Adapt-N: An Overview and Update
Employing Cloud Computing Technology for Corn Nitrogen Management

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http://adapt-n.cals.cornell.edu
Control Points for Reducing N Losses in Corn Production

1. Input management (higher N use efficiency – 4R)
2. Fate and transport mechanisms (drainage, irrigation, cover crops)
3. Remedial actions (filters, buffers, wetlands)
N Losses Increase Exponentially With N Rate Beyond a “Critical” Value

Key Points:
• Environmental loss can be minimized while optimum yield is supported
• Finding “sweet spot” is critical
Where is the Sweet Spot?

Distribution of Economic Optimum N Rates

fertilizer = $0.60/lb; corn = $6/bu

from: http://extension.agron.iastate.edu/soilfertility/nrate.aspx

corn after corn

Corn after soybean
Reasons for Tendency to Over-Fertilize:  
*Coffee Shop Wisdom on Risk and Risk Perception*

**Psychological:**
- Under-fertilization results in highly visible leaf yellowing; over-fertilization is not noticeable. Farmers therefore tend towards the highest rate.
- Confusion about multitude of recommendation systems

**Economic:**
- Uncertainty around optimum N rate
- Profit losses from under-fertilizing (yield penalty) are greater than those from over-fertilizing (unnecessary fertilizer expense).
- Consultants cannot afford to be “wrong” with low recommendation
- Fertilizer dealers have additional incentives to suggest high rates or encourage poor application timing (fall, early spring)
Many sources of variation in N availability and crop needs

→ generalized recommendations are too simplistic

- Organic amendments (manure, compost, etc.)
- Crop rotations
- Soil type differences
- Soil organic matter contents
- Soil and crop management (tillage, planting date, etc.)
- **Weather:**
  - Temperature
  - Precipitation!

Interactions are complex and nonlinear!
Meta-analyses of Corn N Response Studies

• Tremblay et al., 2012: 51 corn N response studies in North America: “Soil and weather properties were found to have a fairly pronounced effect on corn response to N fertilization.”

• Xie et al., 2013: 143 trials at 60 locations in Québec: “This study provides evidence that weather conditions prevailing before side-dressing are more critical to in-season N rate effects than those after side-dressing, as was reported by Sogbedji et al. (2001) and Kahabka et al. (2004). Corn yield response to in-season N fertilizer applications is related to precipitation and temperature during early-season growth, since they can directly affect the [...] optimal side-dress N fertilizer rate.”
Crop N uptake patterns ......

![Graph showing corn N uptake over seasons]

- Plant N
- Spring, Summer, Fall
SOM mineralization provides much of corn N needs......

Critical Time Period – N builds up in soil before corn uptake


corn N uptake

... in normal year

Amount of N Fertilizer Needed...

soil mineral N, normal year, no manure

Soil or plant N

Spring Summer Fall
Need for supplemental N fertilizer depends on early season weather ...

Critical Time Period – N builds up in soil before corn uptake

soil or plant N

Amount of N Fertilizer Needed...

soil mineral N, normal year, no manure

... in year with wet spring

soil mineral N, wet spring

... in normal year

Amount of N Fertilizer Needed...

Spring

Summer

Fall
Early application of N risks major losses......

fertilizer or manure

soil or plant N

soil mineral N and pre-plant fertilizer, normal year, no manure

N excess “insurance”
... in normal year

N deficiency
... in year with wet spring

N deficiency

spring

Summer

corn N uptake

soil mineral N, wet spring
Importance of Timing

• A precise N rate CANNOT be determined before the growing season
• Adapt-N recommendations are most useful for in-season N applications
Greater Sidedress Flexibility with High-Clearance Equipment

Purdue Univ.
Nitrogen Management with Cloud Computational Tools

- Generalized to site-specific recommendations
- Adaptive, real-time management
  - Weather
  - Local soils
  - Crop management
- Universal process-based approach
  - Incorporates system complexity and variability through relevant processes
- Real-time and post-season evaluations
- Universal access through web services
- Allows for progressive improvement and refinement
• **At core: PNM model**
  – Built from well-calibrated dynamic simulation models (Hutson & Wagenet, 2003; Sinclair & Muchow, 1995)
  – Simulates crop and soil processes using field-specific info

• **High Resolution Weather Data:**
  – daily, 4x4 km, near-real time weather
  – Critical input: highly localized & seasonal

• **User-friendly Web Interface**
  – Designed as *management* tool
  – Provides N recs and diagnostics
High Resolution Climate Data (4x4 km)
Critical Input to Adapt-N Tool

Iowa, June 14, 2011
What factors does *Adapt-N* include in making a recommendation?

