

CORN YIELD RESPONSE TO NITROGEN RATE AND TIMING IN MICHIGAN

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Improving our understanding of the factors affecting corn yield and yield response to N fertilizer in Michigan is important for providing efficient and profitable N recommendations. North Central region states have collaborated to adopt a Maximum Return to N (MRTN) approach to corn N rate recommendations, incorporating economic considerations with recent N response data. Corn N response studies have been ongoing in Michigan, with data from 2008 adding to a N response database including a total of 47 site years. This specific study was sought to not only contribute to the new corn N recommendation database, but also investigate the mechanisms driving corn N response in order to better manage agronomic systems.

A total of 9 trials were initiated in spring 2008. One site was lost during the season, leaving a total of 8 sites. Experimental sites were located in a manner that provided a representation of the major soil associations common to Michigan corn production (Figure 1). Treatment designs included basic and expanded plot plans (Table 1). Basic plot designs, one on a university research farm and two on producer fields, included six N rates applied as pre-plant broadcast incorporated urea. Expanded plot designs, three on university research farms and two on producer fields, included six N rates applied as pre-plant broadcast incorporated urea, starter fertilizer with planting, and sidedress injected UAN.

Soil samples were collected preplant (0-6" and 6-12" from control plots) for site characterization, and at research farm sites, pre-sidedress (0-12"), and post-harvest (0-6" and 0-3' in 1' increments) soil samples were collected. Plant growth evaluation included stand counts; V6 and R1 tissue sampling; chlorophyll meter and GreenSeeker optical sensor measurements at V6, V8, V10, and R1; end-of-season stalk sampling; grain yield and grain N analysis. Plant tissue analyses and Minolta SPAD relative chlorophyll readings will be evaluated to differentiate trends in relation to N rate and timing and among each other. Remote sensing (NDVI) data collected at the research farm sites throughout the year with the GreenSeeker sensor will be evaluated and added to a regional database, where multiple universities and industry are developing algorithms for using these data to develop N recommendations and improved N management.

Corn grain response to N for each individual site is listed for expanded (Table 2) and basic (Table 3) treatment design structures. Agronomic maximum yield, and the corresponding N rate, is determined by fitting data to yield response curves. At only two sites, Saginaw and Tuscola-Fairgrove, were N rate applications of 120 lb N ac⁻¹ not sufficient to achieve maximum yield. Results from 2008 will be pooled with other recent Michigan response data to develop a N response database for use in revising corn N recommendations.

Table 1. Nitrogen fertilizer treatments at study locations in 2008

Ingham, Saginaw Branch, Hillsdale	Kzoo, Fairgrove, Reese
----- lb N/ac -----	
Control	Control
40 (pp UR)	40 (pp UR)
80 (pp UR)	80 (pp UR)
80 (40pl, 40sd)	120 (pp UR)
120 (pp UR)	160 (pp UR)
120 (40pl, 80sd)	200 (pp UR)
160 (pp UR)	
160 (40pl, 120sd)	
160 (sd UAN)	
200 (pp UR)	

pp UR: urea (46-0-0) applied preplant and incorporated
pl: 2x2 starter at planting
sd UAN: 28% urea ammonium nitrate solution applied sidedress, injected

Figure 1. Corn N-response study locations in 2008. Solid stars denote locations used in data analysis, non-solid stars denote sites that were excluded due to drought effects.

