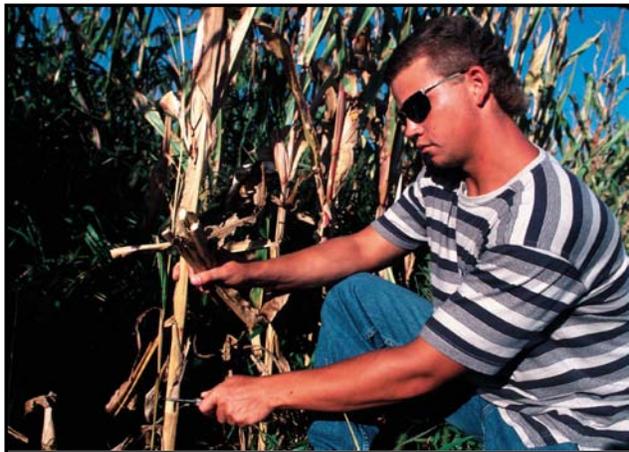


**Water Quality Enhancement Activity – WQL04 – Plant tissue testing and analysis to improve nitrogen management**



**Enhancement Description**

Use plant tissue tests to adjust nitrogen application rates.

**Land Use Applicability**

Cropland.

**Benefits**

The use of either plant tissue testing or leaf tissue testing is an adaptive nitrogen management technique used to adjust nitrogen application rates in-season (leaf tissue test) or for the following crop year

(stalk test). Test such as these help provide a thorough analysis of how nitrogen is being used by the current crop, giving a basis for adjustments to nitrogen rates. The end result is a more complete utilization of the nitrogen applied and less nitrogen remaining in the soil to be lost to the environment through nitrate leaching or soil emissions of nitrous oxide.

**Criteria**

This enhancement requires the use of an analysis of appropriate plant tissue to monitor the uptake of nitrogen and other nutrients during the growing season and to make necessary adjustments in nutrient applications. The purpose is to correlate the application of N during the growing season to plant needs. In addition, deficiencies in other plant nutrients that would restrict N uptake and utilization must also be corrected. Follow guidelines from the laboratory and local land grant university for interpretation of the results and appropriate adjustments in the application of N and other nutrients.

1. In addition to leaf tissue analysis, the following testing and analysis information is specific to nitrogen management for corn.
  - a. Corn stalk testing and analysis - The nitrogen status of the corn crop can be determined by measuring the nitrate concentrations in the lower portions of cornstalks at the end of the growing season. This involves taking an 8” sample of the cornstalk after black layer development in corn. The stalk is analyzed for nitrate to determine if the corn received insufficient, sufficient, or excessive levels of nitrogen. Since this test is conducted after the current corn crop is mature, the results are used to “fine-tune” nitrogen recommendations in the next corn crop. Follow your Land Grant University guidelines for the use of this type of test.



- b. Corn leaf tissue testing and analysis - Chlorophyll meter readings can be used to determine the nitrogen status of corn late in the vegetative growth period. This involves planting “reference strips” where 10-25% more nitrogen is applied than recommended. Then a chlorophyll meter is used to compare the reference strips with the rest of the field to determine if nitrogen is deficient. Additional late season nitrogen is applied if needed. For additional information, follow your Land Grant University guidelines for using and interpreting the results of a chlorophyll meter test.
2. Use similar guidelines for plant tissue testing for other crops that require significant nitrogen inputs.
  3. Producer must have a current soil test (no more than 3 years old).
  4. Nutrient application rates are within the “Land Grant University (LGU) recommendations based on soil testing and established yield goals and considering all nutrient sources.

