Adaptive Management and In-Season N Application Update

Expanded End-of-Season Evaluation Options for Corn

6-13-2018

Nutrient Management Spear Program, Cornell University
New York State Department of Agriculture and Markets
Natural Resources Conservation Service
New York State Department of Environmental Conservation

With Input From
The NMSP Internal and External Advisory Committees

The NRCS 590 Nutrient Management Standard is a core component of compliance with the New York State CAFO Permit. The NRCS 590 standard requires the use of land grant guidelines for nutrient applications, the evaluation of N leaching and P runoff potential, following a rotation and tillage sequence, and employing field conservation practices designed to address sheet, rill, and gully erosion, among others.

Since the true optimum N rate for any field can only be confirmed at harvest, producers and planners must work with ranges to ensure adequate N is supplied to crops, while striving to avoid excess applications. From crop production and environmental management points of view, limiting yields due to nutrient shortage and excess nutrient application beyond what crops can use are both undesirable. Since 2000, planners have been allowed to substitute on-farm yield for those in the Cornell database so long as the farm had at least three years of yield data to back up the higher yield potential. In 2013, a partnership of state and federal agency staff and Cornell University nutrient management specialists framed an adaptive management process based on guidance from USDA-NRCS. The goal of adaptive management is to create guidance for and incentivize on-farm evaluation of practices that improve nutrient management over multiple crop seasons. This can be especially important in field crop systems with regular manure applications and sod in rotation where producers are looking to better gauge and use the soil's organic N supply and N buffer capacity in N fertility strategies. The implementation of a flexible management system that sets baseline rates with the option to adapt and supplement the baseline as needed using in-season tools (models, crop sensors, soil and/or plant tests, etc.) was a logical approach. A fundamental component of the adaptive management process as described by NRCS includes an end of season evaluation step to determine if the fields were in fact responsive to the additional N or if they may have been over-fertilized. The partnership released two fact sheets in 2013 to guide farm decisions under this process (links copied below). Maintaining yield records and assessing crop N status through the corn stalk nitrate test-N (CSNT) were identified as the evaluation steps for N management of corn. The process calls for managing CSNTs below 3000 ppm over the intermediate to long term. In 2016, a drought year, 37% of all fields tested for CSNT exceeded 3000 ppm. In 2017, a wet year, still 19% of all fields tested exceeded 3000 ppm. These results show the importance of CSNT and yield assessment for multiple years, as well as the opportunity to improve on N management.

During the summer of 2017, planners and producers asked for a wider range of options to implement the end-of-season evaluation. It should be clear that under the adaptive management process, farmers and planners may use any in-season adaptive management tool at their disposal and may batch fields as

necessary for purposes of determining which ones will receive N beyond the baseline recommendations. Consistent with the NRCS Adaptive Management guidance, the end-of-season evaluation step will need to be performed on a field-by-field basis. The NMSP will continue to work with advisory committees, agency partners, producers, and planners on refinements of this document as needed.

Adjusted Yield Potential for Farms with Three or More Years of Yield Data

Farms with at least three years of corn yield data (see Agronomy Factsheet 71: http://nmsp.cals.cornell.edu/publications/factsheets/factsheet71.pdf) can use actual farm yields for individual fields, for the predominant soil type within that field, or by yield potential for the soil type (if sufficient information is available) for the specific farm. With only 3 years of yield data, the lowest yielding year can be dropped from the average while yield tracking continues. With 4 years of data, the lowest yielding year can be dropped from the average to obtain a 3-year average while tracking continues. With 5 years of data, up to 2 low years can be dropped to determine the 3-year average. Once 5 years of data are obtained, maintain a rolling average of the most recent five years with the option to drop the two lowest yielding years from the average. Silage yields (at 35% DM) can be converted to corn grain yield equivalents (at 85% DM), by multiplying by 6.7 (2018 Crop Insurance Handbook).

The adjusted yield potential can be used in the N equation to derive N application rates. No further action is needed as long as actual applications do not exceed the calculated N rate.

