalfa:

Grain and Fertilizer Prices	Soil Test Nitrate ppm NO_3-N	Recommended N Rate (lb. N/acre)	
		Excess Rainfall[3]	Normal Rainfall
Unfavorable (1 bu. Corn buys 7 lb. of N)	0-10	90	90
	11-15	0	60
	16-20	0	0 [4]
	>20	0	0
Favorable (1 bu. Corn buys 15 lb. of N)	0-10	90	90
	11-15	60	60
	16-25	0	30
	>25	0	0

* Pm-1714, *Nitrogen Fertilizer Recommendations for Corn in Iowa*, Iowa State University

[1] A critical concentration of 25 ppm NO_3-N is appropriate in absence of additional information. Reduce the critical concentration by 3-5 ppm if rainfall is more than 20% above normal amount between April 1 and time of soil sampling.

[2] A field should be considered manured if animal manures were applied with a reasonable degree of uniformity since harvest of the previous crop or in 2 of the past 4 years.

[3] Rainfall should be considered excess if rainfall in May exceeded 5 inches.

[4] Addition of 30 lb. N/acre may have no detectable effects on profits, but producers could reasonably elect to apply this rate.

MICHIGAN*

Soil Nitrate ppm NO_3-N	Interpretation	Soil N Credit N Credit (lb. N/acre)[1]
≤10	Low	0
11-15	Medium-Low	30
16-20	Medium	60
21-25	Medium-High	90
≥26	High	**

* *Soil Nitrate Test for Corn in Michigan;* Field Crop Advisory Team Alert, Michigan State University Extension, 14 May 2009

** No additional nitrogen fertilizer is recommended.

1 N credit for corn when N recommendation is based on Maximum Return To Nitrogen (MRTN)

OHIO

For a discussion of interpreting PSNT results in Ohio, refer to the *Ohio CORN Newsletter 2008-14,* 20 May 2008.

WISCONSIN*

Soil Nitrate ppm NO_3-N	Soil Yield Potential[1]	
	Very High/High	Medium/Low
	N Credit (lb. N/acre)[2]	
>21	**	**
18-20	100	80
15-17	60	80
13-14	35	40
11-12	10	40
0-10	0	0

* UWEX publication A2809, *Nutrient Application Guidelines for Field, Vegetable and Fruit Crops in Wisconsin*

** No additional nitrogen fertilizer is recommended.

1 Refer to UWEX publication A2809 to determine soil yield potential. PSNT is not recommended on sandy soils (loamy sands and sands).

2 Refer to UWEX publication A2809 for a discussion of other factors that affect N guidelines.