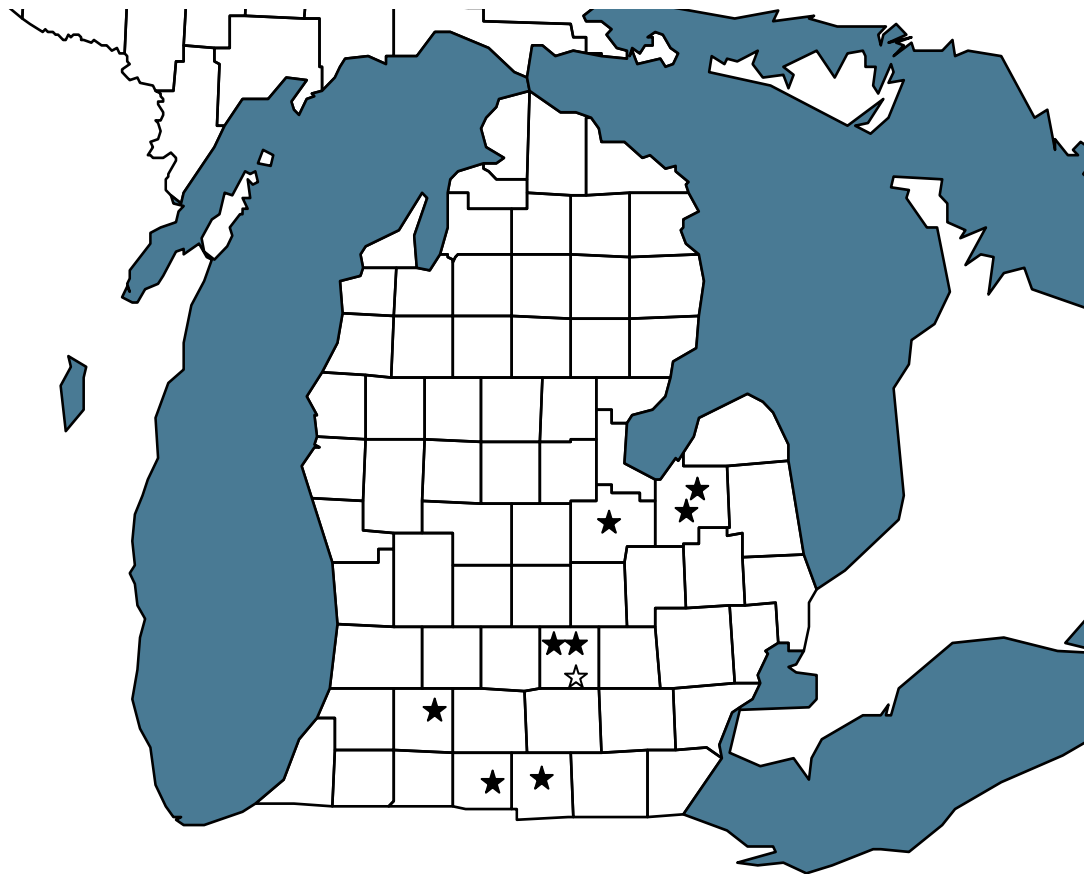


Table 2. Corn grain response to N fertilizer in Michigan, 2008: Expanded treatment designs plot structures ($\alpha=0.05$)

	Saginaw	Ingham Sb/C	Ingham C/C	Branch	Hillsdale
lb/ac	----- bu/ac -----				
0	88 e	96 e	77 d	76 b	97 c
40 bc	134 d	150 cd	102 c	88 ab	127 d
80 bc	194 c	132 d	127 bc	94 a	167 c
80 (40/40)	190 c	164 abc	111 c	88 ab	168 bc
120 bc	211 b	157 bc	161 a	87 ab	187 a
120 (40/80)	211 b	152 cd	137 ab	96 a	188 a
160 bc	233 a	184 a	129 abc	88 ab	190 a
160 sd	226 ab	155 bc	127 bc	98 a	197 a
160 (40/120)	223 ab	167 abc	152 a	97 a	187 ab
200 bc	231 a	176 ab	142 ab	86 ab	191 a
Prev. Crop	Sb	Sb	C	Sb	Sb
Agronomic Max					
Yield (bu)	228	172	144	91	190
N Rate (lb)	173	192	138	79	163

Previous Crop: Sb:soybean, C:corn

Agronomic Max: Maximum corn grain yield and corresponding N rate determined by yield response curves

Table 3. Corn grain response to N fertilizer in Michigan, 2008: Basic treatment designs plot structures ($\alpha=0.05$)

	Kalamazoo	Tuscola-Reese	Tuscola-Fairgrove
lb/ac	----- bu/ac -----		
0	49 c	89 d	61 e
40 bc	62 b	133 c	117 d
80 bc	71 a	162 b	152 c
120 bc	55 ab	173 ab	177 b
160 bc	57 ab	180 ab	180 b
200 bc	49 c	187 a	207 a
Prev. Crop	Sb	Sb	Sb
Agronomic Max			
Yield (bu)	64	182	201
N Rate (lb)	92	156	212

Previous Crop: Sb:soybean, C:corn

Agronomic Max: Maximum corn grain yield and corresponding N rate determined by yield response curves