Managing N Under a New Paradigm: High Grain & High N Prices

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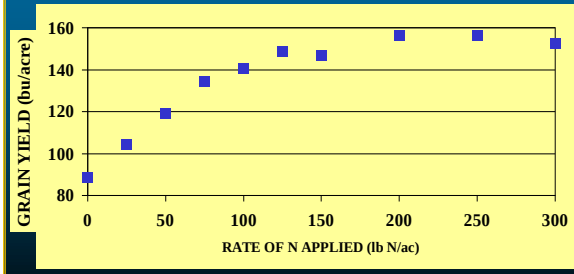
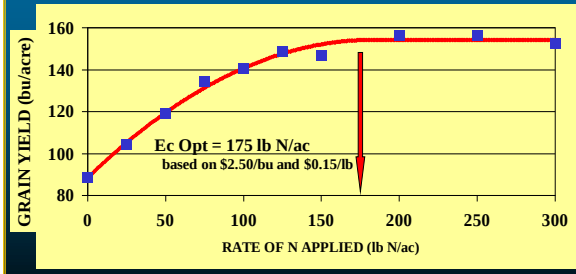
Nitrogen Recommendations

1) How much N should be applied?
2) Economic Optimum Rate (Ec Opt)
3) Point where the last increment in N applied is paid for by the increment of increased yield
4) < Ec Opt = not maximizing returns
5) > Ec Opt = waste of money
6) Economic Optimum ≠ Maximum yield
7) How is Economic Optimum determined?

