



Natural Resources Conservation Service
WASHINGTON

WQL04 – Plant tissue tests and analysis to improve nitrogen management

CSP Enhancement Washington State Supplement

Land Use Applicability: Cropland

January 2014

Client/Operating Unit:

Tract Number:

Farm/Ranch Location:

Farm Number:

Specifications Date:

Field Number(s):

Planned Installation Date:

Proposed Treatment Acres:

Enhancement Description:

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Use plant tissue tests to adjust nitrogen application rates.

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 for plant tissue tests and analysis to improve nitrogen management

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 Land Grant University (LGU) that provide tissue analyses,
 - That recognize private commercial laboratory analyses,
 - Where chlorophyll tissue testing is a recognized methodology, or
 - 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.

Layout Sketch & Drawing (Provide sketch, drawings, maps, and/or aerial photographs.)

- Geo-referenced field map with all delineated treatment areas where CSP Enhancement WQL04 is to be applied.

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*:

Blackmer, A.M. and A.P. Mallarino. 1996. Cornstalk Testing to Evaluate Nitrogen Management (PM-1584). Iowa State Univ. Extension.

Brouder, S. and D. Mengel. 2003. The Pre-sidedress Soil Nitrate Test for Improving N Management in Corn (AY- 314-W). Purdue Univ. Extension.

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

Field Office Technical Guide:

eFOTG, <http://www.nrcs.usda.gov/technical/efotg/>

* Some online documents may take several minutes to download.

State Supplemental Information

States may need to have information available on how to conduct the test, where to send the samples and how to interpret the results.

- Tissue sampling, when combined with soil analysis, is a good tool in Washington, not only for corn, but potato, tree fruit, vine crops, and other crops where prediction and diagnosis of deficiencies for any or all essential plant nutrients can improve Nitrogen Use Efficiency and management.
- Often a deficiency in tissue N may be due to a deficiency or excess of other essential nutrients (such as Potassium or Iron, etc), climatic conditions or reduced root development that is inhibiting normal N uptake. Interpretation of tissue sampling must account for other limiting factors besides available N supply alone.
- Most Agricultural Testing Laboratories can analyze tissue samples, provide results and often times interpretation guidance. Laboratories that participate in the North American Proficiency testing program are listed:

<http://www.naptprogram.org/about/participants/all/>

- Sampling procedures, timing and sample handling is very important to the interpretations of results for tissue sampling programs. Consistency is also important when evaluating trends. Methods are generally crop and stage of growth specific. Guidance on sampling methods and interpretations:
- Guidelines for Sampling and Interpreting Results, April 16, 2001. Reference provides exhaustive list of Crops and sufficiency estimates for most essential plant nutrients.

<http://www.clemson.edu/agrvl/plantsampling.htm>

- Sampling for Plant Tissue Analysis, Guide A-123, updated July 1999. College of Agricultural, Consumer and Environmental Sciences New Mexico State University. *Reference provides guidelines for sample collection, handling, analysis and interpretation for a plant tissue sampling program.*

http://aces.nmsu.edu/pubs/_a/a-123.html

- The most important use of plant analysis is as a monitoring tool for determining the adequacy of current fertilization practices. Sampling a crop periodically during the season or once each year provides a record of its nutrient content that can be used through the growing season or from year to year. With soil test information and a plant analysis report, a producer can closely tailor fertilization practices to specific soil-plant needs.
- It also may be possible to prevent nutrient stress in a crop if the plant analysis indicates a potential problem developing early in the season. Corrective measures can be applied during the season or, if the crop is perennial, during the next year. Combined with data from a soil analysis, a tissue analysis is an important tool in determining nutrient requirements of a crop.

