

Summary

- Un-fertilized strips yielded an average 141 bu/ac.
- Generally, adding more than 120 lb/ac N fertilizer did not typically increase yields or profit.
- At a corn price of \$3.00/bu and a N cost of \$0.30/ac, a yield increase of 3.0 bu/ac is needed to pay for the extra 30 lb of applied N fertilizer.
- Economically optimum nitrogen rates for all 68 sites averaged 121 lb N/ac at a N Cost:Corn Price ratio of 0.10. (\$0.30/ pound N: \$3.00/bushel corn)
- 57% of the 68 sites had an EONR less than 125 lb N/ac which is the maximum suggested rate at a N Cost:Corn Price ratio of 0.10. (\$0.30/ pound N: \$3.00/bushel corn)
 - When 2004 is excluded, 64% of the 68 sites had an EONR less than 125 lb N/ac.
 - When 2004 is excluded, 73% of the 68 sites had an EONR less than 130 lb N/ac.



For More Information

Cost-share Programs to Conduct On-Farm Fertilizer Rate Trials

- Minnesota Nutrient Management Initiative
<http://www.mda.state.mn.us/nmi/>
- BMP Challenge
<http://www.bmpchallenge.org/>
- Special Watershed Programs
Check with your local County or Watershed Project

More Information

- Iowa Soybean Association
<http://www.isafarmnet.com/enviroagron/index.html>
- Center for Agricultural Partnerships
http://www.agcenter.org/projects_midwater.html

University of Minnesota Nitrogen Rate Guidelines

- UMN Nitrogen Rate Guidelines
<http://www.extension.umn.edu/distribution/cropsystems/DC3790.html>

Contacts

For more information regarding these results or how to develop your own nitrogen rate response curve contact:

- Dr. David Mulla, University of Minnesota, 612-625-6721
- Brian Williams, Minnesota Department of Agriculture, 507-665-6806
- Kevin Kuehner, BNC Water Quality Board, 507-934-4140

Special Thanks to Project Participants, Cooperators and Sponsors.

- Farmer Participants
- Area Coops, Crop Consultants and Agri-businesses
- St. Peter Wellhead Protection Project
- Seven Mile Creek Watershed Project
- Center for Agricultural Partnerships
- Blue Earth Consulting
- 319, Clean Water Partnership Program and MPCA
- SROC-Waseca
- McKnight Foundation
- BNC Water Quality Board
- Brown Nicollet Environmental Health
- Maple River Watershed Project
- Watonwan River Watershed Project
- EPA Targeted Watershed Program
- Minnesota Department of Agriculture
- University of Minnesota Precision Ag Center
- University of Minnesota Extension Service

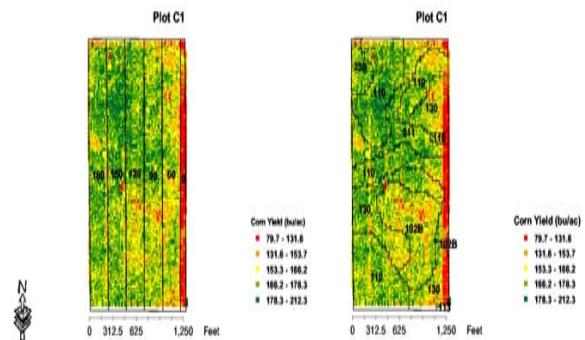
On-Farm Nitrogen Rate Trial Results

South-Central Minnesota Corn following Soybeans 2000-2005



Methods

- 50-acre fields with previous crop soybeans and no manure in past 5 years were selected.
- Five different nitrogen rates were applied in 10-acre strips. Widths are set to match the farmer's applicator and harvest machinery. Strips are at least 200 feet wide by 1,500 feet long.
- Total nitrogen rates of 60, 90, 120, 150, and 180 lbs./ac were applied.
- Nitrogen source was mainly fall applied anhydrous or spring applied UREA.
- On the majority of sites, a smaller 2.5-acre strip of 0 pounds of applied N was used as a control.
- The plot was field harvested using a GPS enabled yield monitor.
- The harvest was documented, calibrated, and verified by a certified crop consultant.
- Yield and soils data were then analyzed at the University of Minnesota Precision Ag Center to determine Economically Optimum Nitrogen Rates (EONR) and Yields.
- Farmer is paid \$750 to participate (depending on watershed) and data is kept confidential.
- St. Peter Wellhead Trials were conducted on 30-acre fields with rates of 0, 60, 90, 100, and 150 lbs. of applied N per acre and were replicated three times in 2.5-acre strips.



Results

Summary of Average Yields for Each Fertilizer Treatment by Year

Table 1

Year	Application Rate (lb N / acre)					
	0	60	90	120	150	180
	----- average bushels / acre -----					
2000	131	154	158	160	163	NA
2001	124	141	145	148	149	145
2002	134	159	165	169	170	170
2003	154	182	188	195	197	199
2004	142	169	183	193	201	203
2005	162	184	198	201	200	198
Average Yield for All Sites	141	161	168	173	175	178
Minimum Yield for All Sites	105	118	120	122	130	127
Maximum Yield for All Sites	177	200	213	226	233	236
Number of Sites	41	68	68	68	68	55

Raw Data Results:

- Table 1 summarizes the average yields for each fertilizer rate over a six-year study period.
- Average yields for each fertilizer rate varied from year to year as a function of site characteristics, soils and climatic conditions for that particular year.
- A wide range of yields were observed for each fertilizer treatment.
- There was an increasing trend observed for corn yields.
- Crop yields in treatments with no applied fertilizer (controls) averaged 141 bu/ac, showing that large amounts of nitrogen are supplied by soil mineralization.