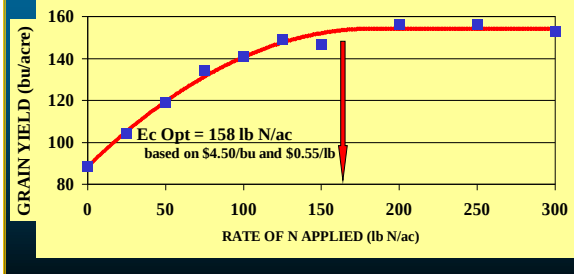
Economic Optimum N Rate



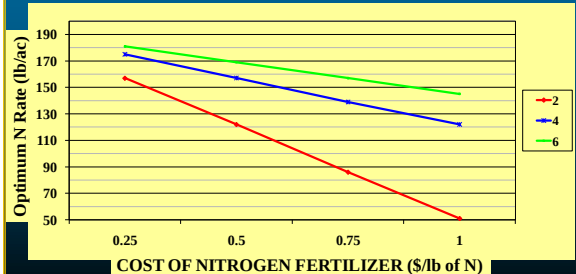
Economic Optimum N Rate

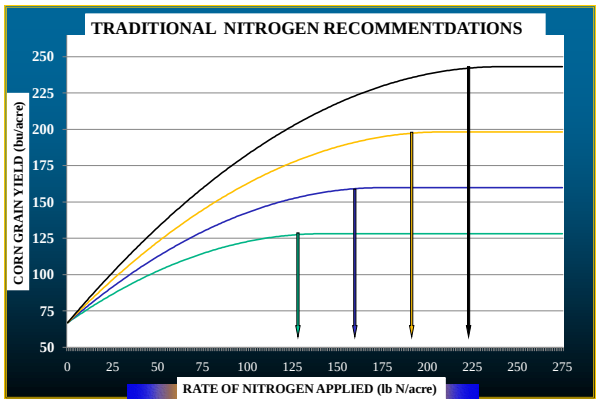


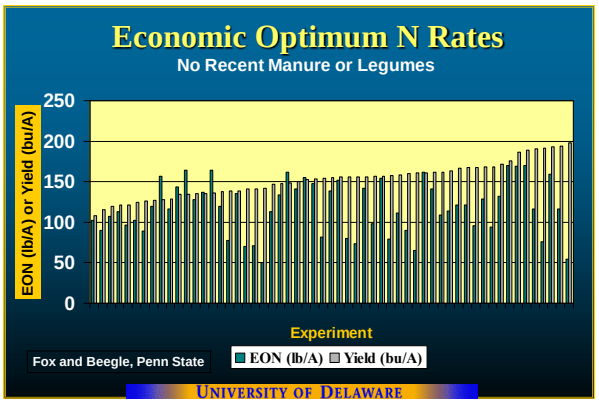
Economic Optimum N Rate

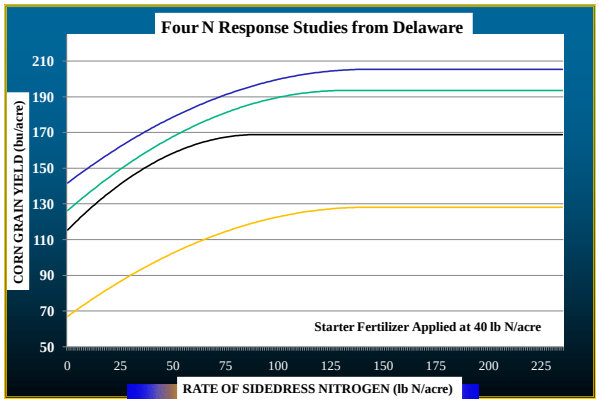


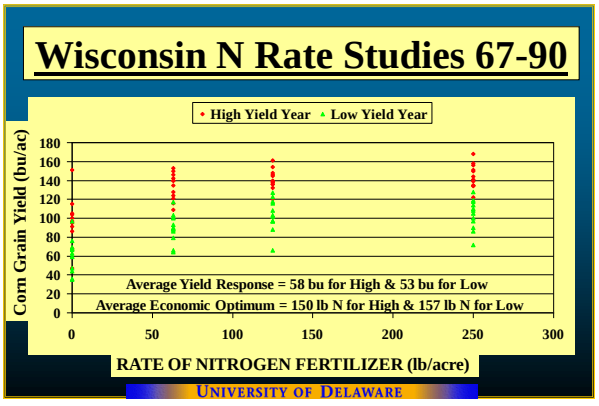
Economic Optimum N Rate

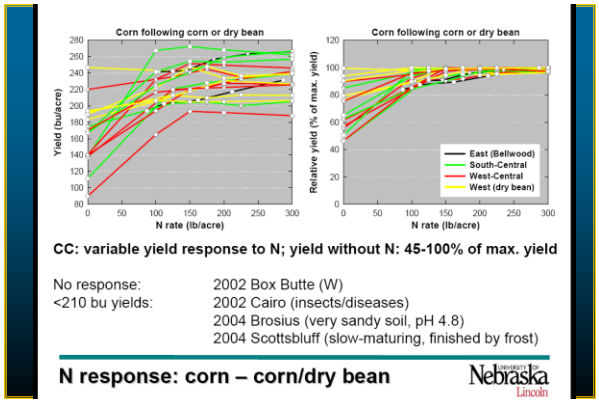








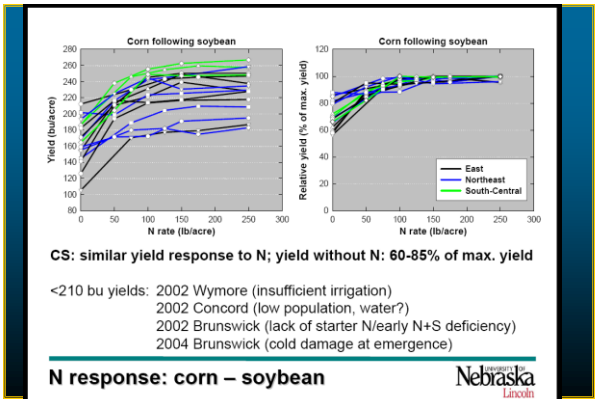




CC: variable yield response to N; yield without N: 45-100% of max. yield

No response: 2002 Box Butte (W)
<210 bu yields: 2002 Cairo (insects/diseases)
2004 Brosius (very sandy soil, pH 4.8)
2004 Scottsbluff (slow-maturing, finished by frost)

