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

Michigan Supplement

Water Quality Enhancement Activity – WQL04 – Plant Tissue Testing and Analysis to Improve Nitrogen Management

Enhancement Name
Use plant tissue tests to adjust nitrogen application rates.

Land Use Applicability
This enhancement is applicable on cropland.

Benefits
The use of either plant tissue testing or leaf tissue testing is an adaptive nitrogen (N) 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 corn crop, giving a basis for adjustments to N rates. The end result is a more complete utilization of the N applied and less N remaining in the soil to be lost to the environment through nitrate leaching or soil emissions of nitrous oxide.

Criteria
1. Test and analysis information specific to N management for corn follows:

- Corn stalk testing and analysis
  Follow the procedure given in Purdue bulletin, "End-of-Season Corn Stalk Nitrate Test", which is found in Section IV of the Michigan electronic Field Office Technical Guide (eFOTG), G. Technical Tools, Nutrient Management, in the Nutrient Management References folder. Samples can be sent to the Michigan State University (MSU) Soil Testing Lab or any county Extension office.

  According to MSU Extension bulletin E2904, nitrate concentration between 450 and 2,000 ppm generally indicate good N use efficiency with optimum yields and limited residual soil nitrogen. Values below 450 ppm may indicate very efficient N use and optimum yields or a corn crop that ran short on N with some reduction in yield. Values above 2,000 ppm indicate more N was available than was necessary. Maintaining a database of stalk nitrate values from field to field and from year to year is a good way to fine-tune N management.

- Corn leaf tissue testing and analysis
  For corn leaf tissue testing using the **chlorophyll meter method**, follow the procedure given in the Nebraska bulletin, "Using a Chlorophyll Meter to Improve N Management." It is found in Section IV of the Michigan eFOTG, G. Technical Tools, Nutrient Management, in the Nutrient Management References folder.

For corn leaf tissue testing using **collected leaf tissue samples**, follow the procedure given in A&L Fact Sheet No. 34, "Plant Tissue Sampling of Row Crops". It is found in Section IV of the Michigan eFOTG, G. Technical Tools, Nutrient Management, in the Nutrient Management References folder. Contact the MSU Soil Testing Lab or any county Extension office for forms and information on submitting tissue samples.

A range for tissue N in corn between 2.90% and 3.50% is considered a sufficient concentration.

2. The following are plant tissue testing guidelines for other crops that require significant N inputs:

   - For vegetable crops, follow the tissue sampling procedure given in the Minnesota Extension Bulletin 5886, "Nutrient Management for Commercial Fruit and Vegetable Crops in Minnesota". It is found in Section IV of the Michigan eFOTG, G. Technical Tools, Nutrient Management, in the Nutrient Management References folder.

   - For potatoes, follow the guidance found in MSU Extension Bulletin E2779, "Nitrogen Management for Michigan Potatoes". It is found in the Nutrient Management References folder in the Michigan eFOTG, as referenced above.