Water Watch

A newsletter for the Maquoketa River Watershed

Refined nitrogen rates studied by area farmers

by John Rodecap, Iowa State University Extension project coordinator, Maquoketa Watershed Project

Ten northeast Iowa corn growers took nitrogen (N) rate demonstrations to their own fields last year. Several will evaluate crop N requirements for the next two years following record-high 2002 corn yields and N removal from their fields.

An economic analysis using $0.17 per pound N and $2.25 per bushel corn has shown the Economic Optimum Nitrogen Rate (EONR) to be 114.3 pounds per acre on test strips in 2002 where producers applied 0, 60, 90, 120 and 150 pounds of N. Profitability using $0.20 N and corn prices of $2.00 and $2.40 per bushel are shown in figure 1.

A bushel of corn contains approximately 0.8 pounds of N, primarily as a component of protein. The average EONR yield on the 10 cooperating farms was 194 bushels per acre (figure 2), thus 155 pounds of N per acre was harvested from the 50-acre study fields. The end-of-season cornstalk nitrate N (NO_3-N) average analyses in figure 3 showing the optimum range of 700 to 2,000 parts per million (ppm) is consistent with the calculated EONR in the 10 study fields. All of the trials were planted in corn following soybeans.

The EONR was calculated for each of the 30 soil types on the 10 N-study fields. The Kenyon (83B) soil with an average EONR of 124 pounds of N per acre was present within all 10 demonstration fields.

A normal 150 bushel per acre corn crop requires about 300 pounds of N (125 pounds per acre in the grain, 175 pounds per acre is left in the roots and stover). Organic matter decomposition and mineralization is a major source of plant-available N. Microbes involved in the mineralization of the corn roots

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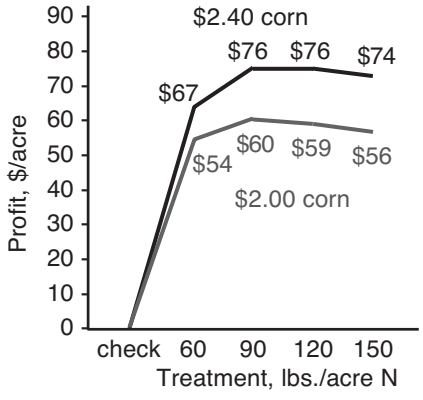

Figure 1. Profitability of additional N (N at $0.20 per pound and corn at $2.00 and $2.40 a bushel), field-scale N study, 2002.

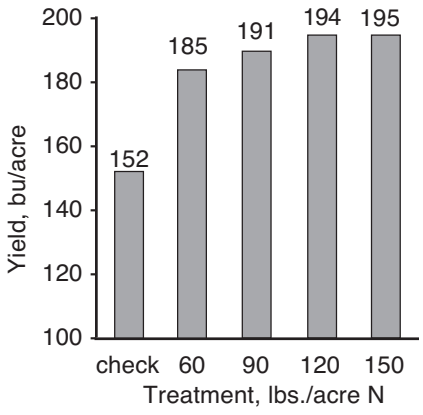

Figure 2. Average corn yields, field-scale N study, crop year 2002.

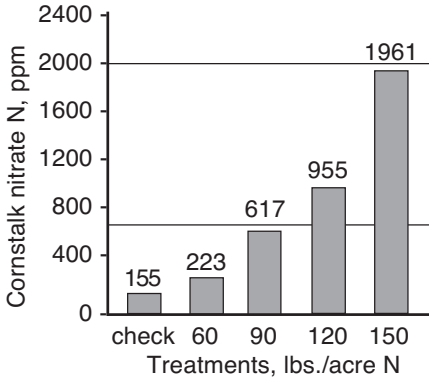

Figure 3. Average cornstalk nitrate N, field-scale N study, 2002. Optimum range is 700-2,000 ppm.

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Refining N cont.

and stover use considerable N in the early stages of residue decomposition. In contrast, there is minimal plant residue following a soybean crop thus less requirement for N during crop residue mineralization. Ammonium N (NH_4-N) and nitrate N (NO_3-N) in 32 inches of annual precipitation adds about 12 pounds of N per acre in northeast Iowa.