Another source for Local plant tissue sample program guidance for specific crops and locations are the Land Grant University Extension specialists in Washington:

<http://ext.wsu.edu/locations/>

Pre side dress/ in-season nitrogen testing (PSNT)

<http://extension.umass.edu/cdle/fact-sheets/nitrogen-management-pre-sidedress-nitrate-n-test-psnt>

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/24399/EMNO8650.pdf?sequence=1>

Guidelines provide information Why and When to use the test procedure, soil sampling technique, guidelines for interpretation and useful information regarding N cycle and N uptake by Corn. Interpretation of Plant tissue results for N management need to consider the sufficiency of all other production factors that affect Nitrogen use efficiency by crops prior to focusing on N rates alone. Examples other essential plant nutrients, stand, variety and plant health as well as climate considerations.

Soil Nutrient Testing – Oregon State Extension:

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/22023/ec1478.pdf>

<http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/20762/pnw570-e.pdf>

Corn Stalk Nitrogen Test- Late Season

<http://extension.umass.edu/cdle/fact-sheets/nitrogen-management-end-season-cornstalk-nitrate-test>

When corn plants are over fertilized, nitrate will accumulate in the lower portion of stalks without contributing to a greater yield. Measurement of nitrate concentration in the lower portion of corn stalks at the end of the growing season can be used to determine nitrogen deficiency, sufficiency, or excess in corn silage, grain corn, and sweet corn. The Cornstalk Nitrate Test (CSNT) can be used to gain confidence in the nutrient management planning process.

General sampling procedures for corn stalk N test – Late Season.

The test requires collection of corn stalks at end of season just before harvest. For grain corn, stalk samples should be taken between one and three weeks after black layer formation on 80% of kernels.

- Collect samples from 15 random plants for every 10 acres of field.
- Cut an 8 inch segment of stalk starting 6 inches above ground level.
- Remove leaf sheaths from the segments.
- Stalks severely damaged by disease or insects should not be used.
- Areas with differing soil types, or management history should be sampled separately.
- Place segments in a paper bag (not plastic, this promotes fungal growth) and dry or freeze.

General Interpretation of Stalk Nitrate Concentration:

Stalk nitrate concentrations for corn can be divided into three categories;

Low:	less than 500 ppm N
Optimum:	500 to 1700 ppm N
Excessive:	greater than 1700 ppm N

Documentation Form

Producer:
 Date:
 Tracts:
 County:

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

1. A map showing where the activities are applied,
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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),
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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.

Field Number(s):					
Crop:					
Yield Goal:					
Acres for each Treated Area:					
Test Used (Stalk, Leaf or Other Tissue):					
Dates of Plant Tissue Test(s):					
Plant Tissue Test Results (including reference strips):					
Amount of all Nutrient Applications for each Treatment Area:					
N:					
P ₂ O ₅ :					
K ₂ O:					
Change in Annual N applied per treatment area:					
Measured Crop Yields:					

- Attach Soil Test Results for Each Treatment Area
- Attach manure analysis results (if applicable)
- Attach map showing where activities are applied

WSU Analytical Laboratories Database:

<http://www.puyallup.wsu.edu/analyticallabs/>

Commercial and Agricultural Resources:

<http://extension.wsu.edu/wsprs/Pages/AgResources.aspx>

Client's Acknowledgement (To be signed before the Enhancement is applied.)

By signing below, I acknowledge that I:

- have reviewed and understand the site specific design, installation specifications and operation/maintenance requirements in this State Supplemental Sheet and have an understanding of the purpose(s) of this Enhancement;
- will install, operate, and maintain this Enhancement in accordance with the National Sheet, the Washington State Supplemental Sheet and the site specific specifications.
- will make no changes to the planned design and installation without prior written approval of the Natural Resources Conservation Service.
- will obtain all necessary permits and/or rights, and comply with all ordinances and laws pertaining to the installation, operation, and maintenance of this Enhancement, prior to the start of installation; and
- will assume responsibility for notifying all Utilities affected by the installation, operation and maintenance of this Enhancement.

Signature

Date

USDA is an equal opportunity employer and service provider.