

University of Minnesota On-farm Nitrogen Research in Irrigated Corn in Dakota County

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Background

In response to increasing fertilizer costs the University of Minnesota changed its fertilizer nitrogen (N) rate recommendations for corn in 2006. Instead of using yield goals to determine how much nitrogen to apply, the new guidelines are based on economics, soil productivity and a producer's attitude towards risk. The recommendations were developed in cooperation with universities in seven corn belt states and are based on research from over 700 sites in the upper Midwest. They are central to the voluntary Best Management Practices for nitrogen in Minnesota, agricultural practices that are economically sound and, when followed, capable of minimizing risks to the environment.

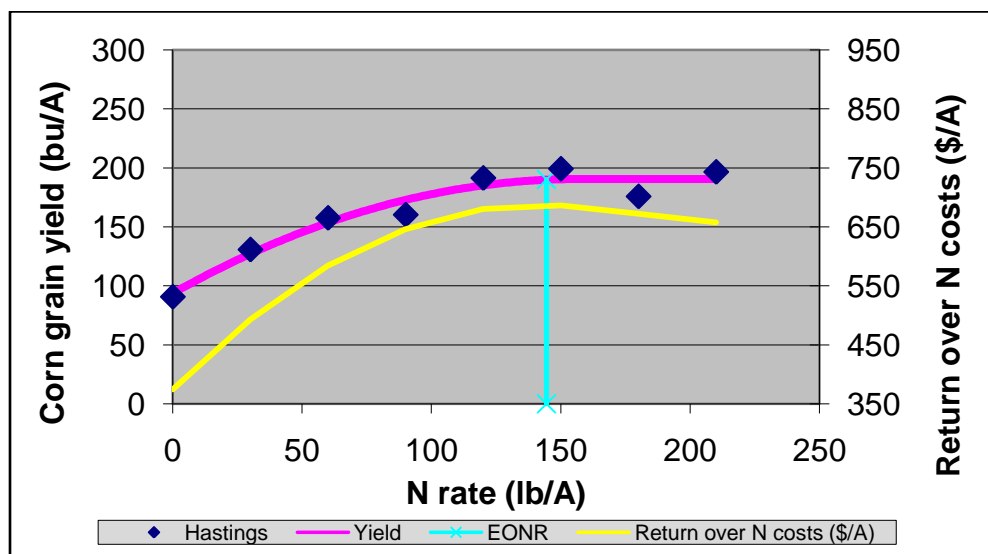
Why duplicate the research in Dakota County?

While over 700 sites were used in the original research, none of the sites represented irrigated corn on coarse-textured soils, conditions that are common in Dakota County. Since 2006, several study sites were established with the help and support of local farmers and the Vermillion River Watershed Joint Powers Organization (VRWJPO) to study the corn yield response to nitrogen rates under Dakota County conditions.

Study results from 2006 & 2007

A total of three sites, two on sandy soils and one on a loam soil, were established during the 2006 and 2007 growing seasons to evaluate corn yields in response to fertilizer N. Eight fertilizer N application rates were included and ranged from 0 to 210 pounds N per acre (0, 30, 60, 90, 120, 150, 180, 210 pounds per acre). While results from all of the sites support the new University guidelines, results from the 2007 sites are highlighted in Figures 1 and 2.