N response: corn – corn/dry bean



CS: similar yield response to N; yield without N: 60-85% of max. yield

<210 bu yields: 2002 Wymore (insufficient irrigation)
2002 Concord (low population, water?)
2002 Brunswick (lack of starter N/early N+S deficiency)
2004 Brunswick (cold damage at emergence)

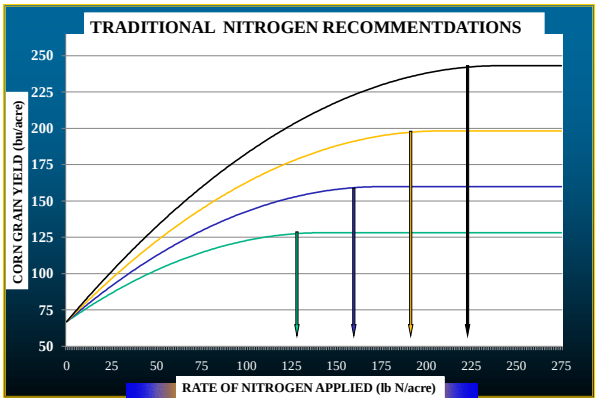
N response: corn – soybean

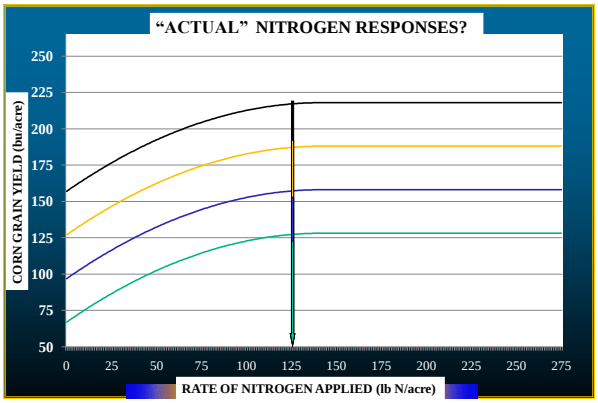
	Average	Min.	Max.	
SOM (%)	2.3	0.7	3.4	
pH	6.5	4.8	8.1	
Bray-P (ppm)	24	5	84	13 <= 15 ppm
Olsen-P (ppm)	14	3	44	16 <= 10 ppm
K (ppm)	432	93	696	2 < 125 ppm
NO_3-N (ppm)	4.4	0.8	8.9	10 >= 5 ppm
0-N yield (bu/acre)	166	90	247	
0P yield (bu/acre)	224	165	276	
0-K yield (bu/acre)	231	183	279	
Max. yield (bu/acre)	233	182	275	14 > 240 bu

Averages and ranges across all 34 site-years.
Soil properties: 0-8" depth or 4-ft sample (NO_3-N)

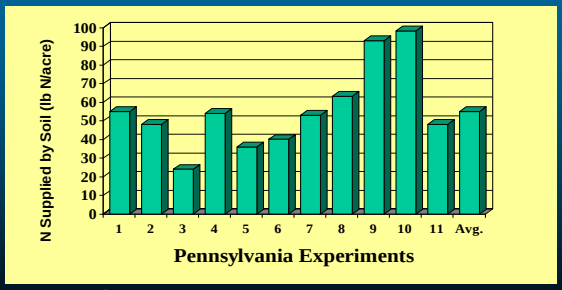
NSFP site ranges

Nebraska





N Supplying Capacity of PA Soils



Source: Beegle & Fox, Penn State University

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What Should We Do?

