Strategy 1: Don’t let your corn look like this

Central Iowa, August 2008
How much money do you think the producer lost in this field due to N deficiency?
Yield map: yellow corn yielded poorly

\[ y = -3.01x + 514 \]

\[ R^2 = 0.52 \]

Darkest corn around 170 bushels
Yield map: yellow corn yielded poorly

$y = -3.01x + 514$

$R^2 = 0.52$

Darkest corn around 170 bushels

Lightest corn around 80 bushels

Average yield 125 bushels

45 bushels less than dark green corn
N Deficiency costs a lot!

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)
How did this corn get yellow?
Excess rainfall, April to June
Four wet springs

Outlined areas > 16 inches rain April-June

2008

2009

2010

2011
There was widespread N deficiency 2008-2011 across the Corn Belt.
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There was widespread N deficiency 2008-2011 across the Corn Belt.
I estimate that we lost 2 billion bushels of potential yield 2008-2011
Strategy 1: Don’t let your corn look like this

How can you avoid it?
In a wet year, N must be applied in-season. How do I know that?
Central Missouri 2008:
in-season N kicks butt

180 N at planting

+ 44 bu/ac

110 N sidedress knee-high
Central Missouri 2009: in-season N kicks butt again

+ 68 bu/acre

153 N sidedress knee-high

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

80 bu difference
## Central Missouri 2013: N rate & timing

<table>
<thead>
<tr>
<th>N timing</th>
<th>N rate</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee-high</td>
<td>167 (chlorophyll meter)</td>
<td>213</td>
</tr>
<tr>
<td>Knee-high</td>
<td>174 (crop sensor, VR 67 to 191)</td>
<td>207</td>
</tr>
<tr>
<td>Knee-high</td>
<td>132 (soil nitrate test)</td>
<td>196</td>
</tr>
<tr>
<td>Preplant</td>
<td>180</td>
<td>126</td>
</tr>
<tr>
<td>Preplant</td>
<td>140</td>
<td>101</td>
</tr>
<tr>
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<td>140 (soil nitrate test)</td>
<td>94</td>
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<tr>
<td>Preplant</td>
<td>100</td>
<td>72</td>
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<td>---------------</td>
<td>---------------------------------------------</td>
<td>-------</td>
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Sidedress N benefit in this experiment 2007-2013 totals about 260 bushels/acre

Wait! What about:
Anhydrous ammonia in April?
With N-Serve?
Or ESN?
Missouri 2013 (wet)
N source & timing

<table>
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<tr>
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<th>Corn yield</th>
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<td>April</td>
<td>Urea + Agrotain</td>
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Missouri 2013 (wet)  
N source & timing

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## Missouri 2013 (wet)

### N source & timing

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<tr>
<td>April</td>
<td>Anhydrous ammonia</td>
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N-Serve didn’t increase this yield
## Missouri 2013 (wet) N source & timing

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<td>April</td>
<td>Anhydrous ammonia</td>
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</tr>
<tr>
<td>July (waist high)</td>
<td>Urea + Agrotain</td>
<td>162</td>
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An all-preplant N program will fail on most fields in a wet year
But a planned all-preplant N program is OK

N lost in wet years can be replaced
Yellow corn can be rescued

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

• Average yield response 34 bu/acre (11 fields)

• Yield response depended on visible stress
  – High stress: 57 bushels (2 tests)
  – Medium stress: 41 bushels (5 tests)
  – Low stress: 14 bushels (4 tests)
Rescue N timing

• How late is too late?
  – Six tests in 2010, all applied at tasseling, ave 34 bu response
  • Tasseling is NOT too late
  – Give up by 2 weeks after tassel?
How do I know whether I need to apply rescue N?
Good question

Has it rained a lot since you made your main N application?
Nitrogen Watch: the first line of defense

• On my webpage
• Shows ‘danger zones’ that are on track for serious N loss
• Based on precipitation maps (from radar)
• Updated weekly until the end of June
• Separate maps for well-drained (leaching) and poorly-drained (denitrification) soils
Nitrogen Watch June 30, 2013
OK, I’m in the ‘danger zone’. Now what?
My best answer right now: Get up in a plane WITH A CAMERA

But better options are coming
Adapt-N: the second line of defense

- Computer process model
- Online
- From New York
- Being commercialized right now
- Full commercial release before the growing season
- Quite a few field tests in Iowa with On-Farm Network, successful outcomes I think
Adapt-N: the second line of defense

- Uses data on your soils, your N source & timing, your weather
- Requires you to input your soils & management
- Should get you in the right ballpark
- I don’t think it will reliably predict spatial variability in N deficiency
NVision: the third line of defense

Late June aerial photo

Predicted yield loss (average 41 bu/acre)

Predicted N need (applicator-ready)
NVision: the third line of defense

aerial photo  yield loss map (ave 74)  N rate map: fix the problem
NVision: the third line of defense

• The numbers you need to make the right decision and take the right action
• Patented by University of Missouri (& me)
• I’m working hard to put together the right team (or find the right situation) to launch commercially for 2015
• Better than Adapt-N or other models to manage spatial variability (also more reliable?)
How much do I really need to think about this?

How many wet years are we going to have?
Nitrogen Watch May 26, 2013

We made maps like this for every year going back to 1900.
More wet area in the central U.S.

I think you better have a good plan in place for wet years.
Guess what?
We’re getting there
2013: Far more in-season N than ever before

- Pioneer agronomist webinar June (mainly IA/MO)
  - On average expected 50% of acres to get in-season N
- Phone calls July: a dozen consultants, extension agronomists, and retailers in MO/IA/IL
  - On average thought 45% of acres had received in-season N
- Field day wagons northwest MO in August
  - 22/63 = 35% of corn producers had applied in-season N
- I don’t think it had ever been above 5% before
Shift gears....a little teaser

I think that on-farm testing is the wave of the future for P & K management