**Annual Report to the International Plant Nutrition Institute for Funds Provided for**

**Beta-testing the Adapt-N tool in On-farm Strip Trials**

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Since the spring of 2012, we have made significant progress in gathering further data for calibration and validation through on-farm beta-test trials, improving the Adapt-N tool, and educating stakeholders about the importance of adapting N inputs in corn systems to weather impacts. At this point it appears that Adapt-N can save growers money ($20 - $30 per acre on average) and prevent excessive N inputs (on average 40-60 lb per acre) in the majority of cases. This provides strong incentive for growers to move to more sidedress applications of nitrogen. Progress over the 2012 season is summarized below.

BETA-TESTING RESULTS:

2011 NY data analysis was completed in March and written up in an [article in What’s Cropping Up?](http://blogs.cornell.edu/whatscroppingup/2012/03/28/adapt-n-increased-grower-profits-and-decreased-environmental-n-losses-in-2011-strip-trials/) linked here. In summary, Adapt-N application rates were reduced by 60lb/ac in NY and 45 lb/ac in IA in comparison to current grower practice (lower in all cases in NY, due to a relatively dry spring in NY in 2011). There were limited yield losses except in corn after soybean. In corn-after-corn trials, and in silage trials, Adapt-N thus resulted in an average profit of about $35/ac in NY ($25/ac in Iowa averaged across all trials), so that Adapt-N increased profits in 86% of cases in NY and 78% of cases in Iowa. In corn after soybean trials, Adapt-N resulted in an average profit loss of $11/ac, because the model was inappropriately providing both, a flat soybean credit, and a credit related to lack of immobilization of N in soybean stover, effectively nearly doubling the NY soybean N credit and thus causing significant losses of yield in NY, small losses in Iowa (where a 30 lb instead of 50 lb credit was used). This problem was fixed in the 2012 version of Adapt-N.

Out of a total of over 80 trials that were put in place at the beginning of the 2012 growing season (mostly in New York with support in part from IPNI, and Iowa, with a few volunteer trials in Vermont and Maine), we will have data from about 70 of these by the time data collection and analysis is complete. Of 13 Iowa trials preliminarily analyzed to date, Adapt-N performed well in 10. Average N input reductions were 47 lb/ac after a very dry spring. Average yield reduction was 2.9bu/ac and average profit gain was $14/ac. Of 18 New York grain corn trials preliminarily analyzed to date, Adapt-N performed well in 15. Average N input reductions were 38 lb/ac after a mostly normal spring. Average yield increase was 2.0 bu/ac and average profit gain was $29/acre. It appears that in both years, in most cases, Adapt-N is able to appropriately discern whether there is a need for N input reductions or increases. Overall N rates are reduced, but higher N rates tend to be justified by increased yields. We will continue data analysis of the remaining trials, and results will be written up in an extension publication this spring.

Overall, it is clear that using Adapt-N required using accurate inputs – in particular, representative organic matter tests are necessary, but other soil and crop information (including good estimates of expected yield) should also be entered as accurately as possible so that the model can simulate and provide an appropriate N rate. It appears that there is a lot of opportunity for site-specific management, especially when complementing Adapt-N with new technologies such as better ability to apply N with high-clearance equipment that is GIS enabled.

EDUCATION:

There is more interest in Adapt-N by the week both at the state as well as the regional and national level. We have presented at a number of conferences, field days, workshops and other trainings since last spring, providing over 30 hours of instruction to over 2000 people for well over 2000 person-hours. A table of outreach presentations is provided in Appendix 1. Some high profile national meetings are included in this list. Notably, Harold van Es spoke at the USDA Partnership Management Team (ARS – NIFA – NRCS) Nitrogen Management Technology Symposium, reaching high-level policy makers.

With increasing interest from service providers and growers across the Northeast and Midwest, we have decided to provide a multi-location, day-long webinar training on March 21, 2013, which we are currently planning. Collaborators, who are now fairly familiar with the tool, will host regional trainings that broadcast the webinar via Webex, so that the training will provide information, but also provide the benefit of networking with other participants, and receiving hands-on training in either a computer lab, or on their own laptops, with help from experienced collaborators.

ADAPT-N TOOL IMPROVEMENTS:

We added multiple new features in the spring of 2012. Most importantly we introduced a daily alert system that automatically runs all locations at night, and displays up-to-date recommendations in a user’s account, as well as sending email or text alerts if chosen by the user. We also improved the way the model handles soils, and made soil type inputs (instead of three textural groups) available in New York and multiple Midwest states. We improved previous crop inputs, addressed the soybean-crediting issue we had in 2011, introduced a stochastic price-ratio correction factor in the recommendation calculations, and made other minor changes to the model and interface.