- **High resolution weather:** (4 x 4 km grid) daily precipitation & temperature data
- **Soils:** texture/soil type, slope, rooting depth, % organic matter (NRCS databases)
- **N fertilizer applications:** rate, type, timing, placement
- **Cultivar:** Silage, grain, or sweet corn; planting date, maturity class, population and expected yield
- **Tillage:** fall or spring plowing; conservation tillage/residue management
- **Manure applications:** date, rate, N analysis, incorporation info
- **Rotations:** soy, corn - silage or grain, or sod - last 3 yrs, % legume, surface killed or incorporated
- **Irrigation:** amounts and dates
- **Fertilizer and grain prices & risks**
Basically....
What does Adapt-N do?

• Simulations based on daily time step
• Simulates water and nitrogen dynamics in the soil
• Simulates corn growth
• Soil and crop models interact daily
• Recommendation: Estimates supplemental N needs
• Diagnostics: provides additional information on:
  – N and crop dynamics
  – Environmental impact - nitrate leaching and (soon) N\textsubscript{2}O losses
  – Additional diagnostic information
  – End-of season situation analysis and “what-if” scenarios
Using the tool: Current Adapt-N Interface - Manage Locations

Adapt-N: A tool for adaptive nitrogen management in corn production.

- Login
- Mineral Nitrogen/Cultivar
- Soil/Tillage
- Manure/Soil/Soybean
- Add Application
- Results
- Manage Locations

Select Location

Modify Location

Set Up New Location

Please identify the region, the season, and the location name. You may also identify the group name if you wish.

Region: Northeast  Season: 2011
Group (optional): Select Group
Location Name:

Please identify the latitude and longitude. You can use the map to do this; if you wish to enter latitude and longitude without using the map, you can click on the clear Lat./Lon. button to remove any information provided by the map.

Latitude (e.g. 42.443 42.556447050) Longitude (e.g. -76.502) -73.99192535 clear Lat./Lon.

Submit New Location  Cancel
Adapt-N: A tool for adaptive nitrogen management in corn production.

Season End Date

Nitrogen Fertilizer Applications for this Growing Season

<table>
<thead>
<tr>
<th>Application</th>
<th>Name</th>
<th>lbs N/acre</th>
<th>Placement Depth</th>
<th>Date</th>
<th>Delete Button</th>
<th>Edit Button</th>
</tr>
</thead>
<tbody>
<tr>
<td>starter (fertilizer banded with seed)</td>
<td>monoammonium phosphate</td>
<td>30</td>
<td>2&quot;-4&quot;</td>
<td>n/a</td>
<td>Delete</td>
<td>Edit</td>
</tr>
<tr>
<td>preplant/sidedress</td>
<td>urea</td>
<td>100</td>
<td>2&quot;-4&quot;</td>
<td>04/10/2012</td>
<td>Delete</td>
<td>Edit</td>
</tr>
</tbody>
</table>

You may enter one starter and up to four preplant/sidedress applications. Preplant applications can start as early as 10/1/2011. Select Fertilizer Application.

Crop Information

Grains: 110 dcrm

Planting Date: 04/15/2012 32,500 plants/acre

Grain Cultivars: Expected Yield (bu/acre) 190 - 210
Adapt-N Interface: entering Soil/Tillage info

Soil Information

Please select a soil texture class that best describes the soil in the field.

Canisteo

Please select the estimated rooting depth. > 38 inches

Please select the approximate slope (%) of the field. less than 3%

Was there a soil test? There was a soil test in the last 3 years.

If you know the sample depth, please enter it in inches.
Otherwise, please enter 6 inches. (inches) 6

Soil organic matter: (%) 3.5

Tillage System Information

Please select the tillage system for this field.

Conservation tillage

50%
**Adapt-N Interface: entering irrigation info**

**Adapt-N:** A tool for adaptive nitrogen management in corn production.

- **Login**
- **Manage Locations**
- **Alert Settings**
- **N Rec. Alerts**
- **Mineral Nitrogen/Cultivar**
- **Soil/Tillage**
- **Manure/Rotations**
- **Irrigation**
- **Add Application**
- **Results**
- **Season End Date**

**Irrigation:** Please identify irrigation date and the total irrigation amount. Then click on the 'Submit Irrigation' button.

