

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

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.

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Referencing guidance of other universities or laboratories is not an endorsement by NRCS in Minnesota that these methodologies are pertinent to Minnesota.

The **basal stalk nitrate test for corn** is a diagnostic tool for adjusting future N management practices.

University of Minnesota Guidance:

- [The Basal Stalk Nitrate Test for Corn from 8/16/2005](#)

Other Land Grant University Guidance:

- [Iowa State—Corn Stalk Testing to Evaluate Nitrogen Management \(PM1584\)](#)
- [Iowa State—Cornstalk Samples for Nitrate Analysis at ISU Soil Testing Lab](#)
- [University of Nebraska—The Corn Stalk Nitrate Test \(NF01-491\)](#)
- [Cornell University—Corn Stalk Nitrate Test \(CSNT\) Fact Sheet 31](#)
- [Penn State—Agronomy Facts 70 Late Season Cornstalk Nitrate Test](#)
- [Penn State—Stalk Test Video](#)

In-season plant analysis (tissue test) can be used as a tool to adjust nutrient applications during the current growing season as well as guide future nutrient applications. However, University of Minnesota guidance is limited on using plant tissue tests in-season to decide if additional nutrients should be applied during the current growing season. In addition, application windows are limited especially in dryland farming.

University of Minnesota Guidance:

- [Plant Analysis Sampling and Interpretation \(FO-3176-B\)](#)
- [Plant Analysis for Fruit and Vegetable Production \(pages 32, 33, 34\)](#)
- [Plant Analysis in Today's Agriculture July 6, 2006](#)

Other Land Grant University or Private Laboratory Guidance:

- [University of Wisconsin—Using Plant Analysis as a Diagnostic Tool No. 6—2000](#)
- [University of Wisconsin—Soil Testing Laboratories Plant Tissue Analysis](#)
- [University of Missouri—Crop Nutrient Deficiencies and Toxicities \(IPM1016\)](#)
- [National Corn Handbook—Plant Analysis: a Diagnostic Tool \(NCH-46\)](#)
- [A & L Great Lakes Laboratories, Inc.—Plant Tissue Sufficiency Levels of Row Crops](#)
- [A & L Great Lakes Laboratories, Inc.—Plant Tissue Sampling of Row Crops](#)

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Chlorophyll meters are another tool to adjust nutrient applications during the current growing season as well as guide future nitrogen applications. Use of chlorophyll meters to predict in-season N sufficiency and additional N need is problematic. Frequent sampling is required from numerous sites. Correct leaf and correct leaf location is important. Factors impacting light transition are important. Guidance on interpreting results is limited. Reference strips are necessary. The application window is limited especially in dryland farming.

- [Purdue University—Determining Nitrogen Fertilizer Sidedress Application Needs in Corn Using a Chlorophyll Meter \(AY-317-W\)](#)
- [University of Nebraska—Using a Chlorophyll Meter to Improve N Management \(G1632\)](#)
- [Penn State—Agronomy Facts 53 The Early Season Chlorophyll Meter Test for Corn](#)

NOTE:

- **Using plant analysis (tissue tests) or chlorophyll meters to make in-season fertilizer management decisions may or may not result in net income increases or N loss reductions in Minnesota.**
- **Total nutrient application rates shall be consistent with University of Minnesota or contiguous land grant university recommendations.**
 - [University of Minnesota Fertilizer Recommendations for Agronomic Crops in Minnesota](#)
 - [University of Minnesota—Nutrient Management of Commercial Fruit and Vegetable Crops in Minnesota](#)
 - [University of Minnesota Commodity Crop Production Website](#)
 - [Iowa State University—A General Guide for Crop Nutrient and Limestone Recommendations in Iowa](#)
 - [South Dakota State University—Fertilizer Recommendations \(EC750 Sept. 2005\)](#)
 - [North Dakota State University—North Dakota Fertilizer Recommendation Tables and Equations \(SF-882\)](#)
 - [University of Wisconsin—Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin \(A2809\)](#)