Water Watch

A newsletter for the Maquoketa River Watershed

Project News

Reduced N rates perform well in high-yielding season

by Chad Ingels, nutrient and manure management specialist, Maquoketa Watershed Project

Record corn yields were harvested from 25 nitrogen, phosphorus and manure management demonstrations hosted by Maquoketa River watershed farmers during crop year 2002.

The greatest surprise was the 200 bushel-per-acre average yield from the conservative 60 pounds of nitrogen (N) per acre application rate on seven small-plot corn-following-soybean demonstrations. Average yields on these plots ranged from 206 to 215 bushels per acre with N rates of 90, 120 and 150 pounds of N per acre.

Over the past few years, the trend has been to increased soybean acres in the Maquoketa River Watershed and producers observe that a reduced amount of N is needed for corn following soybeans in the conventional rotation.

That's an added benefit for growers, who added soybeans to their rotation primarily in response to the farm program and commodity prices, and to break the weed, insect and disease cycles associated with continuous corn production.

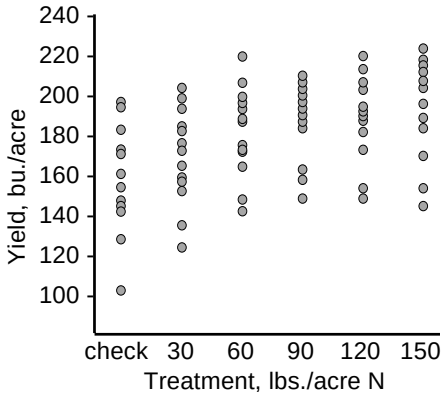

Figure 1. Corn yields for 16 sites, corn following soybean, crop years 2000-02.

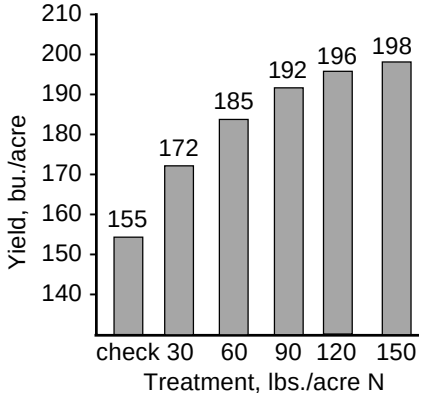

Figure 2. Sixteen-site average corn yields, corn following soybean, crop years 2000-02.

During the last three crop seasons, 16 Maquoketa River Watershed producers have hosted small-plot, various-rate N and phosphorus (P) demonstrations on their farms. These corn-following- soybean demonstrations were fertilized with N rates of zero, 30, 60, 90, 120 and 150 pounds per acre. These sites also had replicated treatments of P_2O_5 at zero, 46 (crop removal rate) and 92 pounds per acre (two-year crop removal rate).

Demonstrations in the Arlington and Preston areas had treatment averages that topped 200 bushels per acre. Figure 1 shows yields from all treatments from the past three seasons while figure 2 shows the average yields for each of the N treatment rates across the 16 sites.

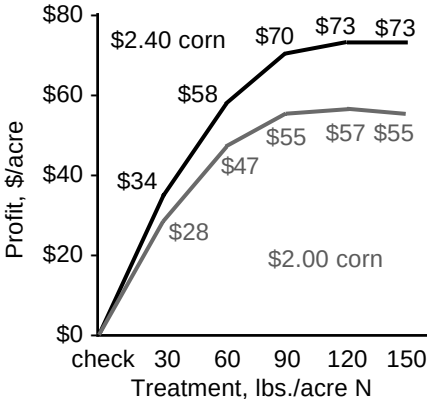

Figure 3. Profitability of additional N (N at $0.20 per pound and corn at $2.00 and $2.40 a bushel, crop years 2000-02.

continued page 2

IOWA STATE UNIVERSITY
University Extension

Issue No. 101, December 2002-January 2003

Reduced N, cont.