**Irrigation Date**

**Amount in inches**

**Submit Irrigation**  **Cancel Irrigation**

Adapt-N Home
Adapt-N Interface: entering Manure/Rotations info

When done entering all field info, click ‘Submit’ to run the simulation.
N Recommendation Methodology: deterministic-stochastic mass balance at sidedress

Methodology:
- Deterministic-stochastic mass balance

**Sidedress N rate** = \( \text{CropN}_{\text{Harvest}} - \text{CropN}_{\text{Current}} - \text{SoilN}_{\text{Current}} - \text{SoilN}_{\text{postsidedress}} - \text{SoybeanN}_{\text{credit}} + \text{N Loss}_{\text{postapplication}} - \text{Correct}_{\text{profit}} \)

**Input:**
- Expected Yield

**Near-Real-Time Simulation at Sidedress**

**Simulated & partial fixed credit**

**Probabilistic simulations**
Correction from Agronomic Optimum Rate to Obtain Economic Optimum N Rate

Combined Price Ratio and Stochastic Corrections (lbs/ac of fertilizer)

Currently used in Adapt-N
Adapt-N Results Page: Example with need for sidedress N

**Sidedress Nitrogen Recommendation for IA Storm Lake:** 115 lbs N/Acre (101 - 128 lbs N/Acre)

This recommendation is based on an "Expected Yield" entry that is assumed to be the economically optimum yield for this field. The recommended range reflects the uncertainty with post-application fertilizer losses for the remainder of the growing season due to unknown future weather events.

1. Calculation of Sidedress N Rate

   Sidedress N rate estimated by AdaptN = CropN\text{Harvest} - CropN\text{Current} - SoilN\text{Current} - SoilN\text{postsidedress} - SoybeanN\text{Credit} + Loss\text{postapplication} - Correct\text{profit}

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CropN\text{Harvest}</td>
<td>205 lbs N/acre</td>
</tr>
<tr>
<td>CropN\text{Current}</td>
<td>65 lbs N/acre</td>
</tr>
<tr>
<td>SoilN\text{Current}</td>
<td>28 lbs N/acre</td>
</tr>
<tr>
<td>SoilN\text{postsidedress}</td>
<td>7 lbs N/acre</td>
</tr>
<tr>
<td>SoybeanN\text{Credit}</td>
<td>0 lbs N/acre</td>
</tr>
<tr>
<td>Loss\text{postapplication}</td>
<td>17 lbs N/acre</td>
</tr>
<tr>
<td>Correct\text{profit}</td>
<td>8 lbs N/acre</td>
</tr>
</tbody>
</table>

**Root Zone Crop Available Water**

*Note that these estimates are for non-irrigated corn production.*

- Current root zone crop available water: 0 inches
- Crop available water at field capacity: 5 inches

- Full Report and Graphs (pdf file)
- Sidedress N Definitions
Adapt-N: A tool for adaptive nitrogen management in corn production.

Sidedress Nitrogen Recommendation for IA Storm Lake: No sidedress N recommended at this time (0 - 0 lbs N/Acre)

This recommendation is based on an "Expected Yield" entry that is assumed to be the economically optimum yield for this field. The recommended range reflects the uncertainty with post-application fertilizer losses for the remainder of the growing season due to unknown future weather events.

1. Calculation of Sidedress N Rate

Sidedress N rate estimated by AdaptN = CropNHarvest - CropNCurrent - SoilNCurrent - SoilNpost sidedress - SoybeanNCredit + LossPostapplication + Correctprofit

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CropNHarvest</td>
<td>205 lbs N/acre</td>
</tr>
<tr>
<td>CropNCurrent</td>
<td>139 lbs N/acre</td>
</tr>
<tr>
<td>SoilNCurrent</td>
<td>69 lbs N/acre</td>
</tr>
<tr>
<td>SoilNpost sidedress</td>
<td>7 lbs N/acre</td>
</tr>
<tr>
<td>SoybeanNCredit</td>
<td>0 lbs N/acre</td>
</tr>
<tr>
<td>LossPostapplication</td>
<td>0 lbs N/acre</td>
</tr>
<tr>
<td>Correctprofit</td>
<td>8 lbs N/acre</td>
</tr>
</tbody>
</table>

2. Excess N

Adapt-N has estimated that the seasonal N supplied (all sources) will exceed total crop N demand (CropNHarvest) by at least 10 lbs N/acre.

