

Updated nitrogen fertilizer guidelines call for slightly higher rates

BY Peter Kramer

Are you using yield goals to calculate nitrogen fertilizer rates for corn?

If so, you are probably leaving money on the table. Profits — not bushels per acre — should dictate N rates.

In October, the University of Minnesota released new corn fertilizer guidelines, which are based on maximum return to nitrogen management, or MRTN. The updated guidelines let you identify the most profitable N rate for any ratio of nitrogen-price to corn-value.

The new MRTN guidelines are available in tables or an easy-to-use online calculator <http://cnrc.agron.iastate.edu/> for corn-after-corn and corn-after-soybeans. Updated N guidelines are also available for corn-after-alfalfa, and corn grown on sandy soils at the University of Minnesota's fertilizer management website <http://www.extension.umn.edu/agriculture/nutrient-management/nutrient-lime-guidelines/fertilizer-recommendations-for-agronomic-crops-in-minnesota/corn/>.

Adopting a profit-based approach

In the current economic environment, it's more important than ever to base your management decisions on bottom line returns. When it comes to nitrogen rates, this means abandoning the old rule of thumb, which called for 1.2 lbs. of N/bushel of expected corn yield.

Instead, we now set rates at the point where a nitrogen application produces a corn yield increase that's large enough to pay for the last pound of N. This point, called the maximum return to nitrogen, varies as nitrogen prices and corn values change. It's not the same as the rate that produces the greatest grain yield, although it usually produces at least 95% of maximum potential yield.

Profit-based N rates — first introduced in Minnesota in 2006 — incorporate decades of trials on corn response to nitrogen across many environments. The recently updated guidelines reflect additional sites of nitrogen response data collected from 2011 to 2015, making them more accurate for prevailing growing season conditions, says Fabian Fernandez, University of Minnesota Extension soil scientist.

The new Minnesota guidelines call for slightly higher optimum rates of nitrogen fertilizer for both corn-after-soybeans and corn-after-corn. The same thing is true across the Corn Belt, Fernandez notes. The reasons for the higher ranges are not clear, he says, but weather is probably a factor. "We're seeing a trend to wetter springs, which affects nitrogen loss." New genetics are another driver.

How to use the N-rate calculator

To determine your most profitable N rate, go to the online calculator and choose Minnesota from the state menu. Select a rotation, then enter your N price, either per-ton or per-pound, and your expected corn value per bushel.

The tool calculates the price-to-value ratio, which usually floats around 0.10, then shows you your:

- most profitable N rate;

- a profitable N rate range;
- percentage of maximum yield produced at the most profitable N rate;
- menu of graphs of your results.

Adapting the guidelines for your farm

The calculator shows an acceptable range of N rates, which will provide similar profitability. Net returns to N in the range fall within \$1 per acre of the potential maximum, Fernandez says.

This gives growers flexibility to adjust N rates somewhat for local environmental conditions, price fluctuations, and their own risk tolerance. For example, if you farm high-organic-matter soils, which can supply extra nitrogen, you might want to select an N rate at the bottom of the acceptable range. Likewise, if you farm low-organic-matter soils, you might want to go with the top end of the range.

The guidelines are based on best management practices, including spring nitrogen application. One question that often comes up is whether to adjust the suggested rates for fall N application. The answer is no. N rates should not be increased for fall application, Fernandez says, “because the need for adjustments will depend on what happens in the spring.” If spring rainfall is excessive — as it was in 2016 in southern Minnesota — you may have to apply more nitrogen during the growing season. The U of M offers a handy In-Season Corn N Calculator <http://www.extension.umn.edu/agriculture/nutrient-management/crop-calculators/> to help you decide if supplemental N is needed.

Another common question is whether the guidelines should be adjusted for regional differences. Some research shows that in northwestern Minnesota and the Red River Valley, N rates should fall towards the lower end of the acceptable range, Fernandez says. Also, the U of M publishes separate N guidelines for corn grown on sandy soils.

Staying within the U-M nitrogen guidelines will minimize the risk of over- or under-applying nitrogen, and maximize your profit potential. Just as important, it will lower the potential for N loss to the environment.

Kramer, of C.B. Agronomics, is a crop consultant from Gibbon. Find information and links to Minnesota certified crop advisers at <http://www.mcpr-cca.org>

Key points

- Nitrogen rates should be based on profitability, not yield goals.
- Minnesota nitrogen fertilizer guidelines have been updated for 2017.
- Use the U-M’s online nitrogen calculator to identify the most profitable N rates for your operation.

