



## Field Balance as an End-of-Season Assessment Tool for Adaptive Nitrogen Management of Corn Silage

### Introduction

In crop production, field-specific management strategies supported by field experimentation can help refine nitrogen (N) application with manure or fertilizer, improving profitability and reducing its environmental footprint. The New York adaptive N management process allows producers who operate with a comprehensive nutrient management plan (CNMP) to experiment with N application in fields at rates that exceed foundational land-grant university (LGU) guidelines but requires them to implement an end-of-season assessment to evaluate the effectiveness of this change.

A 2024 study with farmers and crop consultants resulted in a database of 994 New York corn silage fields and the development of a new end-of-season evaluation tool, based on field N balances. This fact sheet explains what this tool is about, and how to implement it.

### NY Adaptive N Management Process

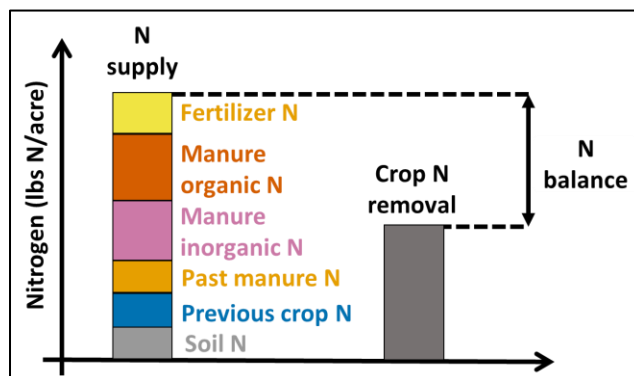
In 2013, a partnership of state and federal agency staff and Cornell University nutrient management specialists framed an adaptive management process based on guidance from USDA-NRCS at the federal level (USDA-NRCS, 2013). This framework allows farms that operate with a comprehensive nutrient management plan to experiment with N application in a corn field with no previous yield records and apply N at a rate that exceeds the foundational land-grant university (LGU) guidelines for that specific field. However, once a field is entered into the adaptive N management process, the farmer is required to measure and record yield and implement an end-of-season assessment to determine if the higher N rate was justified. By design, adaptive management and the end-of-season assessment are field specific.

The initial New York adaptive management process included the corn stalk nitrate test (CSNT) as the end-of-season assessment tool. For fields under adaptive N management, farmers are expected to manage CSNT levels to be below 3000 ppm over time. Additional

evaluation options were added in 2018 and 2023, including assessment of yield results in test strips where crop response to a higher N rate is compared to the foundational LGU guidelines. In 2025, the evaluation options were expanded to now include calculating an end-of-season field available N balance.