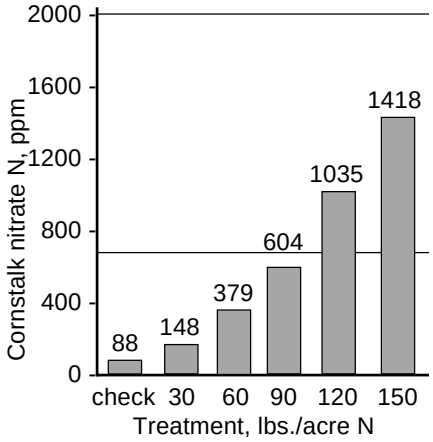

Figure 4. Sixteen-site average cornstalk nitrate N, crop years 2000-02. Horizontal lines mark optimum range of 700-2,000 ppm.

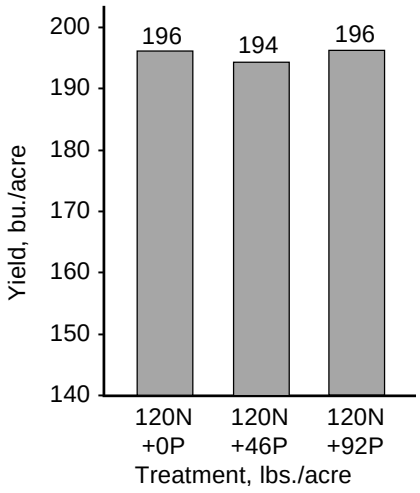

Figure 5. Three-year average corn yields, 2000-02, corn-following-soybean P demonstrations.

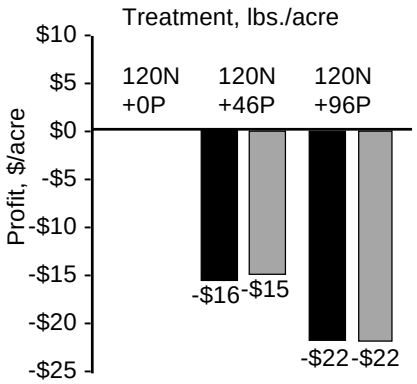

Figure 6. Corn value response to commercial P (P_2O_5 at $0.23 per pound, corn at $2.00 and $2.40 a bushel), crop years 2000-02.

The average return to dollars spent for N fertilizer, priced at 20 cents per pound, and corn at $2.00 and $2.40 per bushel is shown in figure 3. The best return to N fertilizer was the 120 pounds N per acre in the high-yield 2002 crop year. Demonstrations conducted in 2000 and 2001 showed 90 pounds N per acre to be the most profitable rate. Above that rate, there was no additional return on the N investment.

Residual nitrate-N in the cornstalks following corn maturity was measured for all N treatments as shown in figure 4. The check, 30, 60 and 90 pounds N per acre treatments did not have enough N available to optimize corn production. Both the 120 and 150 pounds N per acre rates were within the optimum range of 700 to 2,000 parts per million (ppm).

There has been no yield response to the one and two-year crop removal rates of added P during the three years of demonstrations, as shown in figure 5. Again, the cost of this added P was significantly greater than the income from the additional corn yields, as shown in figure 6.

Iowa State University recommends fertilizing with P when soil tests fall below the high range (less than 21 ppm P), with an option to use a low rate of P in starter fertilizer when P tests are in the high soil test range.

Maquoketa Watershed Project staff wish to thank these producers for hosting the demonstrations: Bill Dallenbach and Larry Hiemes, both of Arlington, Mike and Russel Streeper, Onslow, Gene Grant and Mark Bormann, Preston, Warren Moeller, Miles, and Rich Feddersen, Andover.

Moderate manure plus minimal N equal highest return

by Chad Ingels, nutrient and manure management specialist, Maquoketa Watershed Project

Seven Maquoketa Watershed farmers hosted on-farm manure management demonstrations during crop year 2002, bringing the total to 17 over three years, 2000-02.

Their average corn income when manure was the only nitrogen (N) and phosphorus (P) fertilizer source resulted in increased gross income of $49 per acre, compared to the zero check, when corn was valued at $2.00 a bushel.

When corn is valued at $2.40 a bushel, the improved yield from manure application resulted in $59 per acre gross income. Both results are shown in figure 1 (next page).

The average first-year crop-available N credits from manure averaged 129 pounds per acre for all 17 demonstrations. The manure contribution has ranged from 29 to 286 pounds per acre.

All demonstration farms had high or very high P tests on the manure demonstration sites, so there was not a consistent yield response to the average of 179 pounds per acre added in the manure resource, as shown in figure 2 (next page).

This result was expected due to the high or very high pre-demonstration soil tests for P. Thus, adding P fertilizer to these fields resulted in a net loss of income.

continued next page

Moderate manure, cont.