Stochastic Price Ratio Correction: We did some analysis of the value of the greater certainty of Adapt-N recommendations, with an [abstract provided here](http://scisoc.confex.com/scisoc/2012am/webprogram/Paper73195.html) from the ASA-CSSA-SSSA meetings, and an article in progress. Higher certainty of having the right rate means that there is less need to supply insurance fertilizer, because there is less likelihood of ending up too far off on the wrong side of the agronomic optimum N rate, which causes significant yield and profit losses. We calculated a minimum value of $23/acre just from the greater certainty of the recommendation, and resulting lowered need for insurance N.

We are also currently working on a batch-upload feature. We hope to provide a way that consultants or large growers can upload all their field-by-field data in a file for the 2013 growing season. We anticipate having at least a beta-version that close collaborators can use, and possibly, depending on how well this works, making this available through the interface to all users.

IMPACT:

There's a growing 'buzz' around Adapt-N, with several fairly high-profile articles out in the agricultural literature. Articles are linked as follows: One was published in [Successful Farming](http://www.agriculture.com/crops/fertilizers/technology/adaptn-f-efficiency_175-ar23951), and one in the [Corn and Soybean Digest](http://cornandsoybeandigest.com/fertilizer/space-age-sidedressing-ties-n-dose-weather-new-online-tool-brings-new-accuracy-level-n-pr). The most recent exciting press coverage has been that we were selected as one of the [Top Ten New Products for 2012](http://www.agprofessional.com/newsletters/agpro-weekly/articles/Vote-for-the-best-new-product-of-2012-183777161.html) by Ag Professional Magazine. Adapt-N is the only non-commercial product in the group. This is a wonderful recognition of our tool. It appears from the poll of readers that we won the New Product of the Year Award – we had 53% of the votes shortly before the polls closed, so we are awaiting the announcement.

Adapt-N provides strong incentives to sidedress to growers, because the increased profits can only be realized when waiting until sidedress time to apply the majority of the needed fertilizer, as it is only at this time that the amount can be estimated well. With average profit gains in NY grain corn of about $29/acre and average N reductions of 38lb/ac this year, a rough estimate of actual impact on the approximately 5000 acres of implemented rates in NY would be profit increases of $145,000, and N savings of about 190,000 lb in total. Approximately 7500 acres of implementation across the Midwest and Northeast of Adapt-N recommended rates in 2012 remains our best guess until we conduct a more comprehensive survey.

One great impact will be documented in a Case Study – Part II, to be released this spring. The farm featured in our [case study published in spring of 2012](http://adapt-n.cals.cornell.edu/pubs/pdfs/Adapt-N_CaseStudy_Donalds.pdf) decided to use Adapt-N on the entire farm this year. Our best estimate at this point is that the Donalds saved about $30,000 and 60,000 lb of N this year.

Here is a glimpse at a piece of this story:

“One of the collaborators in the 2011 beta-testing was Donald and Sons Farm in Moravia, NY that grows about 1300 acres of corn and soy annually (see case study from 2011;van Es et al. 2012). Robert and Rodney practice variable rate application, taking advantage of their RTK-GPS system for soil sampling, input application and yield monitoring. Until 2011, the farm based its sidedress N application rates on recommendations from A&L Great Lakes Laboratories, generated based on geo-referenced soil tests by management unit. Recommendations varied across their farm between 195 to 260lb of total N per acre, of which the Donalds apply 22 lb N/acre at planting. After the dry 2011 spring, the Adapt-N recommendation for the trial field was only 80lb N/acre, while their standard recommendation had them applying 220lb N/acre. To their surprise, there was no yield penalty for the reduced N rate.

“I was pretty amazed with the program,” says Robert, who decided to participate in a day-long Adapt-N training at Cornell in March 2012. He adds, “Once you get the hang of the program it’s easy to use.” Realizing that recommendations from Adapt-N could lead to significant savings for the farm (estimated at $70,000 for 2011 due to the very dry spring) the brothers decided they were in – for 2012, they used Adapt-N on the whole farm and hosted multiple trials. That spring, Robert entered his 90 management units into his account. “I spent one Saturday afternoon and all day on Sunday.”

Between June 8 and 21, Rodney sidedressed 922 acres of corn, using their RTK-GPS system to target their variable rates. Recommendations from Adapt-N varied from 65 – 190 lbN/acre, depending on local temperature, precipitation, soil texture and organic matter content (varying from 1-6%) between management units. On 15 of their 17 corn fields Rodney implemented either single or replicated comparison strips with the “old” rate, and on 9 of these fields he also included short 100 ft sections with zero N applied to help the Adapt-N team calibrate the model’s ability to estimate weather-adjusted N contributions from the soil.

