

Using The Illinois Soil Nitrogen Test To Predict Optimum Nitrogen Rates For Corn In Wisconsin

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Outline

- Background of the Illinois soil nitrogen test (ISNT)
- Results of the Illinois soil nitrogen test
- Role of amino sugars in soil
- Other organic N fractions in soils
- Results of organic N fractions measured in soil hydrolysates
- Conclusions



Background of the Illinois soil nitrogen test

- Developed in the late 1990's by University of Illinois researchers
- Use of *low-tech* Mason jars and electric pancake griddles
- Low temperature, alkaline digestion
- Diffusion of NH_3 from alkaline digestion
- Titration or colorimetric determination of NH_3 -N sorbed by acid solution

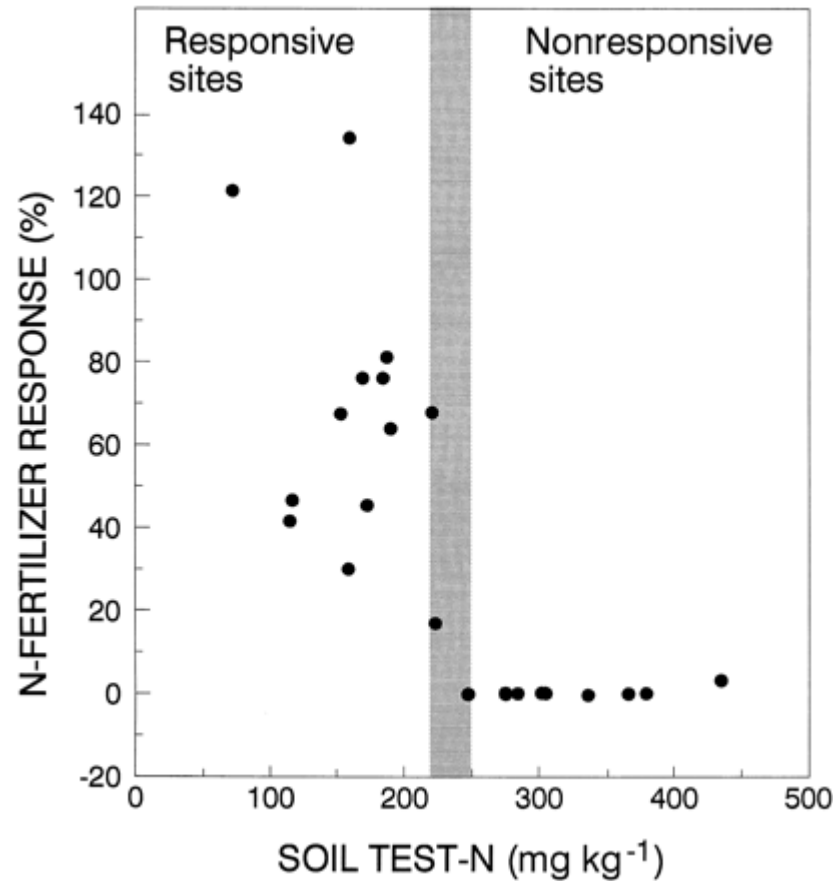


Background of the Illinois soil nitrogen test

- Results showed a relationship between soil amino sugar-N and N-fertilizer response
- Strong correlation of ISNT values to soil amino sugar-N values
- Identified an ISNT critical value of 225 ppm, above which no response to N fertilizer was observed