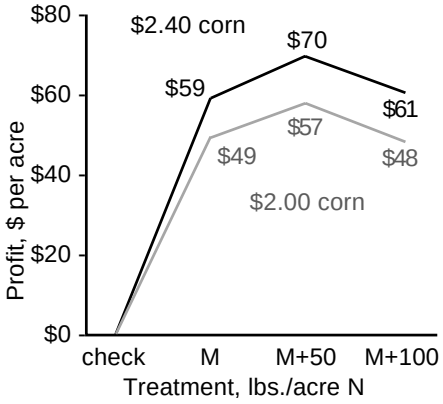

Figure 1. Profitability of additional N (N at $0.20 per pound and corn at $2.00 and $2.40 a bushel), crop years 2000-02.

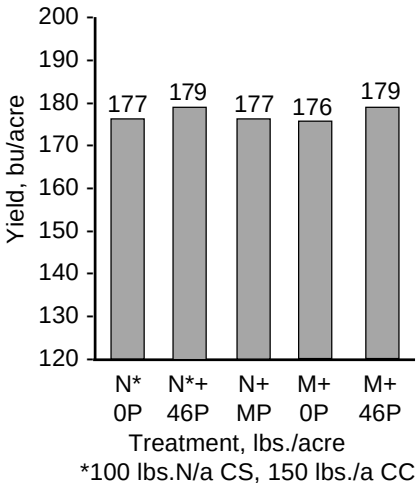

Figure 2. Seventeen-site average corn yields, manure and P demonstrations, crop years 2000-02.

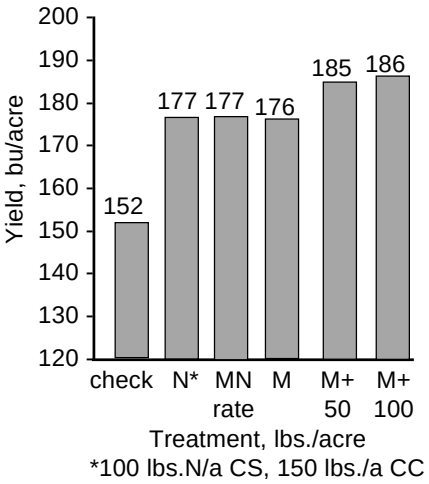

Figure 3. Seventeen-site average corn yields, manure and N demonstrations, crop years 2000-02.

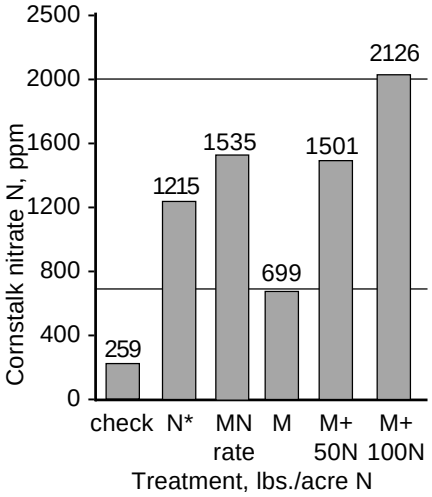

Figure 4. Seventeen-site average cornstalk nitrate N, manure demonstration sites, crop years 2000-02. Opimum range is 700-2,000 ppm.

The manure N contribution was calculated using adjustment factors of field manure history, N loss from surface application versus manure incorporation and first-year nutrient availability based on the type of manure applied.

Replicated treatments of commercial N applied at the first-year crop-available N rate (contribution) from the manure (MN rate) were applied randomly within each manure demonstration site. The equivalent N application resulted in an average corn yield of 176 bushels per acre from the manure N source and 177 bushels from the commercial N application, as shown in figure 3.

The addition of 100 pounds of N to the manure application resulted in the highest average yield of 186 bushels of corn per acre. However, this is not significantly different from 185 bushels of corn per acre achieved when only 50 pounds of N is added to the manured treatments. The higher N contribution from swine finishing manure applied in excess of 3,000 gallons per acre demonstrated no benefit from the additional N.

On average, the return on the N investment was the greatest when 50 pounds of N was added to the manure application, bringing the average crop-year available N to 179 pounds per acre.