1) Most Data Suggests Need ~150 to 175 lb N/ac
2) Take Credit for "Other N Sources"
3) Other N Sources: Animal Manure, Legumes, Crop Rotation, N in Irrigation Water
4) Maximize NUE (Nitrogen Use Efficiency)
5) NUE is maximized through TIMING, PLACEMENT, and Nitrogen ENHANCERS
6) Use Diagnostic Tools: PSNT, LCM, CSNT, RS

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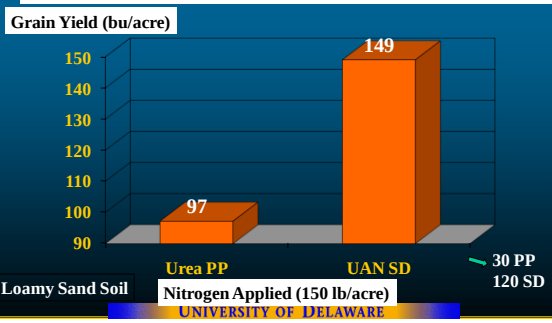
Time of Application (2005)



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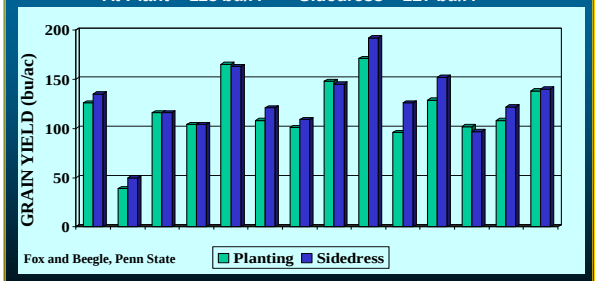
Time of N Application

At-Plant = 118 bu/A Sidedress = 127 bu/A



Avoid Leaching & Denitrification with Sidedressing

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Manure as an N Source

1) Fertilizer costs have greatly increased value
2) Still difficult to know manure credit
3) Book values are good starting point for estimating N credits…BUT…to maximize value...
4) Manure credits should be fine-tuned on a site-specific basis using diagnostic tools
5) These tools include: PSNT, LCM, CSNT, RS
6) Increased value = greater incentive to haul

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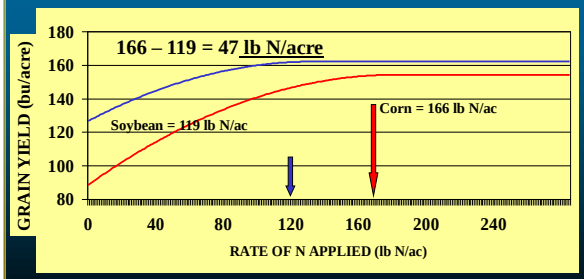
Rotating with Soybeans, etc.



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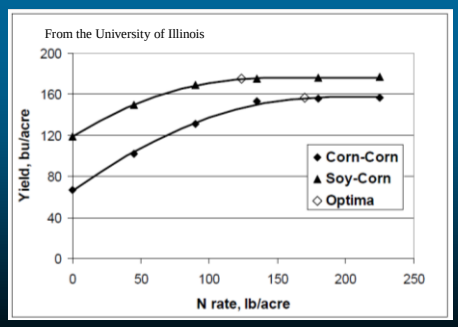

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NITROGEN TECHNOLOGY

1) Products designed to improve NUE
2) Nitrification Inhibitors
3) Urease Inhibitors
4) Slow Release Products

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NITRIFICATION INHIBITOR

1) Conversion of Ammonium to Nitrate
2) $NH_4^+ + 2O_2 \Rightarrow NO_3^- + H_2O + 2H^+$
3) Biological Process
4) Nitrification is temperature dependent
5) NI inhibitors SLOWS DOWN conversion
6) Examples: N Serve; Agrotain Plus; Super U; Nutrisphere-N?

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Urease Inhibitors

1) Urease is the enzyme that breaks down urea
2) Urea ($NH_2 – CO – NH_2$) => NH_4 Carbonate
3) NH_4^+ in a high pH environment goes to $NH_3(g)$

$NH_4^+ <=> NH_3(g) + H^+$

4) Urease inhibitors keep N as urea until in soil
5) If urea gets into the soil (rain or tillage), then there is no need for a urease inhibitor
6) Examples: Agrotain, Agrotain Plus, Super U, & Nutrisphere-N?

