Troubleshooting Fields Using Plant Analysis, Including Stalk Nitrate Testing

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Carrie Laboski

DEPARTMENT OF SOIL SCIENCE
University of Wisconsin-Madison

UW Extension

Photo: Sam Kweskin

STALK NITRATE TESTING

Sampling guidelines

- Samples should be taken 1 to 3 weeks after black layer
- An 8” segment of stalk should be taken from 6 to 14 inches above the soil surface, remove leaf sheaths
- Stalk segments from 15 plants make one sample
- A sample should not represent more than 20 acres
- If soil characteristics or past management practices vary across the field, then separate samples should be collected for each area.
- Stalks severely damaged by insect or disease should not be used

Sample handling

- Place sample in paper bags
- Samples should be refrigerated (not frozen) if they are to be stored for more than one day before shipping
- Contact your laboratory to confirm that they run the stalk nitrate test

Interpretation

Category	Nitrate-N concentration	Interpretation
Excessive	> 2000 ppm	High probability that N availability was greater than if fertilized according to UW-Extension guidelines
Optimal	700–2000 ppm	High probability that N availability was within the range needed to maximize profitability
Low	< 700 ppm	High probability that greater N availability would have resulted in increased yields

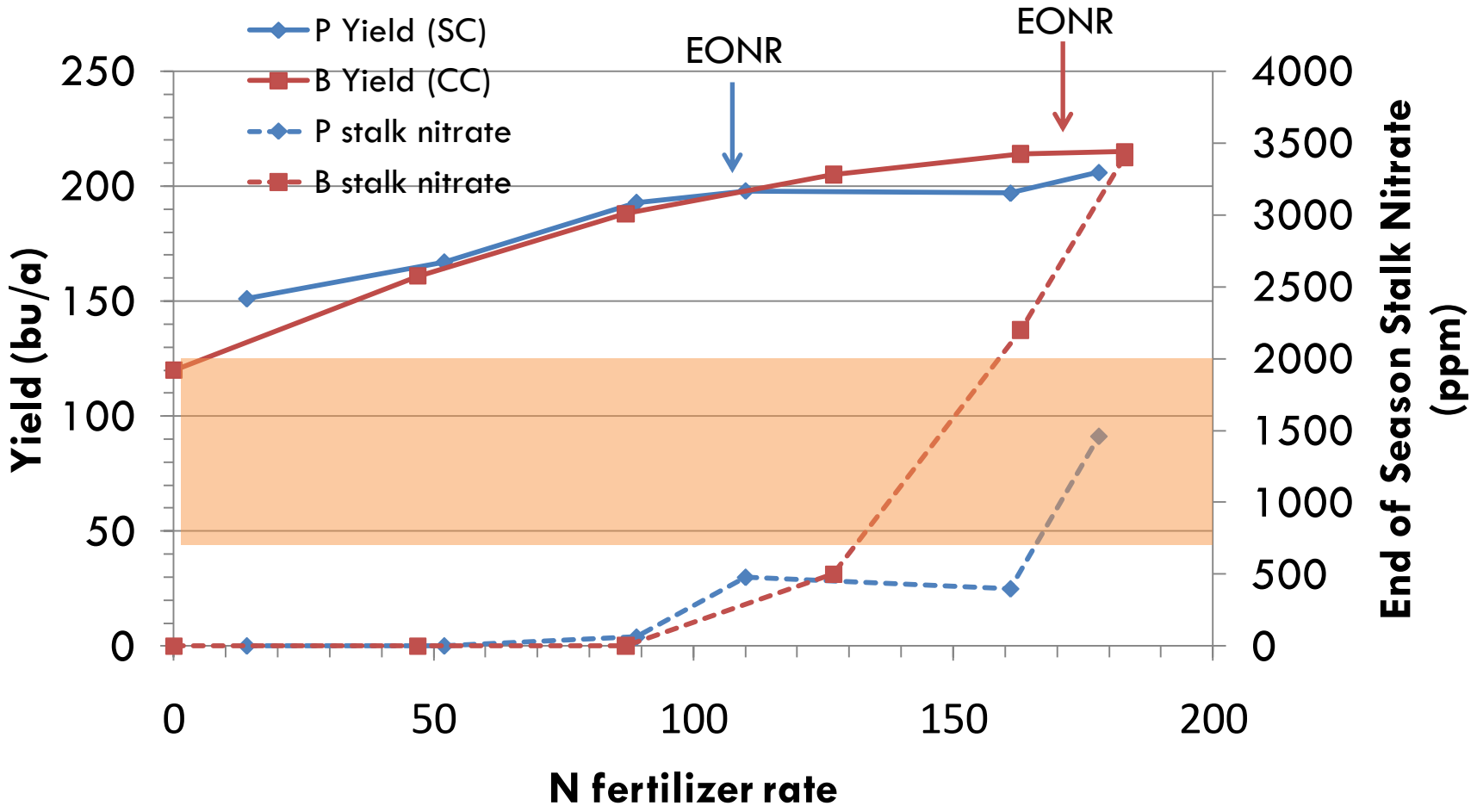
Limitations of stalk nitrate tests

- Identifies excessive and optimal N rates more accurately on medium yield potential soils compared to high yield potential soils
- Test may occasionally incorrectly indicate that excess N was supplied to fields with:
  - Recent (within two years) history of manure application
  - Alfalfa in the rotation
  - Particularly on high yield potential soils
- Test does not provide an indication of the amount of N that was over or under supplied
- Test can be impacted by weather
  - In extremely dry years, values tend to be high
  - Values tend to be low in an extremely wet year

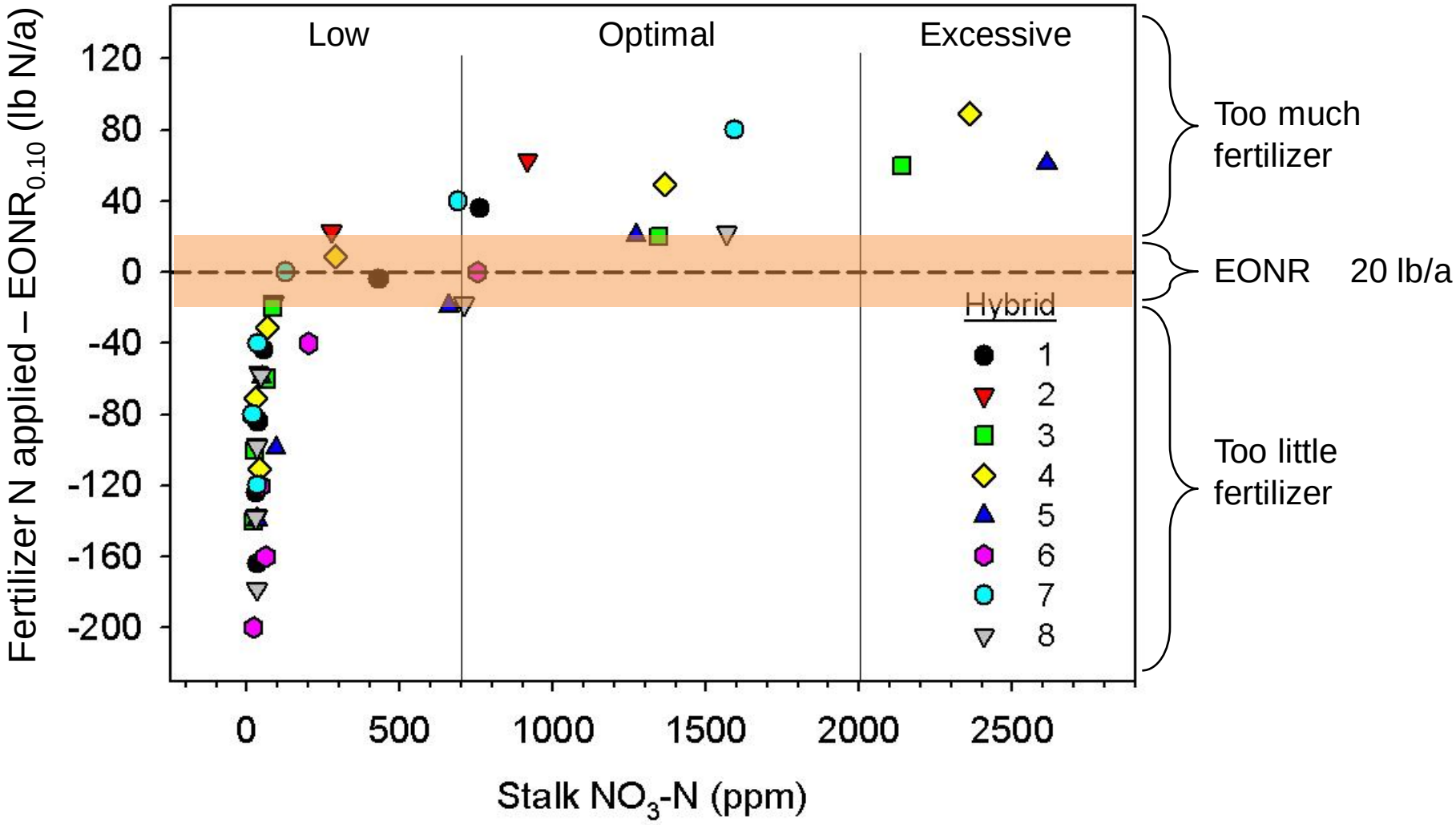
Accuracy of the end-of-season stalk nitrate test to categorize sites as having low, optimal, or excessive N rates on 49 medium and 49 high yield potential Wisconsin soils from 1992-1995