### Calculating a Field N Balance

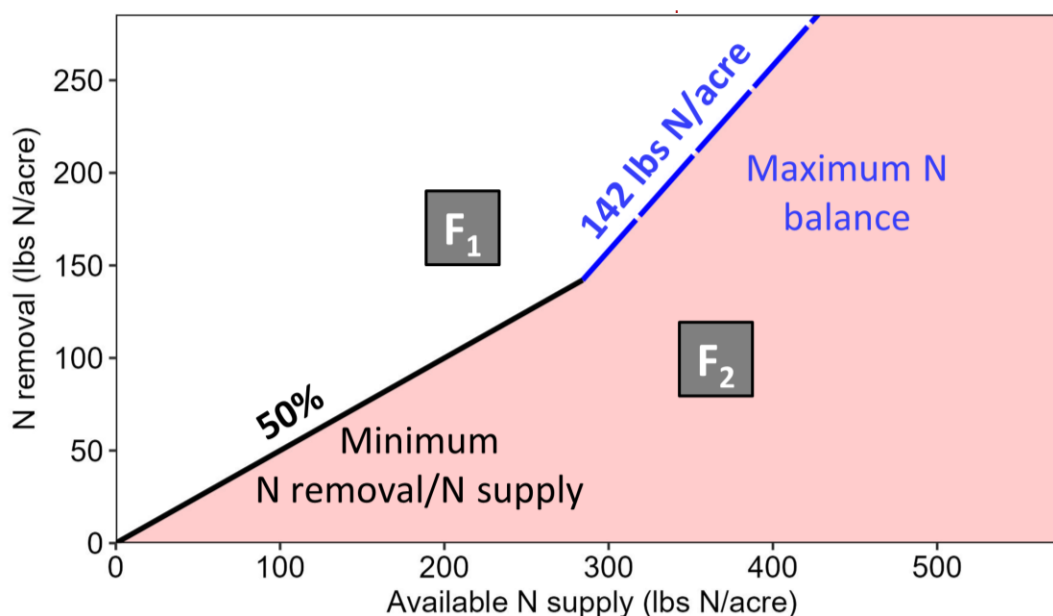
A field nutrient balance is the difference between nutrients supplied to the crop, and nutrients removed with harvest (Figure 1). Available N supply is the sum of the plant-available N contributions from soil, previous crop N credits (e.g. soybeans, alfalfa-grass mixes), fertilizer, and manure. Available manure N derives from both organic and inorganic N, which varies according to manure type, application method, and timing. The various inputs can be estimated based on farm records, manure analysis, and book values for soil N and rotation N credits. Nitrogen removal can be derived by multiplying yield and average silage N content. For details on how to estimate these values, see [Agronomy Factsheet #125](#). The ratio of N removal to N supply (N removal/N supply) is another valuable indicator of N use efficiency that can be estimated with the same N supply and crop removal data.



**Figure 1.** Field-level N balances can be estimated as the difference between N supply and crop N removal.

### Interpreting the Results

Once N removal and available N supply are calculated, the results can be compared with



**Figure 2.** A maximum nitrogen (N) balance of 142 lbs N/acre and minimum N removal/N supply of 50% set the limits for field balances as end-of-season evaluation tool in the adaptive N management process for corn silage production. In this example, the available N supply and N removal for two corn silage fields (Field F<sub>1</sub> and Field F<sub>2</sub>) shows that field F<sub>2</sub> is outside the thresholds (in the red zone), suggesting the higher N rate that was implemented, was not warranted.

two feasible targets defined for these indicators (Figure 2). Fields performing in the red area of Figure 2, have an N removal to N supply ratio that is less than 50% (low N use efficiency per ton of silage produced), an available N balance larger than 142 lbs N/acre (large available N supply, subject to loss), or both.

### Implementation Over Time

When an N application rate in a corn silage field results in an N balance that is in the red area in Figure 2, it signals the N rate can be lowered without impacting yield. Under the adaptive N management process, fields that do not meet the upper limit for available N balance of 142 lbs N/acre and/or are below the 50% N removal/N supply line over time (2-3 years), had abundant available N supply (Field F<sub>2</sub> in figure 2 is an example). For such fields, the additional N applied under adaptive N management was not warranted and N application rates should revert to the foundational LGU guidelines and be based on actual achievable yield records (i.e. based on yield measurements taken as part of the adaptive management process in those first 2-3 years). The 2-3-year period reflects that multiple biotic and abiotic factors may affect crop N requirements in a given cropping season.

### In Summary

Field available N balance assessments were incorporated in 2025 as an additional end-of-season evaluation tool for adaptive N management in corn silage fields. Limits for a

field are defined by a maximum N balance of 142 lbs N/acre and minimum N removal/N supply of 50%. For fields that are outside of these limits for 2-3 years, N application rates should revert to the foundational LGU guidelines.

### Additional Resources

- Cornell NMSP Agronomy Fact Sheet Series.  
<http://nmisp.cals.cornell.edu/guidelines/factsheets.html>.
- What's cropping up blog.  
<http://blogs.cornell.edu/whatscroppingup/2024/12/18/new-end-of-season-assessment-tool-for-nitrogen-management-of-corn-silage/>
- Research paper.  
<https://www.sciencedirect.com/science/article/pii/S0378429024004295?via%3Dihub>

### Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of discharge levels from agricultural land.

For more information

 **Cornell University**  
Cooperative Extension

Nutrient Management Spear Program  
<http://nmisp.cals.cornell.edu>

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2025