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NITROGEN TECHNOLOGIES

1) Agrotain = urease inhibitor
2) Agrotain Plus = urease + nitrification inhibitor
3) Super U = urease + nitrification inhibitor
4) Nutrisphere-N = urease + nitrification inhibitor?
5) ESN = polymer-coated urea fertilizer
6) N Serve = nitrification inhibitor

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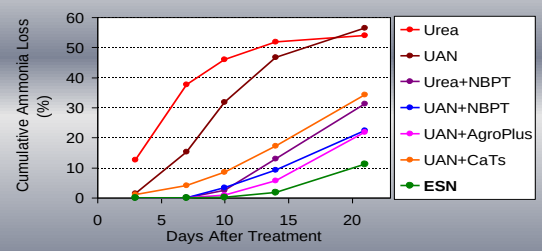
ESN/Agrotain Ammonia Losses



Source: Dr. W. Thornberry, Sturgis, KY; Dr. S. Ebelhar, Univ of Illinois
Laboratory incubation

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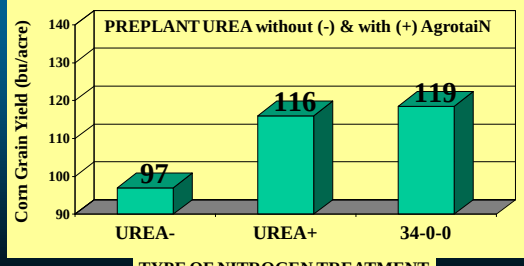
PA Study (Fox & Piekielek, 1993)



3-year study

Avg. 100 + 150

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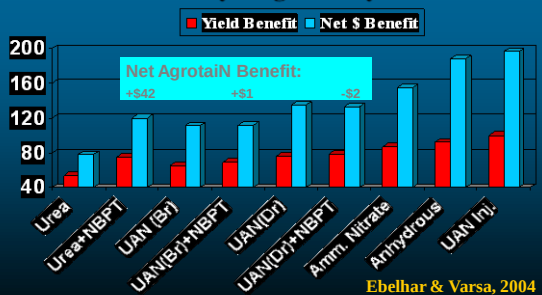
N Sources for No-till Corn

Summary: Eight Site-years

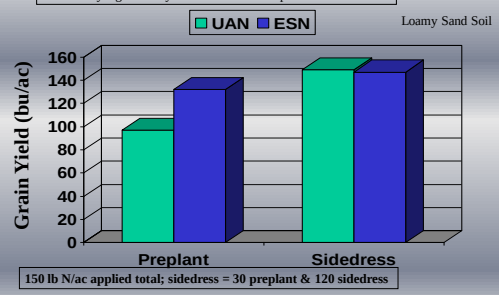


Ebelhar & Varsa, 2004

Yield and Net $ Benefit compared to check treatment.

Delaware: Irrigated Corn in 2005

Statistically significant yield differences except for SD treatments



150 lb N/ac applied total; sidedress = 30 preplant & 120 sidedress

All treatments incorporated; rainfall was near-normal

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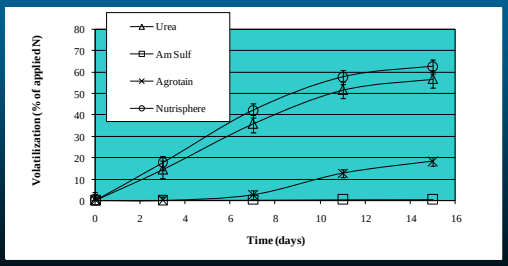
ESN Application on Bare Soil

Ammonia volatilization of urea, ammonium sulfate, Agrotain, and Nutrisphere applied to a Dewitt silt loam soil in an lab-incubation study at 25°C



