



Cornell University

## Donald & Sons Farm Sees Money-Saving Potential in *Adapt-N* Tool for Corn N Rate Recommendations



Growers across the country have used a wide range of methods to decide on nitrogen (N) application rates for corn, from mass balances to a variety of soil and plant tissue tests, to maximum return to nitrogen curves, to... simply... rules of thumb. But most are frustrated by the lack of accuracy of these methods. Early-season weather can greatly impact how much N fertilizer is needed year to year, and this variability has been difficult to manage. The amount of N fertilizer required could easily differ by 100 lbs from one year to the next. This variability results in average N recommendations that are higher than needed in many years, leading to profit loss for growers and environmental damage

through N losses to water as nitrate and to the air as nitrous oxide, a potent greenhouse gas.

The web-based *Adapt-N* tool has the potential to change the way N management is done. Soil data, along with crop and soil management information are supplied by the grower. The *Adapt-N* tool uses these data in combination with newly available high-resolution climate data to simulate N availability and losses due to weather, and thus provide more accurate sidedress N recommendations. The tool is undergoing beta-testing in on-farm strip trials across New York and Iowa in the 2011 and 2012 growing seasons. Once fully validated, *Adapt-N* will, over the long term, help

reduce N losses to the environment that contribute to air and water pollution, while saving farmers money through the optimization of fertilizer purchases and application rates.

One of the New York agricultural enterprises collaborating with the *Adapt-N* team is Donald and Sons Farm located in Moravia, NY. The farm has been in the family for several generations and currently encompasses 1500 acres of land. In 2011, 1050 acres were in corn and 250 in soybeans.

The Donald brothers, Robert and Rodney, are no strangers to on-farm research and have collaborated with Cornell University and private companies many times over the years. When asked why they keep getting involved in research Rodney replied, “Money! Some [projects] take you down a dead end street, but if we see, for example, that we can save putting 100 lbs [of N] on, that’s a lot of money.” So, although the on-farm research can be time consuming for Robert and Rodney, they see the value in the important benefits it can generate.

The Donald brothers’ acreage varies greatly in soil type, and organic matter contents range from about 1 to 5%. The farm currently bases its N application rates on recommendations from A&L Great Lakes Laboratories, generated based on soil tests by management unit. Robert and Rodney practice variable rate application, taking advantage of their RTK-GPS system for soil sampling, input

application and yield monitoring. The bulk of their fertilizer N application occurs at sidedress time, as they have found that early season applications run the risk of losses during wet springs. They experimented for a few years with putting anhydrous ammonia on at preplant, and considered slow-release and inhibitor technology, but decided to return to sidedressing. The amount the Donalds spend on N fertilizer has nearly quadrupled since 2000, and in 2011 they spent \$107,000 – a strong incentive for them to seek new tools to help optimize application rates. As Rodney puts it, “money talks ... and with what we are getting in corn for what we are putting on in ammonia, we’re not gaining.”

This past spring, Robert and Rodney identified 10 acres of a 100-acre field to implement a replicated strip trial to test the *Adapt-N* tool. The field was planted with corn on May 21<sup>st</sup> with 22lbs of N from monoammonium phosphate starter. In early June, Keith Severson of Cayuga Cooperative Extension used *Adapt-N*, inputting the Donald brothers’ field information, such as organic matter content, expected yield, tillage, fertilizer inputs, etc., to generate a N sidedress recommendation of 80 lb N/acre.

When asked what he thought when he heard of the 80 lb recommendation, Rodney said, “it was hard for me to chew on 80. ... It was a little hard for me to chew on!” On June 19th, two sidedress treatments were applied in eight, 16-row-wide strips. Four of the strips received the standard N rate based on the recommendation from A&L labs, which was 220 lbs, and the remaining 4 strips received the *Adapt-N* rate of 80 lbs. Throughout the growing season, the brothers still felt very unsure about the low *Adapt-N* rate compared to their usual practice. They kept their eyes on the field after sidedressing, taking note that the *Adapt-N* strips appeared to be a lighter shade of green. “We thought, uh oh, this is going to be a blow, here we go.”

However, as the season came to a close the results indicated otherwise. There was no loss in yield despite the 140 lb application rate difference. The Donald’s yield monitor data showed spot-yields between about 120 and 230 bu/ac, with an average yield for the field of 171 bu/ac. The average yields for the conventional plots were 174.1 bu/ac,



**Robert Donald with his soil sampling cart equipped with RTK-GPS, used for soil sampling by management unit.**

while *Adapt-N* average yield was 173.6 bu/ac (both ranged from 169 to 179 between strips). Robert and Rodney were shocked by the results stating, “it wasn’t until we were combining that we realized the yield wasn’t really different even though there was a 140 lb N difference [in sidedress rate]”.

The results show great promise for the *Adapt-N* tool and for the Donald brothers’ ability to save on N fertilizer. Assuming that the trial field was fairly representative of the rest of the farm, the Donalds would have saved approximately \$70,000 in fertilizer in 2011. A post-season *Adapt-N* simulation estimated that they had also reduced their N leaching losses in 2011 by about 77%, from 142 to 32 lbs/ac.



### ***Taking a look at Robert and Rodney’s current variable rate application recommendations.***

Robert and Rodney intend to collaborate on more extensive testing of the *Adapt-N* tool next year and see whether different weather conditions affect the recommendations. In addition to another fully replicated strip trial, they may use variable-rate recommendations provided by *Adapt-N* in strips next to those provided by A&L Laboratories on multiple fields. When discussing variable rate application with the brothers, using rates with drastically higher N amounts than needed by the crop was

likened to “aiming for the bull’s eye in the opposite direction of the target,” to which Rodney laughingly replied, “I’ve been doing that all my life.” Variable rate application using *Adapt-N* should allow for a more accurate AND precise accounting of the effects of organic matter-derived N and texture in interaction with that year’s weather on overall N availability.

Overall the trial suggests that more accurate N recommendations based on weather impacts, in addition to soil and management information, could lead to substantially higher profits for farmers, while reducing environmental losses in most years. This creates a win-win situation as farmers face higher costs for fertilizer and we search for feasible and effective ways to reduce detrimental losses to the environment.

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## **Web Resources**

See <http://adapt-n.cals.cornell.edu> for more detailed information about adaptive N management, related scientific papers, and for directions on how to access and use the *Adapt-N* tool for adaptive N management in your fields.

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## **Funders**

The development and 2011 testing of the *Adapt-N* tool was supported through funds from USDA-NIFA Special Grants on Computational Agriculture (U.S. Rep. Maurice Hinchey-NY), a USDA Natural Resources Conservation Service Conservation Innovation Grant, and the New York Farm Viability Institute.