Background of the Illinois soil nitrogen test



Khan et al., 2001

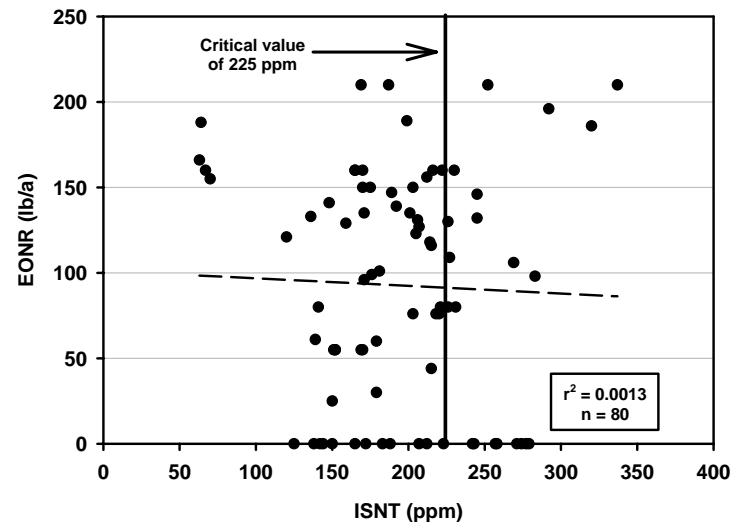


Results of the ISNT



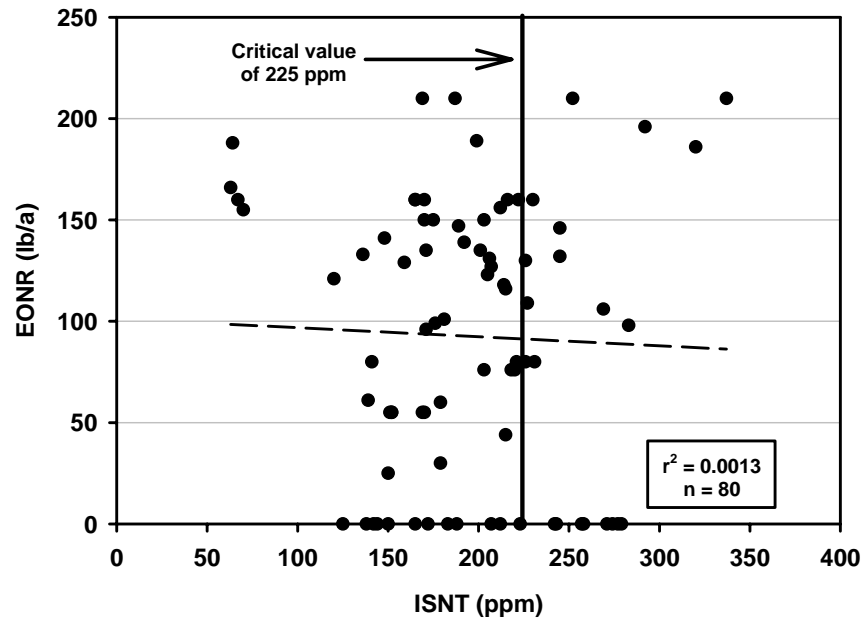
Relationship of ISNT values to economic optimum N rates in Wisconsin

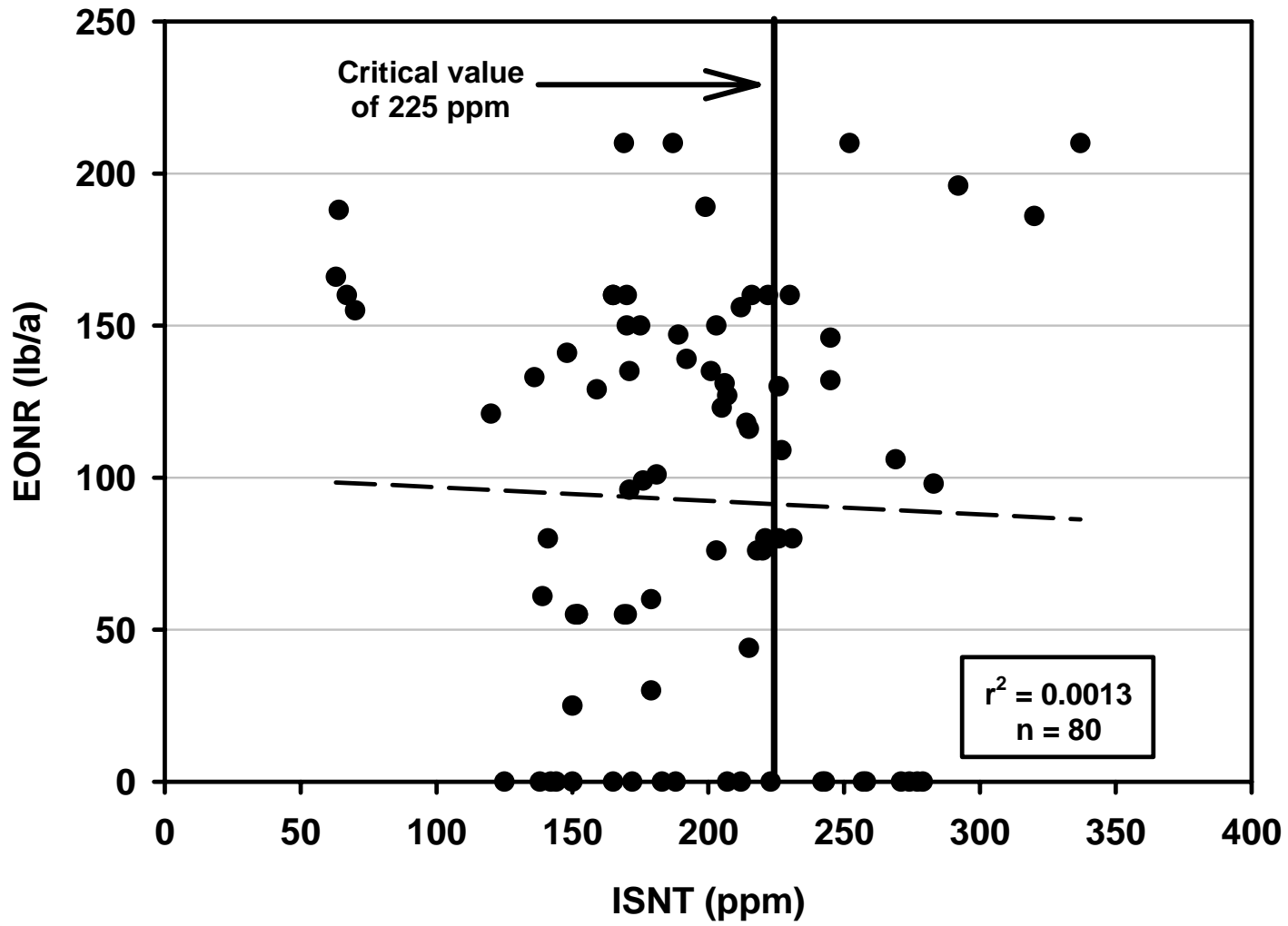
- Poor relationship of ISNT values to economic optimum N rates (EONR) over a wide range of:
 - growing seasons
 - crop rotations
 - management histories
- Experimental sites had a wide range of anticipated and observed N response



