Nutrient Management
Data Collection & Analysis for Adaptive Management
"Guided End-of-Season Stalk Nitrate Testing"

Indiana Job Sheet - 590 ***February 2011***

Definition – Nutrient Management

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

Purpose(s)

- To budget and supply nutrients for plant production.
- To properly utilize commercial fertilizers, animal manures and other materials as plant nutrient resources and soil amendments.
- To minimize agricultural pollution of surface and ground water resources.

What is guided stalk nitrate testing?

Guided stalk nitrate testing is a monitoring practice focused on the evaluation of nitrogen (N) management as an outcome based assessment. This evaluation allows N management practices and plans to be evaluated as to their effectiveness and gives general guidance for potential improvements.

When implemented in a coordinated strategy as part of a group or network, such as a watershed project, this practice will measure the relative benefits of various nutrient management strategies (rates, timing, forms, etc.) on a given field. Group evaluation across fields will then allow farmers and planners to evaluate and compare the results to make future management decisions.

Criteria - General

Producers will work with a network of conservation professionals to set up various nutrient management plots to evaluate different nutrient management strategies.

For each of the various fields or plots, the following data will be collected, analyzed and shared:

- Management data from the field for variables related to N management.
- Digital soil survey information.
- Aerial imagery to analyze nitrogen deficiency in the field.
- Spatial sampling locations
- Corn stalk nitrate test results.

Additional requirements:

- Data will be made available on a website in such a way that is anonymous and not spatially registered.
- The grower must participate in a non-public grower meeting to discuss results with other cooperators in the group.

End-of-the-season corn stalk nitrate test

This test is used to determine the N status of corn plants by measuring the nitrate concentrations in the lower portion of a corn stalk after physiological maturity (black layer). Research has demonstrated this test as useful in identifying cases of deficiency and excess N management for corn.

Defining guided sampling

The stalk nitrate test is useful for evaluating N management, but by itself may only represent the plants sampled. The term "guided" refers to using additional information to guide where the samples should be collected and how they may relate to the rest of the field beyond the actual sampling points.

Two data layers that are helpful in guiding where to collect stalk samples are color aerial imagery and

digital soil maps that represent different soil types within the field.

Aerial imagery

Nitrogen stress in corn affects the color of corn leaves and, therefore the canopy. Images taken from aircraft or by satellites can be useful in detecting color differences in corn fields. Differences in excess amounts of N are generally not detected. Often an aerial image of a field can be used to detect subtle differences in N stress within a field (to a resolution of a single row) and yet be useful in evaluating an entire field.

Example Image: The image below shows an aerial image collected at a 1 m resolution. The streaks from top to bottom are non uniform application of N.

A word of caution, factors other than N can affect crop color. While variation in the fields is often N related, it is also related to other differences such as water stress, disease, and growth differences by soil variation. This makes verification important to determine whether color variations are N related. Therefore, it's necessary to take stalk nitrate samples to verify the source of plant stress in the imagery.

Geo-referencing the imagery

Linking the actual latitude and longitude to an image is called geo-referencing. Geo-referencing permits the overlaying of multiple information layers on top of each other. An example would be overlaying soil survey information on top of an aerial image. This is also important when selecting the actual sampling locations so that a GPS can be used to find the appropriate location in the field.

Tools for point selection

Tools used for selecting sample points include remote sensing, GPS, and GIS mapping software. Computers with GIS make it easy to use aerial imagery and digitized soil surveys to pick the sampling locations. Soil survey information for the entire state is available at no cost on at http://soildatamart.nrcs.usda.gov/State.aspx. In addition, a number of other sources of geo-referenced imagery are available.

How to select sampling locations

In a typical field, select four different sampling locations. One sampling point is based on the color aerial image, trying to locate an area of the field that looks deficient. This sample is used to confirm the whether the color difference is N related. The other three sampling locations are guided by the soil map units. One sample is collected from each of the three dominant soil map units in the field. This pre-selection of varying soil map units will help reflect any N differences caused by soil variability.