Use of Adaptive Management-Adaptive Management Applies to the Following Situations:

Situations where adaptive management steps apply:

1) When a farm opts to use a yield potential above the book value but does not have 3 years of yield data or crop response data. In this case, the higher yield potential is entered in the N equation to derive an N recommendation that is higher than the baseline recommendations; or
2) When the CNMP has used farm specific records of yield potentials (one of the options above) for calculating manure and fertilizer rates, the operation has applied the full rate of manure and fertilizer expected to meet N needs and it is believed, because of a wet spring, that the crop requires additional N to support optimum yield that year.

Additional N beyond the standard guidelines needs to be based on realistic yield expectations and rate selection and implementation need to be documented (e.g. records from a model or sensor, N application maps). The realistic yield expectation should be derived from farm history, soil characteristics, hybrid/plot data, etc.

Farms that opt for the adaptive management process for specific fields need to collect and maintain yield records for each field to which this applies, *and* select one of the following:

1) Collect a CSNT sample from a representative area to assess whether extra N was needed that year. A CSNT sample for this purpose should consist of 10-20 stalk samples. Representative areas should be the higher yielding portions of the field (estimated 25% of the field with the highest yields). With the exception of severe drought years where stalk nitrate levels may be high due to low crop yield, if results exceed 3000 ppm for 2 years, N rates need to be reduced with continued yield and CSNT monitoring until CSNTs are routinely below 3000 ppm.
2) Implement one or more strips treated in accordance with standard guidelines and collect yield

for the surrounding field where additional N was applied as well as the untreated check strip(s). If yield differences are less than 2.0 wet tons corn silage per acre or 13 bushels per acre for two years, this signals that the extra N is not likely needed and field N management needs to be adjusted accordingly in subsequent years. Check strips need to be field length and at least one full chopper or combine head width wide**.**

3) As corn approaches or has entered the dent stage, visit each field for which the adaptive management process was selected and where applied N exceeded the baseline recommendations. Assess plant status and collect 2-3 georeferenced photos of an area representing the general condition of leaf N status within the highest yielding areas in the field (i.e., the estimated top 25% yield area). When the 1-3 lowest true leaves are green, a targeted CSNT needs to be taken; when more than 3 leaves above the soil are yellowing, no CSNT is needed as stalks are not likely to exceed 3000 ppm CSNT (note, optimal yielding corn crops will often exhibit 3-5 N deficient leaves and CSNT values between 750 – 2000 ppm).
4) For crops other than corn, determine and record an individual field N balance per field determined as [total N applied plus N supply by soil and crop rotation credits as defined in the Cornell soils database] minus N removed with harvest. Nitrogen in crop is the total harvested biomass times its N content, which can be estimated using farm specific crude protein or total N values.

Dairy farms that have whole farm nutrient mass balances (NMBs) with N balances of 105 lbs/acre or less, and that maintain a 3-year running average N balance at or below 105 lbs/acre, meet the adaptive management guidelines and do not require additional field-specific evaluations beyond recording yield.

Farms that have questions about N management are encouraged to consider implementing N rich strips (also called N reference strips) to help inform in-season N management decisions. Nitrogen rich strips typically consist of application of fertilizer N at a rate higher than is needed before or directly after planting. In situations where manure is expected to meet most or all of the crop N needs, the equivalent of 50-75 pounds/acre of additional fertilizer N should be adequate for an N rich strip (see http://nmsp.cals.cornell.edu/publications/factsheets/factsheet89.pdf for implementation of N rich strips). Depending on the N source and application method, a urease inhibitor (for surface application of urea) should be used while a nitrification inhibitor could be considered as well. If the N rich strip is indistinguishable from the surrounding area at V8-V10, the extra N was not needed. When N rich strips are implemented for this purpose, it should be clear that the fertilizer N added to the strip is an acceptable practice in a CNMP, per the NRCS 590 standard. Similarly, an N rich strip can also be created by implementing a higher manure N rate (slowing down the application implement).

Factsheets:

http://nmsp.cals.cornell.edu/publications/factsheets/factsheet77.pdf

http://nmsp.cals.cornell.edu/publications/factsheets/factsheet78.pdf

http://nmsp.cals.cornell.edu/publications/factsheets/factsheet71.pdf

http://nmsp.cals.cornell.edu/publications/factsheets/factsheet25.pdf

http://nmsp.cals.cornell.edu/publications/factsheets/factsheet85.pdf