

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.

CSP 2013-1

Mississippi Supplement

WQL04 - Plant Tissue Testing and Analysis to Improve Nitrogen Management

This enhancement is applicable in rotations that involve corn, sorghums, and cotton and must follow procedures outlined in a comprehensive document providing interpretation of both petiole nitrate and leaf blade N for Southeast crops. Refer to Southern Coop. Series Bulletin (<http://www.clemson.edu/sera6/scsb394notoc.pdf>) for additional sampling procedures.

Requirements

- A current soil analysis (three years old or less)
- One plant tissue sample per 20 acres of crops or less.

Sampling Procedures for Corn

Seedling (< 4 inches in height)

Whole plants should be collected by cutting 1 inch above the soil surface. Depending on size, 15 to 20 plants are adequate for a sample.

Early Growth (> 4 inches in height to tasseling)

The most recent mature leaf (MRML) is the best indicator sample. Depending on size, 15 to 20 leaves are adequate for a sample.

Tasseling / Bloom

The ear leaf is the best indicator sample. This is the leaf adjacent to the uppermost developing ear. Fifteen to twenty leaves are adequate for a sample.

Maturity

The ear leaf is the best indicator sample. This is the leaf adjacent to the uppermost developing ear. Fifteen to twenty leaves are adequate for a sample.

Notes for All Samples

Problem-solving samples can be taken at any time during the growing season. Comparative samples of “good” and “bad” plants or sample areas should be taken according to guidelines at the stage of growth. Monitoring samples should be taken at lay-by and tasseling (bloom). Samples should be shipped to the laboratory in paper containers.

Sampling Procedures for Cotton

Petiole analysis

Sample petioles from the most recently matured leaf on the vegetative stem at intervals beginning the week before first bloom and continuing for 7 or 8 weeks after bloom. Samples should be taken at weekly intervals and compared for the results to be meaningful. Interpret

Sampling Procedures for Cotton (continued)

petiole analysis for NO₃-N, total P, and total K only. Nitrate analysis is the most meaningful and the primary reason for sampling.

Leaf blade at early bloom

Sample the uppermost, mature cotton leaf blade on the vegetative stem. Discard the petiole. (Note: some research has included both leaf blade and petiole.] This is usually the 3rd to 5th leaf from the terminal. Sample during the period of one week before to one week after first bloom.

Sampling Procedures for Grain Sorghum

Seedling Stage (< 4 cm tall)

Sample whole aboveground portion of plant.

Vegetative or Prior to Heading

Sample entire, fully developed leaf below the whorl.

Flowering or at Heading

Sample second leaf from the top of the plant. This is the recommended sampling procedure when determining the nutrient status of the treatments, and yield.

Grain Filling

Sample second leaf from the top of the plant.