The end-of-season cornstalk nitrate N (residual N in the corn plant at maturity) was in the optimum range, 1,501 parts per million (ppm), when 50 pounds N per acre supplemented the manure application, as shown in figure 4.

The optimum range for cornstalk NO_3–N is 700 to 2,000 ppm, indicating a high probability that the appropriate N rate was applied to the crop to provide the most profitable return on the N investment.

These demonstrations indicate that manure is a significant N and P resource for crop production.

The type of manure applied, the amount, method and uniformity of application are all factors that need to be considered when determining whether to supplement a manure application with additional N. The demonstrations show that applying more than 50 pounds per acre of N is not justified when using typical manure application rates.

There is a need for adequate additional N from commercial fertilizer when insufficient amounts of manure are applied.

Maquoketa Watershed Project staff express their appreciation to these manure management field demonstration cooperators: Nick Hayes, Tom Hayes, Don Thole, Pauline Antons and Alan Jacobs, Steve Streets, Dennis Eggers and Rich Feddersen.

Large scale N demonstration results

Ten cooperators with field-scale (50-acre) Global Positioning System–Geographic Information System (GPS-GIS) nitrogen (N) management trials were concentrated in the northern end of the Maquoketa Watershed.

The machine-harvested GPS yield monitor N demonstration treatments were arranged in 10-acre blocks of various N application rates. Figure 1 shows the average yields from the N rates applied to the corn-following-soybeans fields, including the zero-N-per-acre check treatment. These results correlate well with the three-year small-plot data reported on page 1.

Analysis of the 30 soil types and respective yields on the 10 cooperating farms will collectively provide the optimum economic N rate on each soil type.

Residual nitrate-N in the lower cornstalk after plant maturity is an additional indicator of N management efficiency and profitability of various N application rates (figure 2).

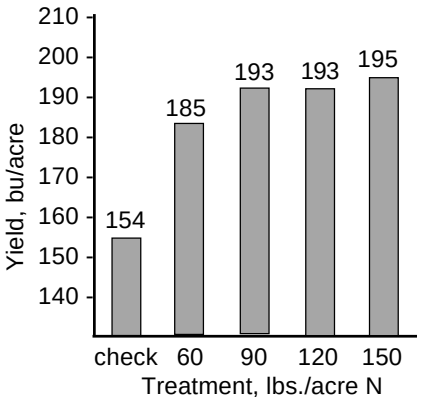

Figure 1. Average corn yields, field-scale N study, crop year 2002.

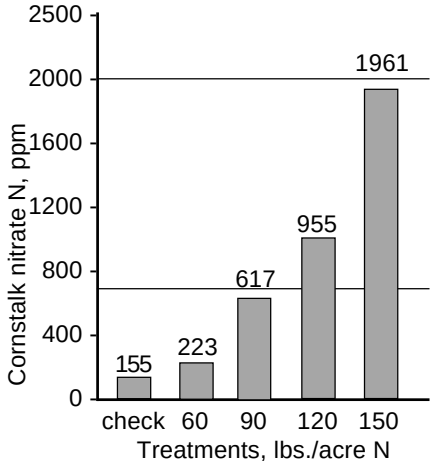

Figure 2. Average cornstalk nitrate N, field-scale N study, crop year 2002. Opimum range is 700-2,000 ppm.

Machine-harvest cooperators were Gary Soules, Tim and Jim Recker, Rand-Rod Farms, Collin Jensen, C&J Farms, Rick Cole, Tim and Jim Burrack, Verle Jones, Loran Steinlage and Nolan Knight.

Additional analysis of these results is under way at the University of Minnesota and results will be reported in *Water Watch* when available.

Water Watch is published bimonthly and funded, in part, by the USDA CSREES project number 00-51130-9731, the Iowa Department of Natural Resources through a grant from the U.S. Environmental Protection Agency under the Federal Nonpoint Source Management Program (Section 319 of the Clean Water Act), and Iowa State University Extension. The newsletter is free to project participants and those interested in issues involving farming methods and their effects on groundwater quality. Subscribe by sending your address to ***Water Watch,*** Box 487, Fayette, IA 52142.
Charles Wittman, editor.
Phone: 563 425-3233; E-mail: cwittman@iastate.edu; Web site: http://extension.agron.iastate.edu/waterquality/

Maquoketa Watershed Project
P.O. Box 487
201 E. Clark
Fayette, IA 52142