Corn Nitrogen Guidelines and Focusing on the "Right" Rate

Optimal nitrogen rates are not closely related to grain yield.

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Weather (e.g., precipitation frequency and intensity), soil texture, temperature, soil physical properties, topography, and soil depth are just a few of the variability factors that may add to the uncertainty when determining optimal corn nitrogen (N) rates. Nitrogen supply and recovery are critical components within overall N strategies that address the economic, social, and environmental concerns regarding nutrient management. Despite claims of having corn N rates "locked in", year to year relationships between optimal N rates and corn grain yield are often quite poor or non-existent.

Resources are available to reduce grower uncertainty when selecting corn nitrogen (N) rates. Michigan in addition to six other states throughout the Corn Belt utilize the MRTN (i.e., Maximum Return to Nitrogen) corn N recommendation system. The MRTN is a pre-season static N guideline model based on corn response to N fertilizer applications across many years and locations while simultaneously accounting for fertilizer and grain investments. The model provides an N rate and profitable range adjustable by growers based upon crop rotation, soil productivity potential, current price of N fertilizer and corn grain, and field history.

In a new video hosted by Dr. Jeff Rutan, a post-doctoral research associate for Dr. Kurt Steinke in soil fertility and nutrient management, Jeff focuses on the rate component within the four R's of nitrogen management. Although split-N applications are a recommended best management practice in Michigan to improve N recovery, growers must determine total N needs to balance in-season N rates. In addition to MRTN, the video reviews other decision support tools including active crop sensors to detect N stress and guide site-specific N rates. Concluding the video are results of a two-year study at Michigan State University which utilized the MRTN approach and active crop sensor model to generate in-season corn SD N rates. The video titled "Using Models to Predict Corn Nitrogen Rates" may be accessed via the Soil Fertility and Nutrient Management Program website soil.msu.edu at Michigan State University.

Important notes to remember when using the MRTN guidelines:

1) The MRTN model is a pre-season general N recommendation model that provides corn N response data that have proven profitable over many years and accounts for both optimal and sub-optimal growing seasons. The model does not account for individual site variability or variable in-season weather events (e.g., individual large rainfall events or excessive rainfall after early N applications) which may affect corn N response and require adjustments to in-season N applications.

2) Corn yield for the N rates listed at the 0.05 price ratio will be near maximum levels but N rates for greater price ratios may result in a greater economic return to the grower.
3) When the previous crop is soybean, the N credit is built into the recommendation system. Do not take any additional N credit as the rotational effect of soybean is already accounted for under the "previous crop" heading. However, nitrogen credits for previously applied manure are not accounted for in the MRTN table and should be subtracted from the recommendations listed in the table.
4) If the previous crop was a small grain that was interseeded with a leguminous cover crop species, growers should follow the recommendation category for previous crop soybean and small grain. If no leguminous cover crop was used with the small grain, growers should default to the recommendation category for previous crop corn.
5) The profitable range listed beneath suggested N rates can be used to adjust N rates based on an individual grower's familiarity with a specific field (i.e., tendency to yield greater or less than expected), the amount of risk a grower wishes to assume, or locally important air, soil, and water concerns.

Table 1. Suggested N rates for corn grain grown in Michigan, 2019.

Soil Productivity Potential[1]	Previous Crop	N:Corn Price Ratio			
		0.05	**0.10**	**0.15**	**0.20**
		Suggested N Rate (lbs. N/acre)			
High/Very High	Corn	**195** 180-210[2]	**170** 160-185	**155** 145-170	**145** 135-160
	Soybean[3] and small grains[4]	**170** 155-185	**145** 135-160	**130** 120-145	**120** 110-135
Medium/Low	Corn	**165** 150-180	**145** 135-160	**135** 125-150	**120** 110-135
	Soybean[3] and small grains[4]	**140** 125-155	**120** 110-135	**110** 100-125	**100** 90-115
Loamy Sands and Sands (CEC < 8.0)	Irrigated – all crops	**215** 200-230	**195** 180-210	**180** 165-195	**170** 155-185

[1] **Low**: average yield = < 135 bu/A; **Medium**: average yield = 136 to 165 bu/A; **High**: average yield = 166 to 195 bu/A; **Very High** = more than 196 bu/A; (average yield is the five-year running average disregarding unusual highs and lows).
[2] Range approximates $\pm$ \$1 of the maximum return to N (MRTN) rate.
[3] When the previous crop is soybean, the nitrogen credit is built into the recommendation. Do not take any additional nitrogen credit. Nitrogen credits for previously applied manure need to be subtracted from the N recommendations.
[4] Refers to small grains interseeded with leguminous cover crop species. Small grains not interseeded with leguminous cover crop species should default to previous crop corn.

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