ADAPT-N UPDATE NOTES: December 10, 2013

We have received requests for clarification on Adapt-N evaluations in re: presentations given by Dr. John Sawyer of Iowa State University (ISU) at the annual North Central Extension-Industry Conference (proceedings: <http://extension.agron.iastate.edu/nce/ncepdfs/2013/ncsfc%202013%20sawyer%20pg60.pdf> and the ISU Integrated Crop Management Conference suggesting that Adapt-N recommendations were on the average below the economic optimum N rate (EONR), as determined from N rate trials conducted in Iowa in 2011 and 2012. These results do not conform to our own data from on-farm trials in the same years where adjusted fertilizer rates generally led to increased profits (Moebius-Clune et al, 2013 <http://blogs.cornell.edu/whatscroppingup/2013/05/15/adapt-n-proves-economic-and-environmental-benefits-in-two-years-of-strip-trial-testing-in-new-york-and-iowa/>). We would like to provide stakeholders with explanations for the discrepancies, to help prevent faulty conclusions drawn based on the recently presented data.

1. N Rate Trials vs. On-Farm Strip Trials

The ISU results were based on N rate research trials. These generally involve multiple N rates that are implemented over many years, and allow for the calculation of the EONR. A well-known concern with these experiments is that when the same N rates are applied repeatedly on the same plots over many years, a "memory effect" is created in the following way: Plots that receive low N rates repeatedly yield lower biomass and return less organic matter to the soil after harvest. Plots that receive high N rates recurrently produce more biomass that also has higher N contents and is more readily decomposed during subsequent growing seasons (low C:N ratio). The combined carryover effects of organic matter inputs, stover N contents, and decomposition rates creates more consistently higher yields in the High-N treatments plots, and lower yields for the Low-N plots. Over time, this reinforces the same results and also masks the year-to-year variability that occurs on typical farmer fields. This is perhaps OK when the research aims to find the long-term average response (like with MRTN, which then appears increasingly precise), but does not allow for an appropriate evaluation of dynamic recommendation tools like Adapt-N. This explains why our research found that the impact of weather on optimum N rate is large, while small N rate trials suggest modest effects.

For an excellent discussion on the OM and N carryover processes, we refer to the paper by Russell et al. (2009, citation below). The study was based on long-term Iowa N rate trials and demonstrates that OM returns and turnover rates are strongly impacted by past N applications.

2. Use of Adapt-N

Dr. Sawyer states that the Adapt-N evaluation was based on "timings for pre-plant application in mid April, sidedress (June 1), and at the end of growing season". This constitutes inappropriate use of the Adapt-N tool in many cases. The tool is designed for in-season management, and therefore estimating N rates for pre-plant or end-of season is not appropriate. In addition, assuming a fixed sidedress time of June 1 instead of the actual date of sidedress is also improper. Most Iowa corn in 2012 was planted in two campaigns spanning from mid April to late May with a two-week wet period in between. Assuming the same June 1 sidedress date is especially improper for the late-planted corn that had barely emerged at that time. We are also uncertain about other inputs that were used for this study. Adapt-N is a precision management tool and is appropriately evaluated only when based on accurate inputs, not general assumptions.

Also, we note that Adapt-N underwent initial beta testing in 2011, and we made some adjustments to the 2011 version to correct for some coding errors. This is part of the scientific development process that we follow where the tool is improved over time with support of trial results. We now have a much improved tool and we don't regard the evaluation of the 2011 version as useful, independent of the above concerns.

3. Economic analysis

Dr. Sawyer's analysis did not include yield or partial profit results, especially in relation to the MRTN rate which over-predicted needed N rates in 2012. We believe that it is not overly meaningful to state how much a recommendation was above or below the EONR without discussing the economic implications (aside from our concern about the validity issues around the long-term N rate response trials discussed under 1.). In dry years, under typical farm field conditions, the yield response curve is fairly flat and the profit differential for lower-than-EONR rates can be very minimal, while having a positive environmental benefit.

We acknowledge that N rate recommendations are challenging, but nevertheless our strip trial evaluations conducted on commercial corn fields showed Adapt-N to be very effective in addressing the weather and management variability issues (results available on our web site). In 2012, we were able to make some comparisons between MRTN and Adapt-N and found that our tool provided higher economic returns than MRTN in 8 out of 10 trials, and reduced N inputs by an average of 30 lbs/ac.

Also, we note that the Sawyer evaluation of Adapt-N was based on the limited set of management conditions present in small plot research trials, while our tool incorporates more complex on-farm variations in tillage, crop, residue, organic matter, fertilizer and manure management. Seasonal weather highly impacts optimum N rates in such varied real world systems. And the claim that Adapt-N underestimates seasonal EONR, especially relative to the MRTN, will be different for the 2013 season, where early results show that the tool can effectively avoid large yield losses by alerting farmers to N deficiencies from excess rain.

4. Concluding Comments

We hope that the above information provides insights into the apparent discrepancies between Dr. Sawyer's and our own results. We regard the MRTN and other static approaches as valuable tools for providing pre-season or generalized guidance, while the Adapt-N tool is a site and weather-specific N management tool. We believe that such precision N management is critical to meeting the demands for reduced environmental impacts while also achieving higher farmer profits. We are committed to evaluating Adapt-N under realistic field conditions to prove and further enhance its capabilities, and we invite farmers, consultants, and fellow researchers to test the tool for themselves. We also invite research collaborations and data sharing.

References

Moebius-Clune, Bianca, Maryn Carlson, Harold van Es and Jeffrey Melkonian. 2013. Adapt-N Proves Economic and Environmental Benefits in Two Years of Strip-Trial Testing in New York and Iowa. What's Cropping Up? http://blogs.cornell.edu/whatscroppingup/2013/05/15/adapt-n-proves-economic-and-environmental-benefits-in-two-years-of-strip-trial-testing-in-new-york-and-iowa/.

Russell, Ann E., Cynthia A. Cambardella, David A. Laird, Dan B. Jaynes, and David W. Meek. 2009. Nitrogen fertilizer effects on soil carbon balances in Midwestern U.S. agricultural systems. Ecological Applications, 19(5), pp 1102-1113.

Sawyer, John. 2013. Comparison of the MRTN and Adapt-N derived rates for corn. North Central Extension-Industry Soil Fertility Conference, Demoines, IA. Vol 29. http://extension.agron.iastate.edu/nce/ncepdfs/2013/ncsfc%202013%20sawyer%20pg60.pdf

For updated information, publications, and to sign in to your Adapt-N account, go to http://adapt-n.cals.cornell.edu. Please address questions to Bianca Moebius-Clune at bnm5@cornell.edu.

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