Leaving Yield Goal and Soil Test N Based Fertilization Behind

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Outline

• Tradition
• Ultimate Goal
• Nitrogen “It’s Alive”
• Yield Goals
• Reference Strips
• Case Studies
4 R’s

1. Right Source
2. Right Place
3. Right Rate
4. Right Time

IPNI: International Plant Nutrition Institute
Tradition?

Soil Fertility
We Solve your problems with a Big Stick!!
Consistent Yield and Response

Exp. 502, 1971-2009

Ave Yld 42 bu/ac
N Need (Theoretical)

Exp. 502, 1971-2009

Optimum N Rate
Avg. 51 lb N/ac +/- 39

Max Yield
Avg. 44 bu/ac +/- 15

N need determined by N-up 112 – N-up check * 50% efficiency
EONR

Exp. 502, 1971-2009
Optimum N Rate
Avg. 59 lb N/ac +/- 34
EONR

- Often set as the rate that is correct 90-95% of the time.
- Minimal risk of not reaching maximum yield
- Economics
- Environment
## EONR over 10yrs

### Econ Optimum N Rate, lb/ac Over 10yrs

<table>
<thead>
<tr>
<th>Year</th>
<th>Econ Opt N Rate (lb/ac)</th>
</tr>
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<tbody>
<tr>
<td>2000</td>
<td>80</td>
</tr>
<tr>
<td>2002</td>
<td>20</td>
</tr>
<tr>
<td>2004</td>
<td>100</td>
</tr>
<tr>
<td>2006</td>
<td>60</td>
</tr>
<tr>
<td>2008</td>
<td>120</td>
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</table>

### N-Rate Frequency and % Occurrence

<table>
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<tr>
<th>N-Rate</th>
<th>Freq.</th>
<th>% Oc.</th>
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<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>80</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>100</td>
<td>3</td>
<td>30</td>
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</table>
Ten Yr Yields

Exp. 502, 2000-2009

Average Yield bu ac⁻¹
0-40-60 39
20-40-60 44
40-40-60 49
60-40-60 53
80-40-60 55
100-40-60 57
Observations

• Four Key Ingredients
  – Planting Date
  – Moisture @ sowing
  – Moderate temperatures during anthesis
  – Moisture from flowering to grain fill.
• 1 missing ingredient equaled Ave. yield
• 2 missing ingredients sig lower than Ave.
The Nitrogen Cycle
Nitrogen

• Additions
  – N$_2$ Fixation, Industrial, Fertilizer, Decomposition, Rainfall and Lightning

• Losses
  – Leaching, Denitrification, Ammonia Vol., Plant Loss

• OM
  – 1,000 lbs N / 1% OM / 6in soil
  – Mineralization, Immobilization
Reference Strips

- **What:** A high rate of N applied in, across, through, over or under each and every field.
- **How Much:** Minimum of 125% of yield goal recommended rate, this includes residual and preplant.
- **How and Where:** 10 to 100 ft wide, anywhere representative.
- **When:** Winter crops; before or after sowing (1+ months), Summer crops; before or immediately after planting.
Reference Strips

• Are Very Visual..
• BMP?
• Risk Aversion?
• Sales and Service?
Optical Sensors

• Numerical describe the crops BIOMASS.
• DOES NOT really WORK WITH OUT A REFERENCE.........
• Multiple options
  – Companies
  – Resolution
Optical Sensors
Yield Prediction

SBNRC (YP0*RI =YPN)
100 Pre (100 lbs N/ac applied preplant)
Sensors and No-till

- There is no cookie cutter recipe
- No Text Book
- Learn from others Mistakes
- Adopt to your farm, soil, machinery, management and mindset.
- Do not go 100% the first year, but put out 100% of the strips.
- Art
Technology LEAPS

• Hood/Tires ➔ light bar ➔ AutoSteer
Case Studies

• Experiences with Reference Strips and Optical Sensors
  – Soil Type Changes
  – Past Practices
  – Warm Moist Winters and Springs
  – Cold Dry Winters
Corn, Soil Type

