

**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



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**Reference: 590 – Nutrient Management**

Referencing guidance of other universities or private laboratories is not an endorsement by NRCS in Minnesota that these methodologies are pertinent to the soils and climatic conditions in this state.

The **basal stalk nitrate test for corn** is a diagnostic tool for adjusting future N management practices. Information on corn basal stalk testing can be found at the following websites:

University of Minnesota Guidance:

<http://www.extension.umn.edu/cropenews/2005/05MNCN40.htm>

Other Land Grant University Guidance:

<http://www.extension.iastate.edu/Publications/PM1584.pdf>

<http://www.agron.iastate.edu/soiltesting/CSN.pdf>

[http://efotg.nrcs.usda.gov/references/public/NE/Corn Stalk Nitrate Test NebGuide\\_Nf01\\_491.pdf](http://efotg.nrcs.usda.gov/references/public/NE/Corn_Stalk_Nitrate_Test_NebGuide_Nf01_491.pdf)

<http://nmsp.cals.cornell.edu/publications/factsheets/factsheet31.pdf>

<http://cropsoil.psu.edu/extension/facts/agfact70.pdf>

[http://cmeg.psu.edu/video/stalk\\_test/stalk\\_test.cfm](http://cmeg.psu.edu/video/stalk_test/stalk_test.cfm)

**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 for Commercial Fruit and Vegetable Crops

<http://www.extension.umn.edu/distribution/cropsystems/DC5886.html>

University of Minnesota Corn and Soybean Guidance.

<http://www.extension.umn.edu/cropenews/2006/06MNCN37.htm>

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Other Land Grant University Guidance:

<http://uwlab.soils.wisc.edu/madison/index.htm?../procedures.htm&contents.asp?menu=2><http://www.soils.wisc.edu/extension/area/horizons/2000/Plant%20Analysis%20as%20Tool.pdf>

<http://ppp.missouri.edu/newsletters/ipcm/archives/v17n8/ipmltr4.htm>

<http://www.ces.purdue.edu/extmedia/NCH/NCH-46.html>

Private Laboratory Guidance

<http://www.agviselabs.com/pdf/intplant.pdf>

[http://www.algreatlakes.com/PDF/factsheets/ALGLFS35\\_Plant\\_Tissue\\_Testing\\_Sufficiency\\_Levels\\_of\\_Row\\_Crops.pdf](http://www.algreatlakes.com/PDF/factsheets/ALGLFS35_Plant_Tissue_Testing_Sufficiency_Levels_of_Row_Crops.pdf)

[http://www.algreatlakes.com/PDF/factsheets/ALGLFS34\\_Plant\\_Tissue\\_Testing\\_for\\_Row\\_Crops.pdf](http://www.algreatlakes.com/PDF/factsheets/ALGLFS34_Plant_Tissue_Testing_for_Row_Crops.pdf)

**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.

<http://www.agry.purdue.edu/ext/pubs/AY-317-W.pdf>

<http://www.ianrpubs.unl.edu/epublic/live/g1632/build/g1632.pdf>

<http://cropsoil.psu.edu/extension/facts/agfact53.pdf>

**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.**

<http://www.extension.umn.edu/distribution/cropsystems/DC5886.html>

<http://www.extension.umn.edu/CommodityCrops/>

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