Nitrogen loss and Late-season N application for corn

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Four wet springs...
Outlined areas > 16 inches rain April-June
...Four years with about 500 million bushels of corn lost EACH YEAR due to N deficiency
Central Illinois
Southern Iowa
This field got 150 lb N/acre as NH$_3$ in very late November (+ DAP)
Yield maps: yellow corn yields poorly

Average yield loss = 45 bu/acre
Total yield loss = 11,925 bu
(45 bu/ac x 265 acres)
Total economic loss = $44,720
(11,925 bu x $3.75/bu)
Southern Indiana
Eastern Illinois
Eastern Illinois
More images of N deficiency on my website

• On my nitrogen loss page:
  [http://plantsci.missouri.edu/nutrientmanagement/nitrogen/loss.htm](http://plantsci.missouri.edu/nutrientmanagement/nitrogen/loss.htm)

• Currently images from 2009 and 2010 are available

• Images from 2008 will be posted in the future

• Grouped by nearest town
Plan B

- What will I do if we get enough rain to cause N loss?
  - Diagnosis & decision
  - Application

- Every producer should have a plan!
- Consultants and retailers should too!
Can rescue N really work?
Yield response:
- 28 bu where stress is visible
- -2 bu where no stress is visible
Rescue N

- Yield response can be large
- Rescue applications can be late (7 foot corn in example)
- Size of yield response is related to corn color in aerial photographs
On-farm rescue N demonstrations
On-farm rescue N demonstrations

- Fully fertilized fields but producers concerned
- N applied anywhere from thigh-high to tassel
Rescue N outcomes

- 11 tests, average yield response 34 bu/acre
- Yield response depended on visible stress
  - High stress: 57 bushels (2 tests)
  - Medium stress: 41 bushels (5 tests)
  - Low stress: 14 bushels (4 tests)
- How late is too late?
  - Six tests in 2010, all applied at tassel, ave 34 bu
  - Give up by 2 weeks after tassel
Rescue N in Illinois: 37 bu
Supplemental N—how late?

Easily until tasseling

Probably until 2 weeks after tassel if deficiency is severe

growth stage of single or main N applic.
N timing in Indiana 2010

Grain Yield (bu/acre)

Total N Rate (lbs N/acre)

V7 Sidedress

V15 Sidedress

Pre and Post Plant Application

+104 bu/acre

-13 bu/acre
Diagnosis

• N Watch feature on my website

• Remote sensing
  – Quantify potential yield loss
  – Prioritize fields (how severe?)
  – Diagnose a lot of fields quickly
  – Not until corn is waist high

• Computer models (Adapt-N in New York)
  – More regional, less accurate
  – Can diagnose the problem earlier
Nitrogen watch

• On my Nitrogen Loss web page
  – http://plantsci.missouri.edu/nutrientmanagement/nitrogen/loss.htm

• Updated weekly from late April (or early May) until the end of June

• Tracks rainfall totals, identifies areas at risk for N loss
Nitrogen watch: example
What does the farmer need?

1) An assessment of which fields need supplemental N the most
2) An assessment of how much effort it’s worth to get supplemental N applied (sprayer conversion or arranging custom N)
3) How many $ am I losing?
4) How much N should I apply?

Best tool: remote sensing
N need in Central Illinois
Diagnosing yield loss

June 24 aerial photo

Yield loss map predicted from June 24 aerial photo

Yield loss map based on yield monitor data (September 30)
NVision: quantitative decision support

aerial photo

yield loss map (ave 74)

N rate map: fix the problem

Will rescue N pay?
Can it be done?

• Assessing potential yield loss due to N stress: YES
• Getting profitable response to late or rescue N applications: YES
• Assessing N rate needed: YES
• Getting late N applied to most fields in a region where N loss has occurred: MAYBE
So if we know we need more N, and we know how much, how do we get it done?

Answer: Any way is a good way
Delivering the Cure

$5/acre and fast
Delivering the Cure
Delivering the Cure

$10/acre
Delivering the Cure

$7/acre to apply N
Yield loss to N burn
(average of 7 locations in Missouri, 2003-04)

150 lb N applied broadcast at corn height:

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1 foot</th>
<th>2 feet</th>
<th>3 feet</th>
<th>4 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium nitrate</td>
<td>1</td>
<td>8</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>28% N solution</td>
<td>9</td>
<td>14</td>
<td>33</td>
<td>61</td>
</tr>
<tr>
<td>Urea</td>
<td>0</td>
<td>0</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
Broadcasting N over corn

- Fast & effective
- Urea is the best choice
  - N burn on leaves has minimal effect on yield
  - But make sure it’s not dusty
- Corn 2 feet tall or less: use Agrotain on urea to prevent volatile loss of N
Is it worth the cost & effort?
Doubling profit with rescue N?
Missouri 2009 estimates

- Growing corn: $1,800 million dollars (Missouri total)
- Rescue N: $400 million dollars

Cost vs. Return

Legend:
- Cost
- Return
How much does fertilizer timing matter?

In a wet year, A LOT
Central Missouri 2008: in-season N kicks butt + 44 bu/ac

180 N at planting
110 N sidedress V7.5
Central Missouri 2009: in-season N kicks butt again

+ 68 bu/acre

153 N sidedress V7.5

180 N at planting
Central Missouri 2010: Can you believe a 3-peat?

80 bu difference
Winning game plans: Sander

• Ted Sander, producer, Randolph County
• About 70 lb N/acre preplant
  – In DAP
  – With herbicide
• Sidedress with Hagie UAN injector guided by crop sensors
Winning game plans: Riekhof

- Gary & Garret Riekhof, producers, Lafayette County
- Fall or spring NH$_3$
  - Some fields full rate, some fields lean rate
- Chicken litter on some fields (slow release)
- Tractor-drawn sidedress UAN injection for fields with visible stress (esp. lean NH$_3$ rate)
  - Corn up to 40’
Winning game plans: Ramsey

• Gabe Ramsey, Central Missouri Agri-Services (Marshall)
• Producers follow their normal N program
  – Suggest 130-150 lb N/ac as NH$_3$ + N-Serve
• Spinner with crop sensors
  – Help producers who experience N loss
Winning game plans: Schaefer

- Dan Schaefer, Illini FS (eastern Illinois)
- Held organizing meeting to sell new N program
- Reduce preplant N rates to 70% (fall NH$_3$)
- Apply N with herbicide
- High-clearance spinner to topdress urea
  - Always in corn after corn
  - In rotated corn based on appearance & weather
- Spinners are ‘combo’ machines
  - Use to spray if low need for topdress
  - Use for topdress if needed, lease sprayer(s)
Winning game plans: Brown

- Steve Brown, Macon MFA
- Organized rescue N airplane in 2010
- 2011 started planned in-season N program with some customers, either:
  - Tractor-drawn UAN injection (contractor) OR
  - Plane broadcasting SuperU
  - Choice based on customer preference
  - Reduced preplant N rates
Questions? Comments?

Photo courtesy of Fred Blackmer