Estimated Excess N: 30 lbs N/acre

Root Zone Crop Available Water

Note that these estimates are for non-irrigated corn production.

- Current root zone crop available water: 9 inches
- Crop available water at field capacity: 6 inches

Downloadable pdf
Adapt-N Results: PDF Report

- All user inputs listed for record keeping.
- Recommendations from Results page
- Graphs describing N dynamics and relevant weather, soil water and plant parameters
Adapt-N Graphs: Temperature and Crop

Growing Season Average Temperature (Fahrenheit)

Post-Emergence Growing Degree Days

Cumulative Nitrogen Uptake by the Crop

Corn Vegetative Growth Stage

Vegetative Growth Stage

N Uptake lb/acre
Adapt-N Graphs: Precipitation

Growing Season Daily Rainfall

Growing Season Cumulative Rainfall
Adapt-N Graphs: Mineralization and Losses

Cumulative Nitrogen (N) Mineralization
(all organic N sources)

Cumulative Total Nitrogen Losses
(gaseous and leaching) from the Root Zone

From the Root Zone

Cumulative Nitrous Oxide Losses from the Root Zone

Coming in 2014:
Estimates of Nitrous Oxide Losses
Adapt-N Graphs: Current N status

Nitrate N in the top 12 inches of the Root Zone

(for PSNT/LSNT equivalent, divide by 4)

"VIRTUAL LSNT"

Inorganic Nitrogen (urea, ammonium, nitrate) in the Root Zone
Gain Confidence with Graphical Output and Field Observations

Compare with PSNT/LSNT

Compare with field observations
Interpret Recommendations

Des Moines 2011
150 lbs/ac preplant N
Daily email-text simulation updates for fields

Sidedress Notifications
To setup email and/or text message notification, please complete the Notification and Monitoring sections. You will only receive information about locations for which all Adapt-N input has been provided. Email addresses and cell phone numbers will be kept confidential.

Notification
Select email notification and/or text message notification by checking the appropriate boxes. Please insure that your email address and cell phone information is correct.

☐ Email
  Email Address on record:  bnmS@cornell.edu
  Update Email

☐ Text Messages
  Cell Phone number on record:  missing Cell Phone Carrier:  Update Cell Phone Information

Monitoring
You will get daily simulation updates for all farm locations that are checked.

<table>
<thead>
<tr>
<th>Group Name</th>
<th>Locations in this group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapt-NProjects2011</td>
<td>🆚 Aurora.NT  🆚 Aurora.NT,A  🆚 Aurora.NT.G  🆚 Aurora.PT</td>
</tr>
</tbody>
</table>
Adapt-N Features and Benefits

The tool:
• Predict corn N needs more accurately
• Receive daily updates on nitrogen needs; cloud-based
• Reduce fertilizer rates, costs, losses; maintain yield
• Estimate excess and losses of N
• Run retrospective analyses
• Obtain system functioning insights

For Retailers and Consultants:
• Offer improved client services: credible research-based tool
• Anticipate nitrogen fertilizer needs by clients
• Professional-level information for consultants
• Date-time stamped records in PDF format
• Organization-level functionality
• “Green” image and future possibilities for carbon offsets/credits
2011 - 2013

Adapt-N On-Farm Trials

and how the tool improves over time

Thanks to all contributors of data and feedback for tool improvement: MGT Envirotec IA; Cornell Cooperative Extension; WNY Crop Management Association; Miner Institute; Willsboro Research Farm; Champlain Valley Agronomics; Cook’s Consulting; CropTech Consulting; GK Concepts Consulting; and others who have contributed.
2011-12: 84 Strip Trials
Agronomic, Economic & Environmental Performance

NY: 2011 (14), 2012 (42)
  – Grain (Corn-Corn, Soy-Corn)
  – Silage
IA: 2011 (9), 2012 (19)
  – All Grain

N Management
  – Fall/Spring manure
  – Spring fertilizer N
  – IA: Fall anhydrous ammonia

N Treatments
  – Adapt-N vs. Grower N
  – 1-7 reps, some added rates
NY 2011: Agronomic Performance in Grain