A specific sampling point should be selected in an area that is uniform so errors in GPS and imagery registration will have minimal impact on linking the samples to the imagery and soils information. For example, don't pick points in an area on the edge of soil map units or in an area where the imagery identifies field variability less than 70 ft away.

How to collect the samples

Stalk samples can be collected after the corn plant has reached physiological maturity (black layer). By using the GPS to locate the sampling area, select at least two rows centered on the GPS guided location.

Sampling the correct location on the plant is critical. Eight-inch long sections, cut from 6 to 14 inches above the ground should be collected. Remove sheaths and leaves, as well as any soil before sending samples to the lab.

Depending on how the samples are to be used to represent a given location or a field, at least 10 stalks

should be combined for a single sample. Plants that are damaged or barren should not be sampled. In order to assure a random sample, pick a number like five, and then sample every fifth plant in the row. If the fifth plant is barren, damaged, before or after a planter skip or double planted, collect the next plant.

Collecting stalk samples after harvest

Collecting stalk samples after a field has been harvested is not an acceptable method for this activity.

Interpreting the results

Based upon research at Purdue, the following interpretation for a given sample is recommended:

- < 450 Low N availability
- 450 - 2000 Optimal N availability
- > 2000 Excess N availability

This interpretation refers only to a given sample and does not address the percentage of a field represented by a single sample. The comparisons of the multiple samples and the soil survey and aerial imagery should be used to make a determination of a field level outcome.

The results also refer to what the plant was able to take up, not the efficiency of a given practice. For example, a system that loses a lot of N can apply a lot of N, lose over half of it, and still result in an excess N status for a corn crop. The comparisons of N status of all the fields in a group along with the management data of what was applied must be used to compare the efficiency of the N applied.

It is important to realize that weather is a big factor. Making adjustments in nutrient strategies based upon one year of data is not recommended.

References

End of Season Stalk Nitrate Testing (Fact Sheet)
http://www.mo.nrcs.usda.gov/technical/nutrient_mgmt/out/Factsheet_GSS_RST.pdf

Cornstalk Testing to Evaluate the Nitrogen Status of Mature Corn (AY-322-W) Purdue Extension Service
http://www.agry.purdue.edu/ext/pubs/AY-322-W.pdf

Guided stalk sampling training video (Iowa Soybean Association On-Farm Network®)
http://www.isafarmnet.com/Tools/MattGSS/gss.html