Total annual N loss measured in surface water ranged from 39.6 pounds per acre in 1999 to 36.2 pounds per acre in 2001 in the annual Iowa State University – Iowa Department of Natural Resources monitoring below the 39,260-acre Maquoketa Headwaters watershed in 1999-2001.

Recent farm program changes have made the corn-soybean rotation less attractive financially. Additional production considerations of insect and disease problems when growing soybeans have prompted four of the N demonstration cooperators to grow corn for the second year in their N study fields. Record high 2002 corn yields and end-of-season analysis of corn stalk residual NO_3-N provide an excellent N use history for second-year field-scale N management studies.

Several cooperators said they were surprised at how well the zero and 60-pound N rate strips yielded in 2002 – 152 and 185 bushels per acre respectively. They are interested in 2003 corn response to various corn-following-corn N rates ranging from zero to 180 pounds of N per acre applied on the 2002 N demonstration strips. Additional field scale nutrient management trials will include various rates of swine finishing or liquid dairy manure.

The Iowa Corn Growers' Corn Promotion Board will fund the 2003 yield loss and end-of-season residual NO_3-N evaluations, according to Tim Recker and Tim Burrack, northeast Iowa Corn Grower Association and Corn Promotion Board representatives. The 2002 N study was financially sponsored by the McKnight Foundation, Shell Oil Company Marine Habitat program, the U.S. Environmental Protection Agency and the Center for Agricultural Partnerships.

The Fayette-based Iowa State University Maquoketa River Watershed Project staff provide coordination and data analysis for N, phosphorus and manure nutrient management on-farm demonstrations.

The N demonstration cooperators in 2002 provided fields applied with various N rates and Global Positioning System geo-referenced yield maps and other production and harvest data. They were Loran Steinlage, Verle Jones, Gary Soules, Nolan Knight, Rand-Rod Farm, Tim and Jim Recker, C&J Farm, Rick Cole, Tim and Jim Burrack and Collin Jensen.

Phosphorus index is an environmental risk assessment tool

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

During the 79th General Assembly (2002), the Iowa legislature passed Senate File 2293, which will have an impact on livestock operations in the state. The file amended the Iowa Code section 455 relating to the disposal of farm animal manure within the state.

One of the changes directed the Iowa Department of Natural Resources (IDNR) to establish a phosphorus (P) index in order to determine the manner and timing of land-application of manure originating from confinement feeding operations.

A confinement feeding operation is designated as an animal feeding operation with greater than 500 animal units (500 beef cattle, 1,250 swine or 357 dairy cows) confined for 45 days or more per 12-month period.

In addition, the legislature directed that the P index be used to determine application rates by field, based on the level of P that may be applied per acre and the application practice.

The resulting P index is to be based on the Iowa P index currently used by the Iowa Natural Resource and Conservation Service (NRCS).

The Iowa P index is a risk assessment tool developed by Iowa State University scientists to provide a relative rating as to the risk of P delivery from fields to surface water resources.

Three sediment and water loss components are used to calculate an estimate of the amount of P delivered from fields that would be available to aquatic ecosystems.

The three major components involved in the index are erosion, runoff and subsurface drainage.

Factors of the erosion component are soil loss, presence and width of vegetative buffers, tillage and P soil test level. The runoff component is calculated using factors of precipitation, land formation, P soil test and P application timing, rate and method.

The subsurface drainage component considers the presence or absence of artificial drainage, precipitation and soil test P level.

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P index cont.

When the three components are added together, the resulting number is placed in one of five P delivery risk categories (see table at right). Using the index, producers and other land users can prioritize which fields or field areas may be more at risk to movement of P. Manure application then could be targeted to fields less likely to pose an environmental risk.

However, in order for the P index to be used as more than an assessment tool, at least five points should be considered, says Ubbo Agena, IDNR nonpoint source program coordinator.

First, at what scale should the resulting P index should be applied — to whole farms, whole fields or just portions of fields? A minimum and maximum acreage to be covered by an individual index value will be developed.