Soil yield potential	Stalk nitrate test category		
	Low	Optimal	Excessive
	% of sites correctly categorized		
Medium	60	92	71
High	75	56	63

2006 Dodge Co. stalk nitrate at MRTN plots



Influence of corn hybrid on late season stalk nitrate value for C-C at Arlington, 2010



Stalk nitrate summary

- Adequacy of any given N rate on a field is dependent upon environmental conditions
  - Basing future N rate decisions solely on 1 year's stalk nitrate values could result in poor decisions
- Stalk nitrate data collected over several years coupled with N management and growing season weather can be useful in determining if N fertilizer rates should be reduced to improve profitability

Photo credits: Todd Andraski

PLANT ANALYSIS

Plant analysis can:

- Confirm visual symptomology
- Assess a crop's response to applied nutrients
  - Where different treatments applied in the same field
    - Eg. strips with and without fertilizer added
- Determine the availability of nutrients
  - When a reliable soil test does not exist
  - Soil test calibration has not been completed
- Reveal early stages of nutrient deficiencies

Plant analysis as a diagnostic tool

- To be useful, must follow some guidelines

1. Take good notes

- Written notes
  - Describe any visual symptomology
    - Where on the leaf and plant do symptoms occur?
    - Where in the field do symptoms occur?
    - How do the roots look?
      - Are nodules active?
      - Signs of compaction?
  - Weather conditions past & current
  - Crop management practices
    - Eg. planting date, hybrid/variety, tillage, pest management, etc.
  - Field history
    - Crop rotation, manure application, past problems, etc.

1. Take good notes

- Sketch a map of the affected area noting:
  - Drainage, topography, soil color, soil texture, and other features that might affect plant growth
- Photographs
  - Include close-ups and panoramas document a point in time
  - In panoramic photos, try to include a landmark
- Mark the affected areas
  - Flags or GPS boundaries

2. Obtain plant & soil samples from normal & abnormal areas

- Comparison may be more useful than using plant analysis sufficiency interpretation ranges alone
  - Hybrids/varieties may vary in their sufficient level
- Soil samples help determine if nutrient deficiency is a result of low soil nutrients or weather/field conditions
  - Eg. K deficiency caused by compaction

Photo credits: E. Birschbach

3. Sample appropriate plant part for given growth stage & adequate sample number

- Tissue nutrient concentration generally decreases as the crop matures
- Sufficiency ranges & DRIS indices (somewhat) developed for a specific plant part sampled at a specific growth stage
  - Sample incorrect part or incorrect stage can result in incorrect interpretation
- Collect adequate number of samples
  - Needs to be representative of area
  - Needs adequate tissue for lab to analyze

3. Sample appropriate plant part for given growth stage & adequate sample number

Crop	Growth Stage	Plant Part Sampled	# of Plants
Alfalfa	Bud to 1st flower	Top 6”	30-40
Alfalfa	Harvest	Whole plant	15-20
Corn	12 inches	Whole plant	10-15
Corn	Pre-tassel	Leaf below whorl	15-20
Corn	Tassel to silk	Ear leaf	15-20
Corn	Ensiled/chopped	Whole plant	10-15
Soybean	Prior to or at initial flower	4th petiole & leaflet or 4th petiole only	20-25
Wheat	Tillering	Newest fully developed leaf	30-40
Wheat	Prior to heading	Newest fully developed leaf	30-40

4. Place sample in paper envelope & send to lab

- Plastic bags are not acceptable
- If soil has splashed onto plant bush it off
  - Do not wash
- Clearly lab sample
- Fill out sample submission form completely & accurately
  - Helps insure correct interpretations
- Contact lab in advance to obtain specific info.

5. Review plant & soil analysis results in conjunction with field notes

- Do the plant analysis results make sense based on field assessment?
- If no, or not sure
  - Call UWEX Co. Agent or a soil fertility specialist for assistance

Limitations of plant analysis

- Many of the previous guidelines developed because of limitations
- Remediation of nutrient deficiency not possible
  - Deficiency may have already caused yield loss
  - Crop may not respond
  - Crop may be too large
  - Unfavorable weather
- Sometimes, plant analysis can be a decision making guide for the next season's crop

Areas for agronomists to improve when sampling for plant analysis

- Submit soil samples with plant samples
- Submit paired (normal and abnormal) samples
- Sample soybean at appropriate growth stage

Photo credits: T. Andraski

When using plant analysis to look for potential problems

- Don't over interpret data
- Assess the bigger picture
  - Economics
  - Temporal/weather patterns effect on nutrient availability

Summary

- Plant analysis a helpful diagnostic tool if used properly
  - Follow sampling guidelines AND
  - Thoroughly research field history
- Remember plant analysis is NOT a substitute for a consistent soil sampling program

Photo credits: E. Sneller