Results with the Illinois soil nitrogen test in Wisconsin

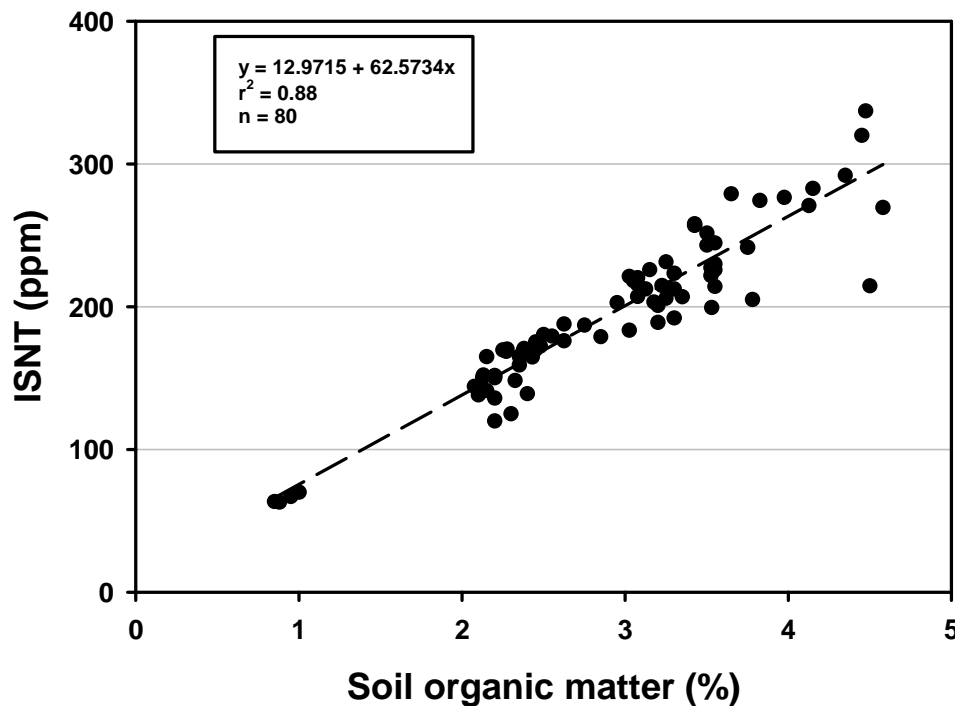
- Critical value of 225 ppm did not separate responsive from non-responsive sites





Relationship of ISNT to soil organic matter

- Strong correlation of ISNT values to soil organic matter (SOM) shows that the ISNT is measuring a constant fraction of soil organic N rather than a readily mineralizable N pool



Role of amino sugars in soils



Role of amino sugars in soils

- Occur in soils as mucopolysaccharides
- Closely related to the microbial biomass associated with N mineralization
- Elevated amino sugar levels in fields with legume and manure histories



Nitrogen fractions in soil hydrolysates



Nitrogen fractions in soil hydrolysates

- Hydrolyzable organic N fractions
 - $\text{NH}_4\text{-N}$
 - Amino sugar-N
 - Amino acid-N
 - Total hydrolyzable-N
 - Unidentifiable hydrolyzable-N



Background of soil hydrolysates

- Early analysis of hydrolysates used steam distillation methods
- Errors in early steam distillation methods underestimated amino sugar-N and amino acid-N
- Diffusion methods developed by Mulvaney and Khan (2001) corrected the low recovery of these two fractions