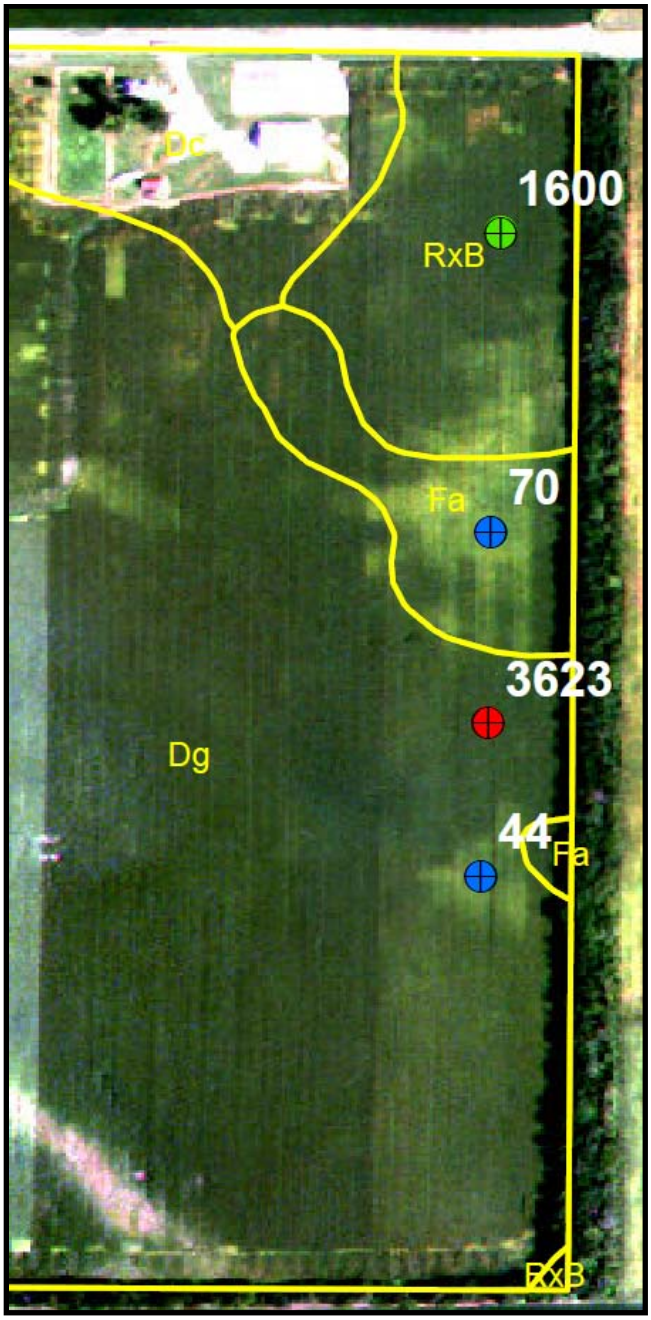

Image example: The image above illustrates four sampling locations in a field with an aerial image and the digital soil map units. Each point is color coded by N status and has the nitrate results in white.

Grower INFORMATION

First Name:	MI:	Last Name:	Company Name:	
Mailing address:		City:	State:	ZIP:
Home Phone:	Mobile Phone:	Email:		

Field & Equipment INFORMATION

Field Name:	Acres:	2009 Crop:	
County:	Township:	Section:	Quarter Section: ☐NE ☐SE ☐SW ☐NW
Tillage: ☐ No Till ☐ Fall Only ☐ Spring Only ☐ Both Fall and Spring ☐ Strip Till		Planting Date: / /2011	
Hybrid/Variety:			
If this field is corn following corn, how many years has this field been continuous corn including 2011? _____			
Is this field irrigated? _____			
Was a cover crop used?_____			

Nitrogen Source	Lbs of N/Acre	Nitrogen Source	Lbs of N/Acre
Starter NPK ___-___-___		NH3 82-0-0 (Fall)	
MAP 11-48-0		NH3 82-0-0 (Spring)	
DAP 18-46-0		NH3 82-0-0 (Sidedress)	
Was a variable rate used to apply MAP or DAP?		**Manure** _____-_____-_____	
Was a variable rate used to apply other forms of N?		Manure Type: ☐ Swine ☐ Beef ☐ Dairy ☐ Poultry	
Was N Serve, Instinct, Nutrisphere or Agrotain used on this field?		☐ Surface Applied ☐ Incorporated ☐ Injected	
UAN 28-0-0 (Spring Preplant) Incorporated ☐ Yes ☐ No		Manure Application Timing: ☐ Fall ☐ Spring	
UAN 28-0-0 (With Planter)		Gallons or Tons Manure/Acre: _____	
UAN 28-0-0 (Sidedress) ☐ Dribbled ☐ Injected		☐ Liquid ☐ Solid	
UAN 32-0-0 (Spring Preplant) Incorporated ☐ Yes ☐ No		*All fields are subject to approval. Grower agrees to allow field access to service providers for stalk sampling.*	
UAN 32-0-0 (With Planter)			
UAN 32-0-0 (Sidedress) ☐ Dribbled ☐ Injected		***Complete this form for <u>each field</u> and return to: _____.***	
UREA 46-0-0 Incorporated ☐ Yes ☐ No			
UAN with irrigation		**Note: please diagram division of any non-uniform practices within field boundaries or attach as-applied maps.**	

Notes:

USDA-NRCS is an Equal Opportunity Provider and Employer