**Corn Grain Yield (bu/ac)**

- Grower-N
- Adapt-N

**Fertilizer N applied (lb/ac)**

- NY4
- NY6
- NY8
- NY9
- NY11
- NY27
- NY28
- NY3
- NY18
- NY22

* * *
NY 2011: Environmental and Economic Performance in Grain

Simulated N Leaching Losses (lb/ac)

- Grower-N
- Adapt-N

Profit from Adapt-N Use ($/ac)

- NY4
- NY6
- NY8
- NY9
- NY11
- NY27
- NY28
- NY3
- NY18
- NY22

Corn after soy

Legend:
- (ns)
- ($20)
- ($40)
- ($60)
- ($80)
- ($100)
NY 2012: Yield and Fertilizer Applied - Grain after soy or other (potato, wheat, silage)

**Corn Grain Yield (bu/ac)**

- **Grower-N**
- **Adapt-N**

**Fertilizer N applied (lb/ac)**

**Notes:**

- *: Significant difference
- ****: Highly significant difference
NY 2012: Partial Profit

Grain after soy or other (potato, wheat, silage)
NY 2012: Yield and Fertilizer Applied – Grain C-C

** p < 0.01, * p < 0.05, (*) p < 0.10

Corn Grain Yield (bu/ac)

Fertilizer N applied (lb/ac)

** p < 0.01, * p < 0.05, (*) p < 0.10
NY 2012: Partial Profit

Grain after soy or other (potato, wheat, silage)

Exceeded expected yield with Grower-N in all except one of fields with profit loss.
**IA 2011: Agronomic Performance**

**Corn after soy**  
* p < 0.05, (*) p < 0.10

### Corn Grain Yield (bu/ac)

- **Grower-N**
- **Adapt-N**

### Sidedress Fertilizer N applied (lb/ac)

- **IA23**
- **IA24**
- **IA11**
- **IA15**
- **IA19**
- **IA20**
- **IA18**
- **IA13**
- **IA21**

* E < 0.05, (*) p < 0.10
IA: Partial Profit

Profit from use of Adapt-N ($/acre)

2011
2012 IA: Agronomic Performance (one MN trial)

** p < 0.01, * p < 0.05, (*) p < 0.10

- Corn Grain Yield (bu/ac)
- Fertilizer N applied (lb/ac)

** Grower-N
Adapt-N

<table>
<thead>
<tr>
<th>Year</th>
<th>Corn Grain Yield (bu/ac)</th>
<th>Fertilizer N applied (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>60</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>61</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>62</td>
<td>150</td>
<td>100</td>
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<td>63</td>
<td>150</td>
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<td>83</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>84</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

** p < 0.01, * p < 0.05, (*) p < 0.10
• 73 & 65: very droughty, no need for extra N to attain expected yield of 220 bu/ac
• 62: Exceeded expected yield with Grower-N
Overall Adapt-N Performance
2011-2012, IA and NY

<table>
<thead>
<tr>
<th>Treatment comparison (Adapt-N) – (Grower-N)</th>
<th>Iowa (n=28)</th>
<th>New York (n=56)</th>
<th>Grand Mean (n=84)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N fertilizer input (lb ac⁻¹)</td>
<td>-32</td>
<td>-66</td>
<td>-54</td>
</tr>
<tr>
<td>N leaching loss (lb ac⁻¹)</td>
<td>-1</td>
<td>-10</td>
<td>-8</td>
</tr>
<tr>
<td>Total N loss (lb ac⁻¹)</td>
<td>-2</td>
<td>-52</td>
<td>-39</td>
</tr>
<tr>
<td>Yield (bu ac⁻¹)</td>
<td>0</td>
<td>-3</td>
<td>-1</td>
</tr>
<tr>
<td>Profit ($ ac⁻¹)</td>
<td>+$20</td>
<td>+$31</td>
<td>+$27</td>
</tr>
<tr>
<td>Trials with greater profit</td>
<td>75%</td>
<td>80%</td>
<td>79%*</td>
</tr>
</tbody>
</table>

*Overall performance with updated tool and optimal use: ~ 88%

2013: A very different year!