Results of soil hydrolysate analysis



Results of soil hydrolysate analysis

- Weak correlation of all fractions to N-fertilizer response
- Amino sugar-N had a poor relationship to N-fertilizer response



Relationships between soil organic N fractions and corn response to N fertilization†

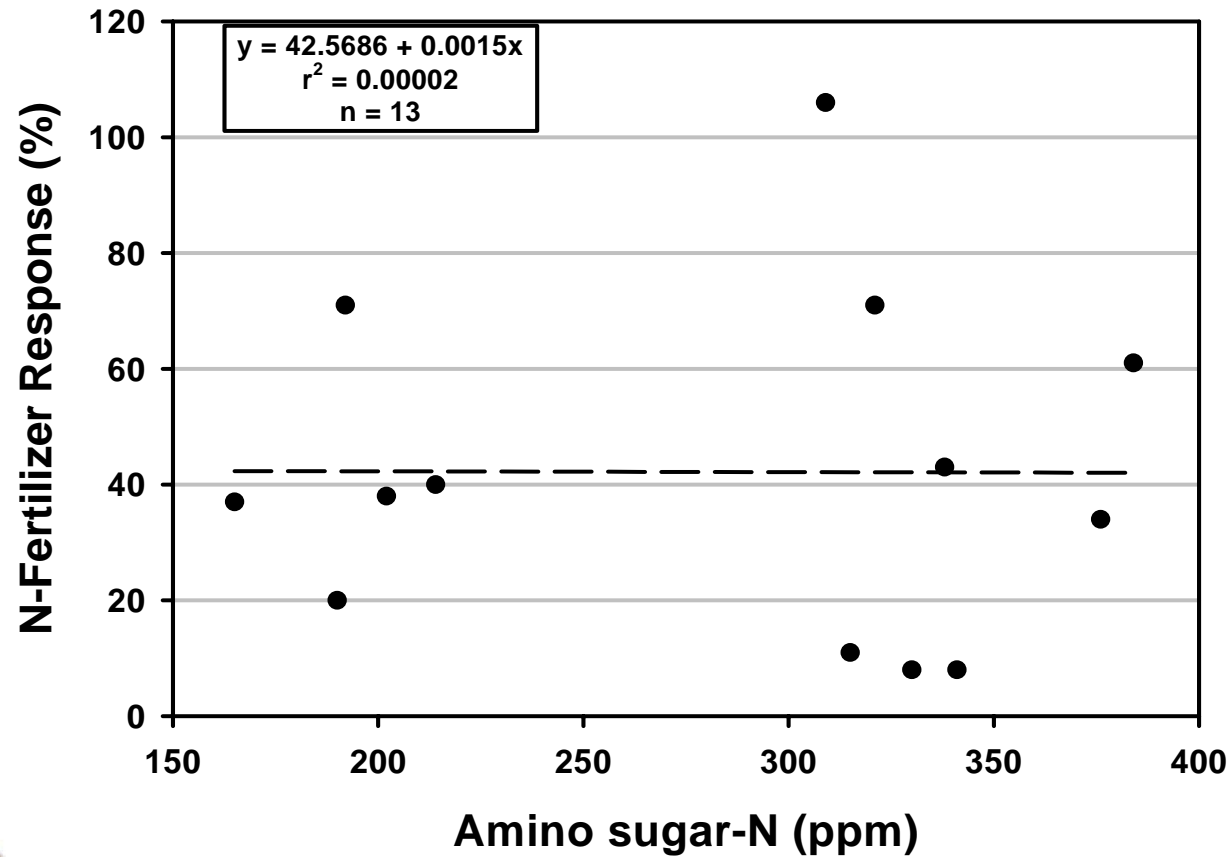
N-Fraction	r^2	$p > f ‡$
Total hydrolyzable N	0.0033	0.8517
NH ₄ -N	0.0126	0.7153
NH ₄ +Amino sugar-N	0.0039	0.8384
Amino sugar-N	0.0000	0.9898
Amino acid-N	0.1039	0.2835

† Corn response to N fertilization is defined as: $100 \times [(\text{maximum yield} - \text{control yield}) / \text{control yield}]$; where maximum yield occurs with a non-limiting N fertilizer rate.

‡ $p > f$ = probability that tabular f ratio exceeds f ratio calculated by analysis of variance.



Relationship of amino sugar-N to N-fertilizer response



Conclusions



Conclusions

- ISNT does not correlate with EONR
- ISNT does correlate strongly with SOM
- Amino sugar-N does not correlate with N-fertilizer response
- Other hydrolyzable-N fractions do not correlate with N-fertilizer response
- ISNT is not a practical tool for use in Wisconsin corn production



Thank you

Any questions?