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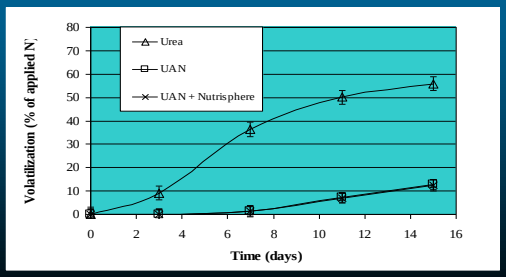
Ammonia volatilization of urea, UAN and UAN + Nutrisphere applied to a Dewitt silt loam soil in an lab-incubation study at 25°C



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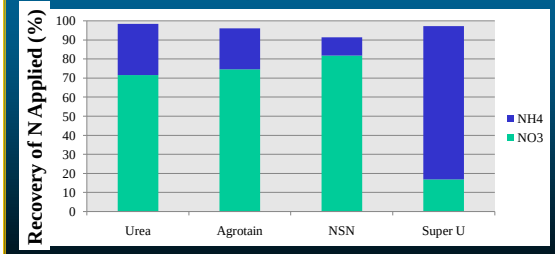
Effect on Nitrification (14-day incubation)



Rick Norman, Univ. of Arkansas

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DIAGNOSTIC TOOLS

1) The value of these tools becomes greater and greater as the cost of N increases

2) PSNT = tool to quantify manure N release

3) LCM = tool to determine N status

4) CSNT = tool to evaluate the N status during the entire growing season…how'd we do?

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Late Season Stalk Nitrate Test

- Excellent postmortem assessment of N management
- Procedure
  - Sample between ¼ milkline and 3 weeks after black layer
  - 8" piece of stalk 6" above the ground
  - PSU and other labs = $10/sample
  - Optimum 700-2000 ppm NO_3-N

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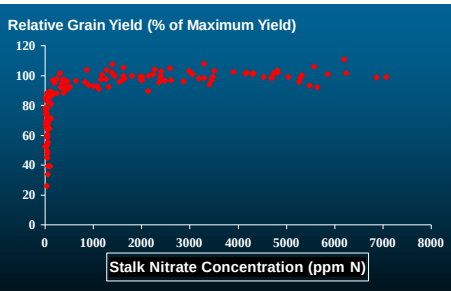
Yield vs. Stalk Nitrate



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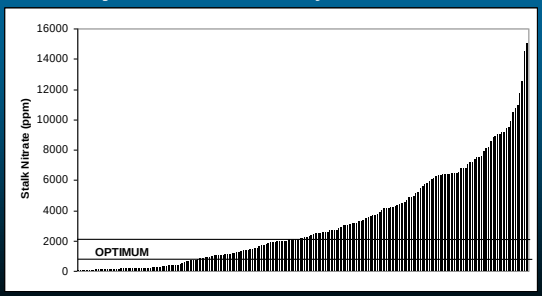
End of Season Stalk Nitrate Test Summary

262 Samples from PA Consultant Project from 2000 thru 2003



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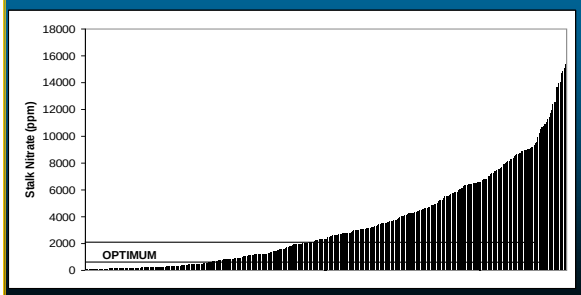
End of Season Stalk Nitrate Test Summary

417 Samples from Penn State Soil Test Lab in 2004



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SUMMARY

1) Optimal N rate is NOT equal to yield potential
2) Corn usually requires about 150 to 170 lb N/ac
3) New technologies have greater value when N is expensive and should be considered under correct situations (i.e., broadcasting urea)
4) Evaluate new products (i.e., like a new hybrid)
5) Site specific management using diagnostic tools has never been more important because of the costs required to apply fertilizer nitrogen!

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