Water Watch

A newsletter for the Maquoketa River Watershed

Project news

Students sampling tile line outlet water for crop nutrients

by Charles Wittman, communication specialist, MWP

On a cloudy day in late April, Jessi Sargent brushed her way through the dead grass at the edge of the wetland on the Larry Meyer farm southeast of Strawberry Point. She's looking for the tile outlet from the wetland into the stream, difficult to see in the dead grass along the bank. When she found the tile outlet she grabbed a convenient branch for balance, leaned out and reached into the flowing water with a 150 milliliter bottle, rinsed out the bottle, then filled and capped it.

Sargent, a senior, and 14 other students from the chemistry for life class at Starmont High School sampled tile lines this spring on farms in the Maquoketa headwaters watershed. Like other students in the class, Jessi had more than one site; she also collected samples from the Bill Hayes farm near Arlington.

Students were responsible for more than taking samples–they also made the initial contact with the landowner, located the tile line or lines and did the labwork.

Back in the chemistry classroom, the students tested the samples for nitrates and phosphorus. This day, senior Travis Chettinger and junior Matt Smith were running the tests. Each took about five minutes. The water sample was placed in a beaker, nitrate test reagent added and the beaker shaken for five minutes. The reagent-sample container was placed in the Hach spectrophotometer where a beam of light determined the amount of nitrate in solution and the numerical value displayed on a digital readout. The students recorded the value and passed the results to the sample taker.

Jessi Sargent gathers a water sample from the tile line draining the wetland on the Larry Meyers farm near Strawberry Point.

To ensure anonymity of the landowner, each site is identified only by a number. Readings are recorded by the site number, and the plan is to eventually have the results in a computer data base, along with nutrient and tillage practices and history of the field just above each tile line outlet.

The chemistry for life class is a consumer-oriented course, according to instructor Troy Schwemm. The tile line sampling fit right into their first unit on water and although the classwork moved on, the sampling and test results still elicited classroom discussion.

Student tile line sampling also fits into the Maquoketa Headwaters watershed citizen council's interest in involving more watershed residents. In late winter 2000, Tom Hayes, council chair, was pursuing an Iowa Farm Bureau (FB) grant for monitoring activities about the same time the school was seeking a federal-state Perkins grant to purchase the Hach tester and other

continued on next page

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Students, cont.

test equipment. The FB grant was used to purchase reagents and the Associated Milk Producers Inc. plant across Highway 3 from the school pitched in by donating a good supply of the sampling bottles.

The chemistry students were the second class to do sampling. Last fall the vocational agriculture students of Dennis Miller initiated testing on a smaller number of farms.

Some producers were hesitant about the sampling, fearing there might be some finger-pointing, says Miller. But they also were curious about N loss. Anonymity of results helped allay those fears.

Testing this spring had to wait until the snow melted and the tile lines and ditches were clear, said Schwemm. Students completed the first round of sampling and planned to complete a second round before the end of the school year. Schwemm said they would like to continue sampling and testing through the summer provided they get additional supplies, especially reagent.

Junior Matt Smith, left, and senior Travis Chettinger, right, test tile line water samples for nitrates using the Hach tester in the foreground.

The results of the tile line water sampling and testing program and the IOWATER volunteer water sampling program will give the community a more complete picture of whether nitrates are leaving crop fields and entering the Maquoketa headwaters.

Nitrogen management influences N loss through tile lines

(This article was adapted from a paper by Gyles Randall presented at the 30th North Central Extension-Industry Soil Fertility Conference held in St. Louis in November 2000.)

Tile drainage from row crop production has been identified as a major source of nitrate entering surface waters in the Mississippi River basin. Drainage studies of nitrate nitrogen (NO_3-N) loss and other issues have been conducted on three research facilities in Minnesota since 1973.

Factors that influence the nitrate content of tile and surface waters can be divided into two categories — uncontrollable and controllable. Uncontrollable factors include precipitation, other climate factors and soil mineralization. Controllable factors include: 1) cropping system used, 2) rate of N application, 3) time of N application, 4) N placement method, 5) use of nitrification inhibitor and 6) tillage systems.

Spring rains and runoff can account for most drainage volume. At the Waseca, Minn., research site, during the 13-year period 1987-1999 the three-month period of April, May and June accounted for 63 to 68 percent of the annual drainage volume under row crop production. Seventy percent of the annual NO_3-N losses through tile lines occurred during the three-month period.

If fertilizer or manure N is applied too early in the fall, and if residual nitrate is present due to lower-than-expected corn yields or if N was applied at higher than recommended rates, potential for spring nitrate leaching increases greatly. Residual N accumulated in the research site soils during the dry years of 1988 and 1989 and was partly responsible for doubling the NO_3-N concentration in tile water during 1990 and 1991 when rainfall averaged 36 percent above normal.

Soils high in organic matter can mineralize a substantial amount of NO_3-N that is susceptible to loss in tile drainage especially when wet years follow very dry years.

Rate of N application is the nutrient management practice that most influences nitrate concentrations and losses in tile drainage water. Tillage systems and N placement appear to have very little impact on nitrate losses.

Improved manure management, including uniform application of known nutrient amounts and immediate incorporation, was researched as critical if the optimum N rate is to be achieved in

continued on next page

Nitrogen, cont.

livestock production systems. If manure is applied at greater than agronomic rates, just like commercial N, elevated concentrations of nitrate will occur in tile water.