Data so far show very few yield losses – only in cases where the expected yield that Robert provided to Adapt-N was below the yield that was actually attained by the higher N rate.

When asked whether they were planning to use Adapt-N again next year, Robert answer was an unequivocal “Oh yeah!” and he then added, “Gotta refine [our use of the tool] some.” Using variable estimated yields “is one of the biggest things” he plans to change – this year he gave Adapt-N a flat 200 bu/ac estimate for every management unit. But, he notes that one of his fields in Scipio “won’t do 175 in the best of years” and “that’s where N is wasted”. “Other fields can regularly reach 250 bu/ac” if given enough nitrogen. Robert recognized that for a precision tool like Adapt-N, a reasonable expected yield is particularly important. Also, Robert had entered only the general soil textural groups that were available in April, and plans to use the soil type inputs that became available in June for all locations in 2013 to further improve the precision of the recommendations.”

**Appendix 1: Educational Events**

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| **Speaker** | **Title or Subject** | **Duration of Adapt-N material** | **Date** | **Location** | **# in Audience (approximate in some cases)** | **Notes** |
| Sara Linn | Adapt-N: an on-line tool for precision corn N management | 30 | 3/14/2012 | Storm Lake, IA | 15 |  |
| Bianca Moebius-Clune, Jeff Melkonian, Harold van Es | Adaptive Nitrogen Management in Corn using the Adapt-N Tool | 480 | 3/19/2012 | Ithaca, NY | 31 | Very well received workshop. evaluations were positive, interactions were very lively. Workshop materials are now available online |
| Bianca Moebius-Clune | Adaptive Nitrogen Management in Corn using the Adapt-N Tool | 180 | 4/4/2012 | Lewis County Extension office and Miner Institute | 10 | Extension, private consultant and NRCS attendees. |
| Bianca Moebius-Clune | Adaptive Nitrogen Management in Corn using the Adapt-N Tool | 240 | 4/5/2012 | Middlebury, VT Extension office and online | 15 | Extension, private consultant and dealer attendees. This training is now available online for on-demand use (http://adapt-n.cals.cornell.edu/pubs). Deb Heleba of UVM plans to also render it as a set of youtube videos for easier access. (the application currently requires Java, and is a little hard to get to work). |
| Bianca Moebius-Clune | Soil Health and Adapt-N | 30 | 7/10/2012 | Willsboro, NY | 25 | Adapt-N brochures provided |
| Moebius-Clune | Precision Nitrogen Management with Adapt-N | 120 | 7/18/2012 | Aurora NY | 100 | Adapt-N brochures provided |
| Mary McKellar | 3 days at booth featuring various tools and info including Adapt-N | 100 | 8/7-9/2012 | Rodman Lott & Son Farms in Seneca Falls, NY | 100 | Adapt-N brochures provided, informal conversations |
| Hal Tucker | Adapt-N: A tool for Adaptive Nitrogen Management in Corn | 50 | 8/7-8/8/2012 | Fargo, ND | 70 | Adapt-N poster, last speaker of the day and there was a lot of discussion. Most of the people there were researchers, grad students, extension, and salesman for sensors. MN, ND, SD, OK, KS were most represented. |
| Bianca Moebius-Clune | Adapt-N, An Online Tool for Precise Nitrogen Management in Corn Production Accounting for Weather | 130 | 8/9/2012 | Borderview Farm, Alburgh, VT | 150 | 10 min presentation to large number of attendees, then 2 hours of interactive hands-on training and discussion with those interested in more detail. Adapt-N brochures provided |
| Ken Ferrie, Harold van Es, Bob Schindelbeck, Keith Severson | Adapt-N – NY successes of an online tool incorporating weather in precise corn nitrogen management | 120 | 8/14/2012 | Dumond Farm, Union Springs, NY | 230 | Ken Ferrie mentioned Adapt-N in his Keynote Talk (~200 people), in-depth presentation was given by other speakers in two breakout sessions. Adapt-N brochures provided. Good discussions over lunch/outside of formal presentations. |
| Michael McNeill | Balancing Minerals for Optimum Corn Production | 45 | 8/30/2012 | Deer Grove, IL | 385 | Mostly farmers were in attendance at this meeting. Interest in the Adapt N concept was high. |