• Situation  40 acres, two soil types.
  – 30 acres of fine soil 10 acres are sandy.
• N-Rich strip across the field and soil types.
• Visual difference.
  – Heavy 20 lb N, Sand 60 lb N.
• Producer applied 40lbs
  – Knowingly over applied on 30 and under on 10.
The producer had recently began farming 160 ac field that previously was farmed as two independent fields, each with a different history. The producer owns a commercially available sensor based variable rate applicator. At planting the producer placed an N-rich strip in the field and took NDVI measurement prior to top-dress. The producer had expected to apply approximately 50 lb N ac\(^{-1}\), the actual applied average N rate was approximately 45 lbs N ac\(^{-1}\). When the application map created by the software was reviewed there was a significant difference in average N-rate and a definite break that occurred in the middle of the field. On the west 60 only 40 lbs N ac\(^{-1}\)was applied while the east half received 60 lbs N ac\(^{-1}\). Without the benefit of the reference strip in optical sensor technology the producer would have likely over applied N to 60 ac and lost a significant amount of yield on the remaining 60 ac.
Wheat, Past Practice

• Situation 160 ac, previously farmed as 2 80’s.
• Utilized RT-200 variable rate applicator
• Planned application of 50 lbs N ac-1
• Applied a total of 45 lbs N ac-1
• Two 80’s:
  - West 80: 36 lbs N  East 80: 57 lbs N
1. Moldboard Plow
2. Canola
3. N/T Wheat
4. 2005 N/T Wheat (06-07)
5. Muddled out wheat for seed /Full cultivation
6. Spring Corn
7. Wheat

1. Moldboard Plow
2. Wheat (Was hayed/no residue)
   Cultivated Beans
3. Deep rip Fallow
4. Corn
5. N/T Wheat (06-07) Not harvested
6. Spring Corn (Wet)
7. Wheat
March 7, 2009
98 GDU > 0
SE of Billings, OK  Applied Rate

Gallons/Acre

- Above 20,999: 0.00 ac
- 18,000 - 20,999: 62.78 ac
- 15,000 - 17,999: 71.01 ac
- 12,000 - 14,999: 13.80 ac
- 9,000 - 11,999: 0.00 ac
- 6,000 - 8,999: 0.00 ac
- Below 6,000: 0.00 ac
Wheat, Immobilization

• Large Scale Replicated SBNRC trial,
  – Three Trts: No Top, Farmer Pract., SBNRC, 60’*400’ plot size
  – Preplant Soil Test 45 bu yield goal: 35 lb N rec.
    • 100 lbs DAP pre-plant, 18 lbs N leaving 17 lb N topdress
  – N-Rich Strip very visible
    • Producer upped his rate to 33
    • SBNRC 59 lb N ac rec
    • 29 bu/ac and 37 bu/ac respectively
Results

Mach Canadian Co Cont Wheat

FP = $129.9
SBNRC = $155.15
Difference = $25.25
Wheat, Mineralization

- Large Scale Replicated SBNRC trial,
  - Three Trts: No Top, Farmer Pract., SBNRC, 60’*400’ plot size
  - Dual Purpose After, 2 yrs out of Alfalfa
  - N-Rich Strip not visible
    - Producer rate of 60
    - SBNRC 7 lb N ac rec
    - 59 bu/ac and 61 bu/ac respectively
Results

Linley Barber Co. Ks Cont Wheat

FP= $263.90
SBNRC = $300.27
Difference= $36.37
Corn, Mineralization

- Large Scale Replicated SBNRC trial,
  - Three Trts: Farmer Pract., SBNRC, VRT, 60’*400’ plot size
  - Missouri River Bottom
  - N-Rich Strip not visible
    - Producer rate of 235
    - SBNRC 115 lb N ac rec, VRT average 83 lb N ac-1
    - 195 bu/ac, 190, and 190 bu/ac respectively

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Avg Profit</th>
<th>Avg Yield</th>
<th>Total N-rate (lbs/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer Practice</td>
<td>699</td>
<td>195</td>
<td>235</td>
</tr>
<tr>
<td>SBNRC Flat Rate</td>
<td>719</td>
<td>190</td>
<td>115</td>
</tr>
<tr>
<td>RT-200 VRT</td>
<td>732</td>
<td>190</td>
<td>83</td>
</tr>
<tr>
<td>N-Rich</td>
<td>689</td>
<td>209</td>
<td>420</td>
</tr>
</tbody>
</table>
Thank you!!!