Nitrogen fertilizer rate guidelines for non-irrigated corn in Minnesota				
	Corn/corn		Soybean/Corn	
	MRTN*	Acceptable Range	MRTN*	Acceptable Range
	-----lb N/acre-----			
0.05	180	160 - 200	140	125 - 160
0.10	155	145 - 170	120	105 - 130
0.15	150	140 - 155	105	95 - 115
0.20	140	130 - 150	95	85 - 105

**Maximum Return to Nitrogen*

Source: "Nutrient Management Fertilizing Corn in Minnesota," D. E. Kaiser et al, Oct. 2016

The Maximum Return to Nitrogen, or MRTN, is the rate that maximizes grower profit in most years. It is based on a large number of U-M replicated nitrogen response trials across many environments: 87 site-years for corn-after soybeans and 58 site-years for corn-after-corn. The acceptable N rate range will produce profits within \$1/acre of the MRTN. To select the best rate, first determine your N-price-to-crop-value ratio (price ÷ value). Most of the time, the ratio floats around 0.10. Then choose a rate within the acceptable range, based on your environmental conditions and risk tolerance. These guidelines apply to all soils in Minnesota, except sandy soils.

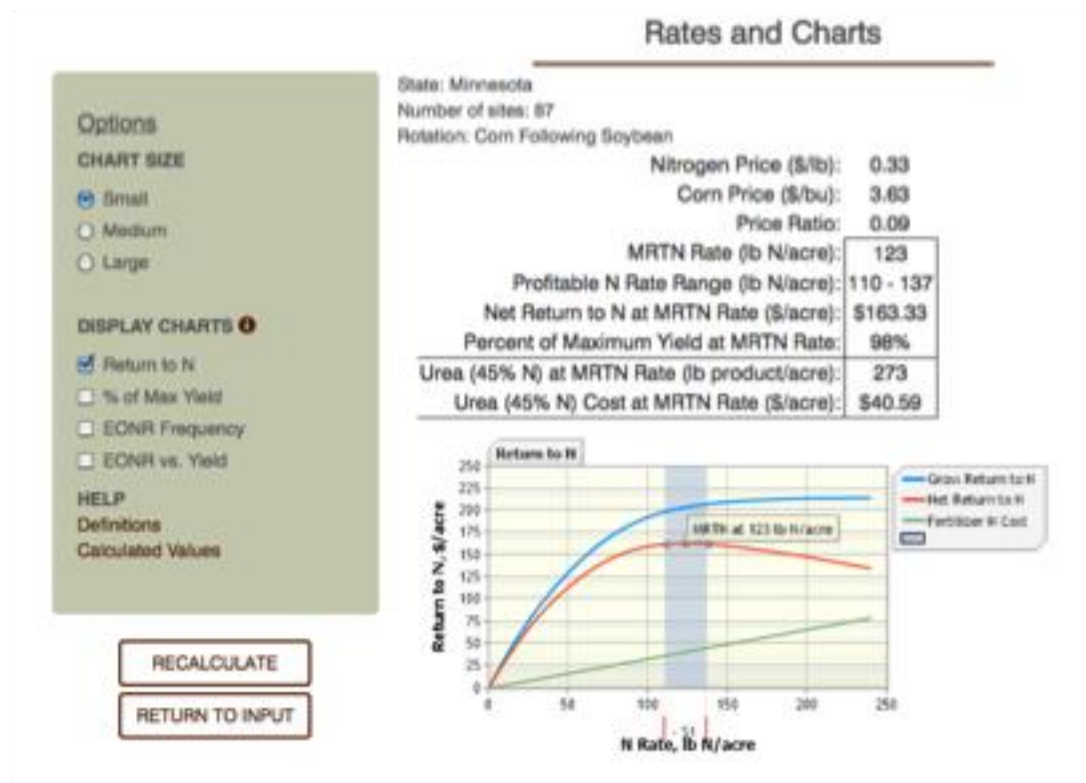
Nitrogen fertilizer rate guidelines for corn on irrigated sandy soils in Minnesota		
N price/Crop value ratio	Corn/corn	
	MRTN*	Acceptable Range
	-----lb N/acre-----	
0.05	235	210 - 255
0.10	210	190 - 225
0.15	190	175 - 210
0.20	180	165 - 190

**Maximum Return to Nitrogen*

Nitrogen fertilizer rate guidelines for corn grown on non-irrigated loamy fine sands with less than 3% organic matter in Minnesota		
N price/Crop	Corn/corn	Soybean/Corn
		-----lb N/acre-----

value ratio		
0.05	100	70
0.10	90	60
0.15	80	50
0.20	70	40

Source: "Nutrient Management Fertilizing Corn in Minnesota," D. E. Kaiser et al, Oct. 2016
For corn grown on sandy soils in Minnesota, the N rate guidelines above will produce the greatest profit in most years.



Source: <http://cnrc.agron.iastate.edu/>

The University of Minnesota's Maximum Return to Nitrogen calculator lets you identify the most profitable nitrogen rate for any given ratio of N-price-to-corn-value. In this example, the blue-shaded bar on the graph indicates the most profitable rates of nitrogen as urea for corn after soybeans, when nitrogen costs \$.33/lb. and corn value is \$3.63/bu. A rate of 110 to 137 lbs/acre of urea will produce about 98% of maximum potential yield, generating a return to N of about \$163/acre.