

August 2020

Appendix D: Maximum Return to Nitrogen (MRTN) Values for Fertilizer

**5-year Progress Report on
Minnesota's Nutrient Reduction Strategy**



Appendix D. Maximum Return to Nitrogen (MRTN) Values for Fertilizer

Written by Jeppe Kjaersgaard, Minnesota Department of Agriculture, in association with Minnesota's Nutrient Reduction Strategy 5-year Progress Report (2020)

Nitrogen (N) fertilizer rates for corn in Minnesota are established based on nitrogen fertilizer rate trials conducted by the University of Minnesota during the last 20 years. The rates are expressed in terms of Maximum Return to Nitrogen (MRTN) values. The MRTN is based on an index of the nitrogen price (\$/lb) divided by the crop value (\$/bu). While there are several factors influencing these values, which will vary over time and individual farm operations, the prices of grain and fertilizers are normally linked within the marketplace and for most situations, a 0.10 ratio is appropriate for corn production when manure is not used. In the guidelines there is a range of +/- \$1 around the MRTN to allow flexibility relative to risk management. See University of Minnesota guidelines at <https://extension.umn.edu/crop-specific-needs/fertilizing-corn-minnesota>. When manure crediting is involved, a 0.05 ratio is commonly used. This allows a margin of uncertainty associated with the heterogeneous nature of nutrient release from certain manures. For more information about University of Minnesota Extension Service recommendations for manure, go to <https://extension.umn.edu/manure-land-application/manure-application-rates>.

MRTN values were first published by the University of Minnesota in 2006. MRTN values for irrigated corn was broken out separately by the 2015 growing season. Updated MRTN values for rain-fed (non-irrigated) corn were updated prior to the 2016 growing season and again prior to the 2019 growing season. Each update has incorporated the most recent results from ongoing nitrogen rate trials conducted by the University of Minnesota and include impacts of new hybrids, improved tools for nutrient management and climate conditions.

The MRTN values for rain-fed corn after corn and corn after soybean are shown in the tables below for 2006, 2016 and 2019. Also shown are acceptable rate ranges around the MRTN. For the 0.10 ratio the recommended rates have increased 25 lb N/ac for corn following corn and 20 lb N/ac for corn following soybean from 2006 to 2019.

A comparison between the MRTN for corn following corn for Minnesota and surrounding states are shown in the figure below. The MRTN rates for Minnesota are similar to those of Wisconsin and Michigan, but lower than those from Iowa, South Dakota and Illinois.

University of Minnesota guidelines for nitrogen fertilizer rates for non-irrigated corn following corn from 2006, 2016 and 2019.

MRTN is Maximum Return to Nitrogen.

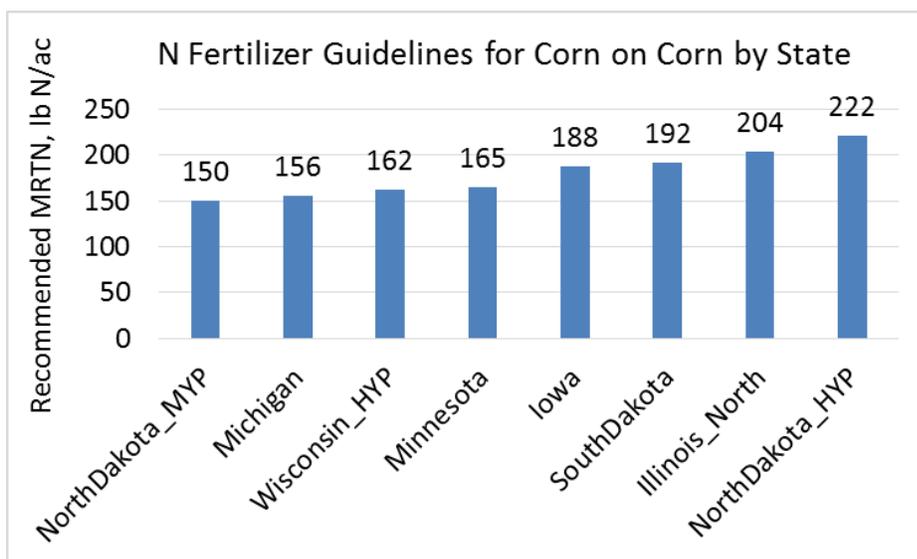
N price/Crop value ratio	2006	2016	2019	2006	2016	2019
	MRTN	MRTN	MRTN	Range	Range	Range
	lb N/acre					
0.05	155	180	195	130-180	160-200	175-215
0.10	140	155	165	120-165	145-170	152-180
0.15	130	150	150	110-150	140-155	140-160
0.20	120	140	145	100-140	130-150	135-155

wq-s1-84g

University of Minnesota guidelines for nitrogen fertilizer rates for non-irrigated corn following soybean from 2006, 2016 and 2019.

MRTN is Maximum Return to Nitrogen.

N price/Crop value ratio	2006 MRTN	2016 MRTN	2019 MRTN	2006 Range	2016 Range	2019 Range
	lb N/ac					
0.05	120	140	150	100-140	125-160	135-165
0.10	110	120	130	90-125	105-130	120-145
0.15	100	105	115	80-115	95-115	105-125
0.20	85	95	105	70-100	85-105	95-115



MRTN for the 0.10 nitrogen price/crop value ratio for corn following corn in Minnesota and surrounding states.

Data collected on March 25, 2019. MYP=Medium Yield Potential, HYP=High Yield Potential. Data for Minnesota is for High Yield Potential. South Dakota recommends using a yield goal approach, all other states uses the MRTN concept.