Economic Analysis Results:

- The tables included in the 'Economics' section are provided to help determine what rate of nitrogen was found to be the most economical given a certain input cost for nitrogen fertilizer and price received for corn.
- During this study period, it would typically take an average per acre yield increase of 2-5 bushels of corn to pay for 30 additional pounds of N fertilizer.
- Figure 3 represents the average Economic Optimum Nitrogen Rate (EONR) given a N Cost: Corn Price ratio of 0.10. (\$0.30/ pound N: \$3.00/bushel corn)
- Results averaged over all six years and 68 sites showed an average economically optimum nitrogen rate of 121 lb N/ac on corn following soybeans.
- Grain yields for these six years and 68 sites averaged 175 bu/ac with 121 lb N/ac of applied fertilizer.
- Overall, a majority of the trials fell within the University of Minnesota guidelines for nitrogen fertilizer except for 2004.
- A wetter than normal growing season helps explain the higher response to nitrogen fertilizer in 2004. (Fig.1)
- May 2004 was particularly wet with rainfall averaging 2.4" (65%) above normal across the Mankato, New Ulm, St. James, St. Peter, and Waseca area. June was also very wet in some South-Central areas. The potential for de-nitrification and leaching losses of N was high in some fields, and side-dress applications of N were being recommended.

Economics

How many bushels of corn does it take to pay for an additional 30 lbs. of N/acre?

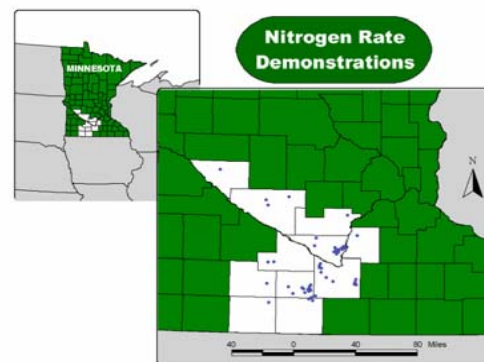
Fig. 2

Corn Price (\$/bu)	Nitrogen Price (\$/lb)						
	\$4.50	1.3	1.7	2.0	2.3	2.7	3.0
\$4.40	1.4	1.7	2.0	2.4	2.7	3.1	3.4
\$4.20	1.4	1.8	2.1	2.5	2.9	3.2	3.6
\$4.00	1.5	1.9	2.3	2.6	3.0	3.4	3.8
\$3.80	1.6	2.0	2.4	2.8	3.2	3.6	4.0
\$3.60	1.7	2.1	2.5	2.9	3.3	3.7	4.1
\$3.40	1.8	2.2	2.6	3.1	3.5	3.9	4.3
\$3.20	1.9	2.3	2.8	3.3	3.8	4.2	4.6
\$3.00	2.0	2.5	3.0	3.5	4.0	4.5	4.9
\$2.80	2.1	2.7	3.2	3.8	4.3	4.8	5.2
\$2.60	2.3	2.9	3.5	4.0	4.6	5.1	5.6
\$2.40	2.5	3.1	3.8	4.4	5.0	5.5	6.0
\$2.20	2.7	3.4	4.1	4.8	5.5	6.1	6.7
\$2.00	3.0	3.8	4.5	5.3	6.0	6.8	7.5
\$1.80	3.3	4.2	5.0	5.8	6.7	7.5	8.4
	0.20	0.25	0.30	0.35	0.40	0.45	

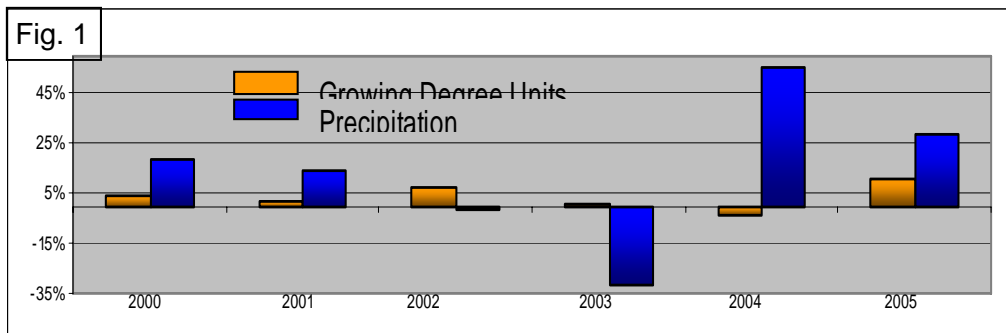
Example, if you purchase N at an average price of \$0.30/lb and sell your corn for \$3.00/bushel you will need to see a yield increase of at least 3.0 bushels/acre to break even for that extra 30lb./acre of applied N fertilizer.

Locations and Weather

- 42 farmers participated in 11 different South-Central MN counties.
- 68 plots covering nearly 4,000 acres were used for this summary.
- Weather conditions were relatively normal except 2003 and 2004.



Growing Season Departure from Normal Precipitation & Growing Degree Units (Normal 1971-2000 Waseca SROC)



Economic Optimum Nitrogen Rate (EONR) Analysis and Comparison with UM Guidelines

Fig. 3

