United States Department of Agriculture
Natural Resources Conservation Service 2013 Ranking Period 1

Water Quality Enhancement Activity – WQL04 – Plant tissue tests 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.

Conditions Where Enhancement Applies
This enhancement applies to all crop land use acres.

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 or for the following year and to make necessary adjustments in nutrient applications.

In-season tissue testing and analysis

1. This enhancement is limited to crops and state's with one or more of the following:
   a. A Land Grant University (LGU) that provide tissue analyses,
   b. That recognize private commercial laboratory analyses,
   c. Where chlorophyll tissue testing is a recognized methodology, or
   d. Where aerial imagery (infrared) technology is a recognized methodology.
2. Participant must have a current soil test (no more than 3 years old).
3. Nutrient application rates are within the LGU recommendations based on soil testing and established yield goals and considering all nutrient sources.
4. Follow guidelines from the laboratory and local LGU for interpretation of the results and appropriate adjustments in the application of N and other nutrients.

Plant tissue testing and analysis for the following year
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 LGU guidelines for the use of this type of test.

Adoption Requirements

This enhancement is considered adopted when the results from plant tissue testing have been used to make nutrient application adjustments, either in-season or for the next crop year.

Documentation Requirements

Each year, documentation for each treatment area (field) shall describe the following essential items:

1. A map showing where the activities are applied,
2. Test used (stalk, leaf, chlorophyll, infrared, 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), and
10. Change in annual N applied due to adaptive management change per treatment area.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References

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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 blow the sample 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	**Acceptable.** PHNT test value can be as low as 5 to 10 ppm without compromising yield.
21-45	**High***
above 45	**Excess***

*See EM 8832-E. *Port-harvest Sot/Nitrate Testing for Manured Cropping Systems West a/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 PI-INT 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 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_2O_5-K_2O)	Net Applied (lbs./acre) N	P_2O_5	K_2O

9. **Stalk Nitrate N:**

_____ Below 3500 ppm **_____ 3500-5500 ppm** **____ Above 5500 ppm**

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

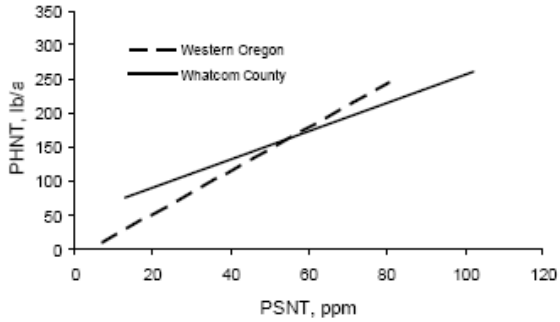

Figure 16.—The relationship between soil nitrate-N measured in midsummer (PSNT) and soil nitrate-N measured in fall (PHNT). Data represent 26 western Oregon fields and 27 sites in Whatcom County, Washington. Sampling depth for the PHNT was 12 inches in western Oregon and 24 inches in Whatcom County.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

For more information

Extension publications

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Other publications

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