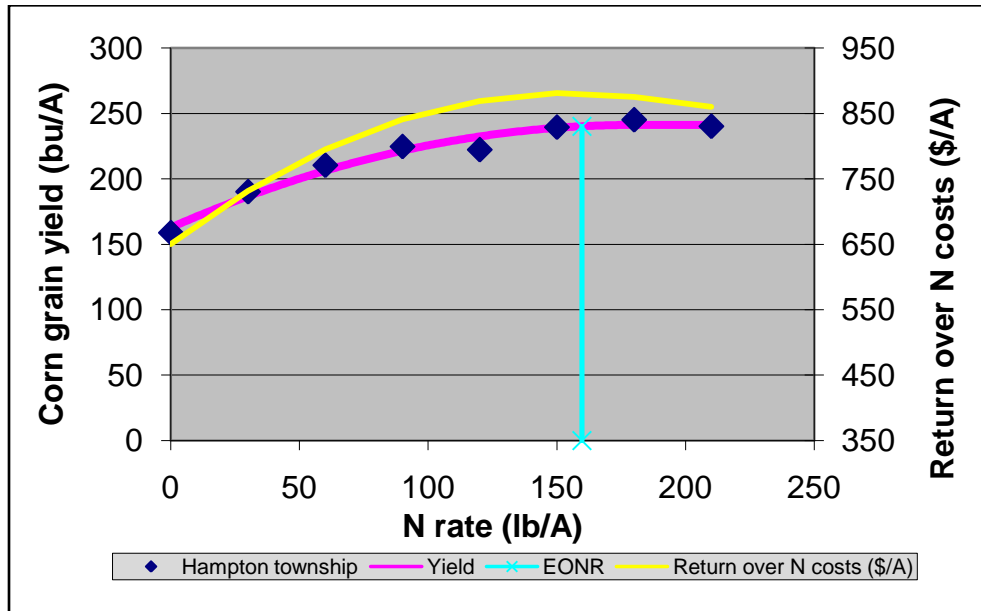
Figure 1. Corn yield response to varying amounts of N fertilizer on an irrigated sandy soil near Hastings, 2007 where the previous crop was potatoes followed by winter rye. Return over N costs based on \$4.00/bu and \$0.50/#N.



Yield response curves are shown by the pink lines. Economic optimum N rates (EONRs) are represented by the vertical blue line and show the point where any additional N would not be cost effective. This is also reflected by the return over N costs (yellow line) which is based on \$4.00 per bushel corn and \$0.50 per pound N. At

Hastings, the EONR of 144 pounds per acre yielded 190 bushels per acre. An EONR of 160 pounds per acre yielded 240 bushels at the Hampton Township site. For all of the sites over these two years, the nitrogen rates that maximized economic return fell within the new University guidelines.

Figure 2. Corn yield response to varying amounts of N fertilizer on an irrigated loam soil in Hampton Township, 2007 where the previous crop was sweet corn. Return over N costs based on \$4.00/bu and \$0.50/#N.



In addition to yield response, basal stalk nitrate-N concentrations were evaluated. Iowa State University first studied corn basal stalk nitrate-N as a post-mortem tool to distinguish between N rates that had been adequate and those that had been excessive. In their suggested interpretation, concentrations between 700 and 2000 ppm are likely adequate, while concentrations above 2000 ppm suggest that N was applied in excess of the crop's needs. In both of our studies, the EONR was in the optimum basal stalk nitrate-N range.

2008 Study

The studies were expanded in 2008 to evaluate new technologies that help determine N needs of the corn during the growing season. In addition to the eight N rates, three new treatments were included:

- “Spoonfeeding” – 180 pounds of N per acre were split into 6 applications of 30 pounds per acre. The objective was to compare a simple split application (90+90 lb/A) to a treatment that mimicked fertigation with several applications N up to the V12 stage.
- SPAD meter – The relative greenness of corn leaves in the SPAD plot were compared to leaves in a non-N limited plot (210 pound rate plot). Readings were taken at four vegetative stages and N was applied to the SPAD plots when the readings were less than 95% of the 210 pound per acre plots.
- Greenseeker™ - This tool senses how much light is absorbed by the corn. The information is related to the crop's biomass and can be used to calculate growth rates and N needs. Similar to the SPAD plots, readings were taken at four vegetative stages and N was applied when indicated by the reading.

All of the 2008 results will be discussed at **Crops Day on Tuesday, March 3** at the **Dakota County Extension and Conservation Center in Farmington**. For more information, contact Phyllis Bongard at 651-480-7757 or email bonga028@umn.edu.