Second, the index must be calibrated to determine if the risk classes are significantly different. Currently, the Iowa P index is a computer model of what may occur but has not been widely field-tested.

Antonio Mallarino, Iowa State University (ISU) agronomy researcher, is currently leading research to both calibrate the index and determine the most appropriate scale of application.

Third, the index risk classification may need to be retooled to more readily identify areas that need specific P management. The Iowa P index is heavily weighted to erosion and unless there are high rates of soil loss, obtaining values in the high and very high classes is difficult to achieve, regardless of P soil test. Using calibration information, IDNR will determine if the risk classes are reasonable, or if the index should be more closely tied to water quality directly impacted by P movement from an individual farm.

Fourth is the ability to apply the index to manure management. Senate File 2293 states that the P index must be used to determine the timing, rate and method of P application. The Iowa P index does not include a soil test P or P application limit. The index is open to interpretation. IDNR will develop universal recommendations for P application based on current research in soil test P and crop removal and P delivery from fields.

Fifth, Agena says, the P index must be simple. Producers must be familiar with the index and the outcomes and be able to readily implement that index on their own farms. IDNR will develop a simple program, using Geospatial Information Systems (GIS) data for soils and precipitation. Producers will use their own variables of tillage, crop rotation and P soil test as inputs to the program and develop P application recommendations closely tied to the water quality impact of the field.

IDNR is working with NRCS and ISU to develop a P index by July 2003. However, the timeline may be delayed due to the extensive rulemaking process.

If the P index goes into effect on July 1, producers who developed an original manure management plan before April 2002 have until July 2007 to include a P index with their plan.

Producers filing an original manure plan between April 2002 and September 2003 would have until July 2005 to include the P index in their plan. Producers who write an original manure management plan after September 2003 must include a P index with their original plan.

Iowa's P Index

Very low (0-1)	Soil conservation and P management practices result in small impacts on surface water resources.
Low (1-2)	The P delivery to water resources is greater than from a site with very low rating, but current practices keep water quality impairment low.
Medium (2-5)	The P delivery may produce some water quality impairment. Consideration should be given to future soil conservation and/or P management practices that do not increase the risk of larger P delivery.
High (5-15)	The P delivery produces a large water quality impairment. Remedial action is required. New soil and water conservation and/or P management practices are necessary to reduce offsite P movement.
Very High (>15)	Impacts on surface water resources are extreme. Remedial action is urgently required. Soil and water conservation practices plus a P management plan, which may require discontinuing P applications, must be implemented.

IDNR encourages proper disposal of dead animals

Updated from the Iowa Conservationist, July/August 2001

Rising fuel costs and concerns about markets have dramatically increased the costs of dead animal disposal in some parts of Iowa.

"If you have the equipment, burial is certainly an alternative for disposal," said Julie Nelson, an environmental specialist at the IDNR Des Moines field office.

"Composting, incineration and sometimes even landfills are other alternatives, but be sure to check with landfills ahead of time, since not all landfills accept animal carcasses."

Iowa law requires burying dead animals in locations and soils that will protect water quality. Nelson said suitable sites would be on ridge tops or high spots in well-drained soils, avoiding areas where the water table is high, the slopes are steep or near any kind of water body.

"Livestock producers need to follow proper disposal techniques for on-farm disposal of dead animals," said Wayne Gieselman, former coordinator of the IDNR animal feeding operations program. "Producers should know that all animals must be buried on the premises where they originate, and there is a limit on the number of animals that can be buried," Gieselman said.

The limit is 44 swine, seven cattle, 73 sheep or lambs, 400 poultry carcasses per acre per year. Animals that die within two months of birth may be buried without regard to number. State rules require that dead animals be disposed of within 24 hours of death.

Burying dead animals

When burying, follow these state rules that also apply:

- Burial must be at least 100 feet from a private well, 200 feet from a public well, 50 feet from an adjacent property line, 500 feet from a residence and more than 100 feet from a stream, lake or pond.
- Burial cannot be in a wetland, floodplain or shoreline area.
- Animals must be covered immediately with six inches of soil and finally covered with at least 30 inches of soil.

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