| **Speaker** | **Title or Subject** | **Duration of Adapt-N material** | **Date** | **Location** | **# in Audience (approximate in some cases)** | **Notes** |
| Michael McNeill | Optimum Nutrient Management | 30 | 9/3/2012 | Stewartville, MN | 65 |  |
| Michael McNeill | Optimum Nutrient Management | 35 | 9/4/2012 | Osage, IA | 80 |  |
| Michael McNeill | Optimum Nutrient Management | 45 | 9/5/2012 | Stockton, IA | 105 | The attendance at these meetings were mostly farmers. There were several media people at each meeting. |
| Harold van Es | Adapt-N: A Tool for Precision Nitrogen Management in Corn Production | 50 | 9/24/2012 | Washington DC |  |  |
| Harold van Es | Adapt-N: A Tool for Precision Nitrogen Management in Corn Production | 30 | 9/25/2012 | Washington DC |  | plus more time - multiple hours - spent on discussion |
| Harold van Es | [Building Uncertainty Into N Recommendations for Maize: Addressing Insurance Applications](http://scisoc.confex.com/scisoc/2012am/webprogram/Paper73195.html) | 15 | 10/22/2012 | Cincinnati, OH | 70 |  |
| Bianca Moebius-Clune | [Adapt-N On-Line Tool for Site-Specific and Weather-Adjusted Nitrogen Management in Maize: On-Farm Strip Trial Results](http://scisoc.confex.com/scisoc/2012am/webprogram/Paper72717.html) | 15 | 10/23/2012 | Cincinnati, OH | 50 |  |
| Harold van Es | [Use of Computer Simulation Models and Databases for Nitrogen Recommendations for Corn](http://scisoc.confex.com/scisoc/2012am/webprogram/Paper70885.html) | 20 | 10/23/2012 | Cincinnati, OH | 100 | room was overflowing out into the hall |
| Keith Severson | Set up table display |  | 11/1/2012 | Auburn, NY | 25 | informal networking, provided Adapt-N brochures. |
| Bianca Moebius-Clune | Adapt-N online tool for precise, weather-based N recommendations in corn: 2011 and 2012 results, and new developments | 40 | 11/13/2012 | Cornell University, Ithaca, NY | 20 | lots of interest, good discussion. |
| Bianca Moebius-Clune | Incorporating weather and management factors into nitrogen management on corn using the Adapt-N tool | 50 | 11/27/2012 | Syracuse, NY | 72 | lots of good networking, lots of interest. About 1/2 the people in the room had heard about Adapt-N, and maybe a dozen had used it. |
| Shannon Gomes | informal networking discussions, no presentation | 60 | 11/28-30/2012 | Racine, WI | 30 | informal conversations re Adapt-N in person with 15 government personel, policy staff, scientists, economists, etc. |
| Harold van Es | Adapt-N Tool for Precision Nitrogen Management in Corn | 35 | 12/12/2012 | Syracuse, NY and other locations via webinar | 100 | lots of interest, good discussion. |
| Harold van Es | Adapt-N Tool for Precision Nitrogen Management in Corn | 60 | 12/18-19/2012 | IN | 200 | invited by Dr. James Camberato, Extension Fertility Specialist; gave two presentations, 60 min each, reaching total of about 200 people; lots of interest, great networking |
| **Speaker** | **Title or Subject** | **Duration of Adapt-N material** | **Date** | **Location** | **# in Audience (approximate in some cases)** | **Notes** |
| Bianca Moebius-Clune | Adapt-N: Incorporating Weather Information Into Sweet Corn Nitrogen Management | 30 | 1/11/2013 | Riverhead, NY | 100 | Invited Presentation |
| Bianca Moebius-Clune | Adapt-N: Hands-On Training | 45 | 1/11/2013 | Riverhead, NY | 7 | Special Hands-On Session |
| Harold van Es | Adapt-N Tool for Precision Nitrogen Management in Corn |  | 1/16/2013 | State College, PA |  | Invited Update on Adapt-N, and hands-on session. |
| Bianca Moebius-Clune, John Jemison, Tom Morris, Erin Roche | Adaptive Nitrogen Management Workshop | 210 | 1/30/2013 | Portsmouth, NH |  | Invited morning session on Adaptive N Management, team-presented by John Jemison (UMaine), Tom Morris (UConn), Bianca Moebius-Clune (Cornell), and Erin Roche (UMaine). It will include hands-on training on use of the Adapt-N tool. Anticipating there will be participants from NY in the audience. |
| Harold van Es |  |  | 2/19-20/2013 | Des Moines, IA |  | Invited Update on Adapt-N. |
| Bianca Moebius-Clune, Harold van Es, Jeff Melkonian | Cornell Adaptive Nitrogen Management Webinar Workshop | 240 | 3/21/2013 | Multiple Host Locations in Northeast and Midwest |  | Currently 5 locations are confirmed (2 in NY, 1 in VT, 1 in IN, 1 in IA) |