### **Documentation Requirements**

Documentation for each treatment area (field) and year of this enhancement describing these items:

1. A map showing where the activities are applied.
2. Test used (stalk, leaf or other plant tissue)
3. Dates of test(s)
4. Acres for each treatment area
5. Soil test results for each treatment area
6. Manure analysis results (if applicable)
7. Crop yields (both yield goals and measured yield(if available))
8. Amounts of all nutrients applied in each treatment area
9. Plant tissue test results (including reference strips)
10. Change in annual N applied due to adaptive management change per treatment area

WATER QUALITY ENHANCEMENT ACTIVITY

**WQL04–OR      Corn Stalk or Leaf Tissue Tests for N Application**

The following guidance on taking and interpreting the PHNT for corn is taken from Oregon State University Extension publication EM8978-E, *Silage Corn Nutrient Management Guide-Western Oregon*, available at: <http://extension.oregonstate.edu/catalog/pdf/em/em8978-e.pdf>

**Oregon Criteria**

**Postharvest nitrate test**

The postharvest nitrate test (PHNT) measures soil nitrate-N not used by the crop. The PHNT looks backward in time and evaluates the balance between N supply and crop N uptake. Nitrate-N accumulates in the soil when the total of applied N plus plant-available N mineralized from soil organic matter exceeds corn N uptake.

Use the postharvest test to:

- Evaluate the balance between N supply from manure and other sources and crop N demand
- Identify imbalances in N supply among fields on a farm
- Identify fields that may respond to changes in timing or amount of manure application or other agronomic practices

If fall soil nitrate-N is high, consider ways to reduce the N surplus in the future. Evaluate the overall N supply, including:

- Timing and amount of current-season application(s) of N fertilizer, manure, or lagoon water
- Plant-available N mineralized from a previous cover crop or perennial grass crop

Note that a low PHNT does not indicate that too little N was applied. Continual mineralization of N can provide enough plant-available N for a crop without accumulation of nitrate-N in the soil. Also, the PHNT does not predict the amount of plant-available N that will be mineralized from soil organic matter or crop residues in the fall.

***Directions for a PHNT***

Collect a soil sample to a 12-inch depth. The amount of nitrate-N in the upper 12 inches is a good predictor of nitrate-N in the rest of the soil profile, provided that nitrate-N was not moved below 12 inches by irrigation or fall rains.

Collect soil samples (15 to 30 cores per field) as soon as possible after harvest (Figure 15). Do not sample fields that received a manure application (including lagoon

water) within the past 30 days. Take samples before heavy fall rains move nitrate-N below the sampling depth. On medium- to fine-texture soils (loam or clay), sample before 5 inches of cumulative rainfall (after September 1). Coarse soils (sand or sandy loam) have low water-holding capacities; sample them before 3 inches of cumulative rainfall after September 1. Sampling Willamette Valley locations before October 15 is acceptable in most years. At sites near the Oregon coast, take PHNT samples before October 1. Use Table 12 to interpret PHNT analyses.

Table 12.—Postharvest nitrate-N test interpretation following silage corn.

Nitrate-N	Interpretation (ppm)
0–20	<b>Acceptable.</b> PHNT test value can be as low as 5 to 10 ppm without compromising yield.
21–45	<b>High*</b>
above 45	<b>Excess*</b>

\*See EM 8832-E, *Post-harvest Soil Nitrate Testing for Manured Cropping Systems West of the Cascades*, for ways to reduce post-harvest test values for fields treated with dairy manure.

Field research in northwest Washington (Lynden area) and western Oregon demonstrated that the pre-sidedress soil nitrate test is correlated with the postharvest nitrate test (Figure 16, page 12). A PSNT test greater than 25 or 30 ppm indicated a high probability of excess N remaining in the soil profile after harvest. In Washington, PSNT values above 40 ppm usually produced PHNT values of more than 150 lb/a nitrate-N (0- to 24-inch depth).

Because of the correlation between PSNT and PHNT values, you may prefer to make dual use of the PSNT: (1) as an indicator of whether sidedress N fertilizer is needed and (2) as an indicator of postharvest soil nitrate-N.