May 2013

June 2013
2013: Trial Results Still Coming in

Preliminary look at some data

Over 100 trials, analysis is ongoing. Many different types:
A vs. G: side by side (no rep), 2 reps, 3+ reps; some included zero-N
N response trials (4-6 rates, 3 reps)
## Preliminary 2013 Results – New York

<table>
<thead>
<tr>
<th>Treatment comparison</th>
<th>(Adapt-N) – (Grower-N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trial</strong></td>
<td><strong>Δ Applied N (lb/ac)</strong></td>
</tr>
<tr>
<td>9</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>30</td>
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<tr>
<td>15</td>
<td>20</td>
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<tr>
<td>26**</td>
<td>-45</td>
</tr>
<tr>
<td>27</td>
<td>70</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>(22) 29</strong></td>
</tr>
</tbody>
</table>

* Manured field, and a lot of variability between replicates. Causes of yield loss may be inadequate manure records or field variability. Drainage unknown.

** Faulty sod input in model. No replication. Compaction & saturation problems (addressed in 2014 model version). Averages in Green are include this data point.

(80%) 89% of trials increased profits
## Preliminary 2013 Results - Iowa

<table>
<thead>
<tr>
<th>Treatment comparison</th>
<th>(Adapt-N) – (Grower-N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trial</strong></td>
<td><strong>Δ Applied N (lb/ac)</strong></td>
</tr>
<tr>
<td>56</td>
<td>-18</td>
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<tr>
<td>57</td>
<td>-40</td>
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</tr>
<tr>
<td><strong>Average</strong></td>
<td>-30</td>
</tr>
</tbody>
</table>

* Additional 15lb did not further increase yield.

- **75% of trials increased profits**
- **Drainage issues in some trials.**
Most Important Grower 2013 Lesson:
It pays to wait with N application until sidedress

**IL Grower:**
- Preplant lb N/ac: 90 (A) vs 220 (G)
- Sidedress lb N/ac: 90 (A) vs 30 (G)
- A: 65lb less N, but 2 more bu/ac in yield

**NY Grower:**
- Preplant & Starter lb N/ac: 176, placed deep, no plan to go back on (G)
- Sidedress lb N/ac: 60 (A) vs 0 (G)
- A: 60lb more N, 25-50 bu/ac yield increase
Bottom Line:
What are Adapt-N’s Benefits?

• 2011-12 produced profit gains in almost 80% of cases, on average increasing income by $31 per acre in New York and $20 per acre in Iowa trials, and improved model.

• Adapt-N reduced overall N application rates in 90% of trials, on average by 54 lb/ac.

• In 2013, preliminary data and field-accounts indicate Adapt-N adjusts for N transformations and losses under wet conditions. Adapt-N reduced yield losses from N deficiencies, while maintaining high N use efficiencies.

• Results provide incentive for sidedressing

• Adapt-N can provide both economic and environmental benefits.
Adapt-N in 2014 and beyond

Public-Private Partnership with Agronomic Technology Corporation

- Maintain scientific integrity, continued advancements
- Integration with complementary technologies (farm GIS, data mgmt, field application softwares)
- Better organization-level functionality and customization
- Commercial data center (bigger Cloud)
- Improved interface, user services, integration with Apps
Model improvements

- Better process modeling – especially improved handling of soil types and range of drainage conditions
- Cover crops beta module
- Inhibitors/controlled release
- Nitrous oxide losses
- Soil health data inputs

Soil Health impacts N needs:
   a) Microbial activity, organic matter content and quality
   b) Compaction, AWC, Aggregation

Short-term incentives to use Adapt-N may lead to long-term incentives to manage for better soil health. Poor soil health is costly.
Adapt-N in 2014 and beyond

Complementary Technologies

a) High clearance equipment
b) Interseeding equipment
c) Integration with farm GIS software
d) Variable rate N application
e) VERIS sensors (to create OM and texture maps)
Join us: Intensive Training Webinar

When: April 3, 2014

Where: Multiple host sites in the Northeast and Midwest, or online

What:
- N concerns and Adapt-N results
- Adapt-N inner workings
- How to use Adapt-N effectively
- Hands-on training on Adapt-N
- Overview of all new 2014 interface and model improvements

To Host a Training: contact Bianca bnm5@cornell.edu
To Attend: get on our e-list by getting an Adapt-N account (adapt-n@cornell.edu)
For more info

• New Manual (pdf download)
• Webinars
• Publications
• Access Adapt-N now
• Sign up to use Adapt-N: send your name, occupation, and location to adapt-n@cornell.edu
• Info on 2014 tool: support@agronomic.com

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