During normal precipitation years, NO_3-N losses were reduced from about 45 pounds to about five pounds N per acre when N fertilizer application rates were reduced from 200 to 110 pounds N per acre. During normal years about half of the N fertilizer applied in excess of recommendations was lost to tile drainage. In these studies corn yields from fall N applications averaged eight percent less than from late April applications. In addition annual losses of NO_3-N in the tile drainage water averaged 36 percent higher with fall application compared to spring applications.

Intensive Iowa State University (ISU) and Iowa Department of Natural Resources water monitoring of the 40,000-acre Maquoketa Headwaters watershed at a site in Backbone State Park during 1999 revealed that 35 pounds of N per acre was lost from the watershed. At 20 cents per pound of N, that represents $275,000 or approximately $7 per acre. Row crops, such as corn and soybeans, yield much greater drainage volumes and NO_3-N concentrations (30 to 50 times higher) compared to crops such as alfalfa, or land in the Conservation Reserve Program and woodlands.

Drainage research is continuing because 25 percent of the cropland in the United States needs drainage to achieve its agronomic potential and 25 percent of the existing drainage systems are over 50 years old. Two studies have shown 38 and 40 percent reduction in nitrate loss due to increased denitrification when tile lines are placed three feet rather than four feet in the soil and at closer spacing. The effect on crop yields due to early season restricted root growth followed by late summer drought conditions remains a question to be answered.

"Improved N management practices across the Midwest may reduce loss of N in tile water by 15 to 20 percent but that will not be sufficient to meet the environmental goals of society," says Gyles Randall, soil scientist and professor at the University of Minnesota, Waseca.

ISU researchers say that reestablishment of wetlands, which can remove 600 to 900 pounds of N per wetland acre per year, will be needed in addition to improved N management.

Phosphorus management – what is doable?

(Adapted from a paper by John E. Sawyer, Iowa State University Agronomy Department.)

Successful crop production requires careful management of several production factors, including crop nutrient requirements. A system that optimizes crop production should also minimize potential negative impact on soil and water resources and provide profitability.

Phosphorus (P) is an essential nutrient for crop production that requires special consideration for nutrient management and water quality protection. P is chemically reactive with the soil. This adds to the difficulty in predicting effects of soil P on water quality.

P is present in large quantitites in most soils. Much of the P is present in mineral and organic forms that are not immediately plant-available. Long-term cropping without adequate supplemental P causes a decline in plant-available P and resultant reduced crop yields. Application of commercial P fertilizer and manure has been a practice for improving P availability and maintaining crop yields.

The environmental concern related to P is movement from soils to streams and lakes. Enrichment of water with P results in accelerated growth of algae and other undesireable aquatic plants. Decomposition of dead plants reduces oxygen levels, which effectively limits use of these waters for recreation, fisheries, industry and drinking.

P movement from soil occurs mainly through P attached to eroded soil and with P dissoved in runoff water.

Several factors define the potential susceptibility of a field for supplying P to surface waters.

1) Source: total P, soil test P level and P fertilizer and manure rate, timing and placement.
2) Transport: soil erosion, surface runoff and leaching to tile lines.
3) Destination: distance of surface flow to a water body or leaching depth to tile lines, direct surface water flow versus flow spread over a large area and intercepting buffer areas.

These are the major factors integrated into a P index, a tool designed to evaluate the potential risk of P losses from fields. The P index can be used to help determine best management practices to implement in order to limit P loss from fields.

Maquoketa River watershed producers who wish to have the P

continued on next page

Maquoketa River projects update

Mineral Creek Watershed Project received $17,800 in supplemental WSPF funds for additional practices, to be allocated by June 30. All of the original $86,313 in cost-share funds has been allocated for conservation practices; some of the projects are completed and many are under construction.

An IOWATER mini-grant was proposed by **Mineral Creek** and the **Maquoketa Alliance** to do base flow comparisons of bacteria and nutrient levels and turbidity in 19 subwatersheds this year. These data will be added to the 10 observations made over the last five years during high-flow conditions.

Sand Creek watershed, an area southwest of Manchester, is the subject of a project proposal for funding of a water quality project.

A water quality project grant was submitted to the Iowa Department of Natural Resources and Iowa Department of Agriculture and Land Stewardship requesting $804,000 for **Lower Deep Creek,** a watershed around Preston in Jackson and Clinton counties.

The **Lake Delhi Advisory Committee** completed a preliminary list of conservation practices for cost-share in the Lake Delhi Watershed. The U.S. Geological Survey will conduct depth, sediment quality and water quality surveys. Work is scheduled to begin early this summer.

Pasture walks in watershed area

Two pasture walks are scheduled this summer in the Maquoketa River watershed area. They are Wednesday, June 20, at the Joel Kurtenbach farm, Wyoming, and Wednesday, Sept. 5, at the Kim Klocke farm, Arlington. Both pasture walks begin at 1 p.m.

Kurtenbach has an expanding dairy herd of 400-plus head and a swing 24 parlor. The farm is six miles east of Onslow on E29, then south on 20th. Avenue to the second set of buildings. Klocke has stocker cattle, cow-calf and sheep grazing operations on converted hayland interseeded with ryegrass, and an innovative watering system. The farm is 3/4 mile west of Volga on C2W, then south four miles on Acre Road; the farm is on the west side of the road.

Phosphorus, cont.

index calculated for their fields may call (563) 425-3233 for Chad Ingels, Iowa State University Extension manure and nutrient specialist for Maquoketa River water quality projects.

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