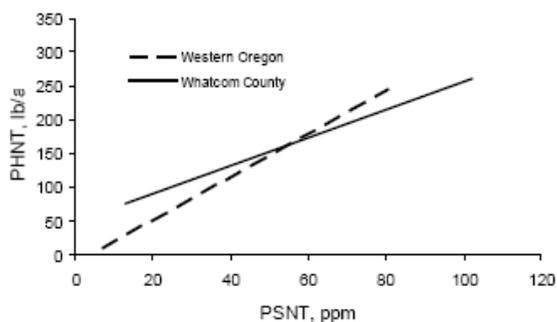


Figure 16.—The relationship between soil nitrate-N measured in midsummer (PSNT) and soil nitrate-N measured in fall (PHNT). Data represent 26 western Oregon fields and 27 sites in Whatcom County, Washington. Sampling depth for the PHNT was 12 inches in western Oregon and 24 inches in Whatcom County. At all sites, lagoon water was not applied after the midsummer (PSNT) test.



Figure 15.—Obtain a soil sample immediately after harvest, to evaluate adequacy of the N application rate.

This Enhancement requires stalk or leaf tissue testing. OSU publication EM8677, Laboratories Serving Oregon: Soil, Water, Plant Tissue, and Feed Analysis, provides a list of laboratories, and is available at: <http://extension.oregonstate.edu/catalog/html/em/em8677/>

### **Documenting the Enhancement**

- 1. A map or aerial photo showing fields where the Enhancement is applied.**
- 2. Acres for each Treatment Area (Fields)**

Field(s)	Acres

3. Test Used: \_\_\_\_\_ Stalk Test \_\_\_\_\_ Leaf Tissue
4. Date of Test: \_\_\_\_\_
5. Stalk/Leaf Tissue Test Results (attach)
6. Manure Analysis Test Results (if applicable)
7. Yield Goal: \_\_\_\_\_ bushels/acre Measured Yield: \_\_\_\_\_ bushels/acre
8. Nutrient Application Records By Treatment Area

Fertilizer Application					
Field	Total (Gross) Applied (lbs./acre)	Formulation (%N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O)	N	Net Applied (lbs./acre) P <sub>2</sub> O <sub>5</sub> K <sub>2</sub> O	

9. Stalk Nitrate N: \_\_\_\_\_ Below 3500 ppm \_\_\_\_\_ 3500-5500 ppm \_\_\_\_\_ Above 5500 ppm

<b><u>Below 3500 ppm:</u></b>	N supply may have been inadequate or late; root limitation may have reduced uptake
<b><u>3500-5500 ppm:</u></b>	Adequate N supply and expected yield
<b><u>Above 5500 ppm:</u></b>	N supply excessive, late, or both

10. Based on the results above, anticipated change in next year's Nitrogen application:  
 \_\_\_\_\_ Expect to Apply Less N \_\_\_\_\_ No Change \_\_\_\_\_ Expect to Apply More N

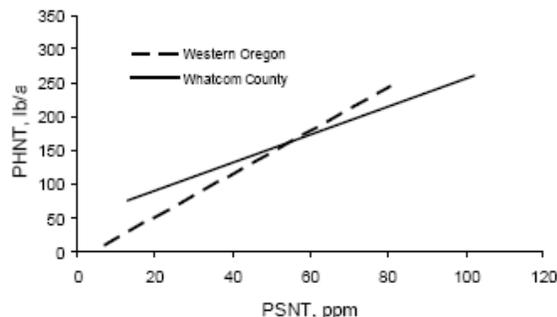


Figure 16. — The relationship between soil nitrate-N measured in midsummer (PSNT) and soil nitrate-N measured in fall (PHNT). Data represent 26 western Oregon fields and 27 sites in Whatcom County, Washington. Sampling depth for the PHNT was 12 inches in western Oregon and 24 inches in Whatcom County. At all sites, lagoon water was not applied after the midsummer (PSNT) test.

## For more information

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