

Upper Salt Fork Ditch — Spoon River Watershed Project

A multi-year study to evaluate tile drainage modifications for reducing nitrate loss from agricultural fields

Project Background

For the past 5 years, researchers at the University of Illinois have been monitoring nutrients (focusing on nitrate) at the United States Geological Survey's gaged outlet of the Upper Salt Fork watershed (north of St. Joseph, IL). In addition we have monitored farmer attitudes about water quality issues and conservation practices.

Our research goals for the project were to document the current level of nitrate export from the Upper Salt Fork River watershed to establish baseline conditions and to use real-world production farms to measure and characterize nitrate leaching through tile drainage systems. Researchers also examined both production practices and edge-of-field remediation techniques to assess the impact on

fertilizer recovery and/or reduction in nitrate leaching. Interviews and surveys with farm operators and landowners were conducted in 2010 and 2013, providing insights into water quality risk perceptions and factors influencing adoption of nutrient management practices.

Currently, researchers are monitoring tile flow and nutrient load in 10 tiles on four different farms within the watershed. Ideally, paired fields are chosen with the same operator, soils, production methods, and crops; and are instrumented to constantly measure flow, with water samples collected proportionally to flow (i.e. as flow increases more samples are collected) using automated samples. The water samples are analyzed in a laboratory using

standard methods to determine the concentration of nitrate or phosphorus throughout each flow event. Researchers can then calculate an average concentration as well as calculate the total pounds of nitrate-N or phosphorus lost from the field.

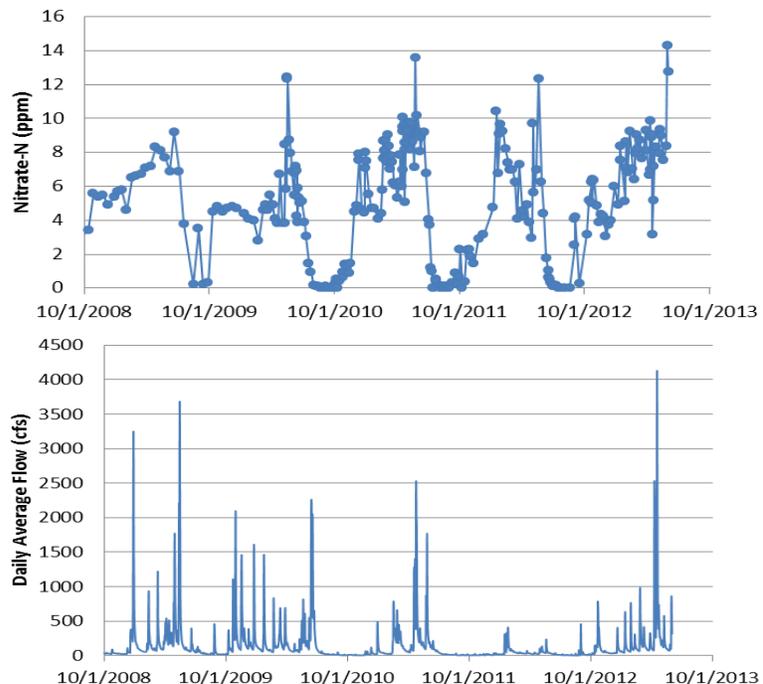


Tile flow and water sampling equipment

Water quality data

These graphs show the flow rate and nitrate concentration of water exiting the outlet of the Upper Salt Fork River watershed during the past 5 years at the USGS gaging station north of St. Joseph, IL. Approximately 1150 tons of nitrate-N goes down the river annually, which is equivalent to 1 million dollars of anhydrous ammonia each year. The USGS recently installed a gage on the Spoon River with a real time nitrate sensor which will allow researchers to better understand N dynamics in the watershed.

Upper Salt Fork River



Drainage Water Management

Drainage water management is a technique being evaluated for reducing tile flow and nitrate loss from agricultural fields. The idea is to hold back tile water during the winter by raising stop logs using an Agri Drain structure and releasing the water prior to field work. Using adjacent tiles within the same field, this technique blocked one tile and allowed the other to

drain normally. During the winter/spring months in 2011 and 2012, researchers were only able to elevate the water table over a two acre area as we found most of the tile water had moved laterally through the soil to the adjacent tile. This finding highlights the challenge of employing this practice in areas with high tile densities. To avoid this problem, in the winter of 2013 we blocked both tiles, holding the water back for more than two months and raising the water table over a larger area. Tile nitrate concentration was not affected, but the reduction in tile flow decreased tile loads. However, researchers are concerned the tile water circumvented the Agri Drain structures and re-entered the tile lines downstream of the structures.



"I think for farmers it is dollar and cents and how it will affect me. Not that they don't care about their neighbors, cause they do. But I don't think they think a whole lot past east central Illinois in terms of what is happening with the water" - Farm operator

Farm Operator Perceptions on Water Quality

The majority of farm operators rated the quality of water in the Upper Salt Fork watershed as moderate to excellent. Farm operators also rated a moderate level of concern about water quality issues throughout the Upper Salt Fork watershed.

Few farmers indicated specific sources of water quality problems in the

watershed. Approximately 16% of respondents rated sediments and municipal discharge as major problems followed closely by nitrogen (15.5%). The number of farm operators indicating severe problems of water quality decreased in 2013 from 2010.

Survey findings highlighted the complexity of perceived water quality

risk at various geographical scales. Survey respondents indicated a high level of concern about water quality related to their home, farm and drainage district. Levels of concern dropped at the Upper Salt Fork watershed scale, but increased again in relation to the Mississippi River and Gulf of Mexico.

Cover Crops

Last year's dry conditions during the growing season limited corn yield and N uptake; and large amounts of unused fertilizer remained in fields after crop harvest. Researchers designed an experiment to test the ability of a cover crop to absorb unused fertilizer N and reduce potential N loss from tile drainage. Using a paired field approach with two adjacent tile systems, we planted a cover crop over

one tile, while the adjacent field and tile did not receive a cover crop. The cover crop (annual ryegrass and radish) was aerially seeded into standing corn on Sept 8, 2012. By Nov 8, the cover crop above ground biomass accumulation was substantial with nearly 1 ton of dry biomass per acre, containing more than 50 lbs of N per acre. We found the cover crop decreased nitrate loss in tile drainage by about

50% compared to the field without a cover crop. This spring we gave the cover crop a fertilizer N credit of 30 lbs per acre and decreased the fertilizer N rate accordingly. Results from this coming fall will show whether or not cover crops have improved overall production efficiency. Of the surveyed farm operators, 9.5% stated they currently use cover crops and 76.5% stated they may be willing to try this practice.

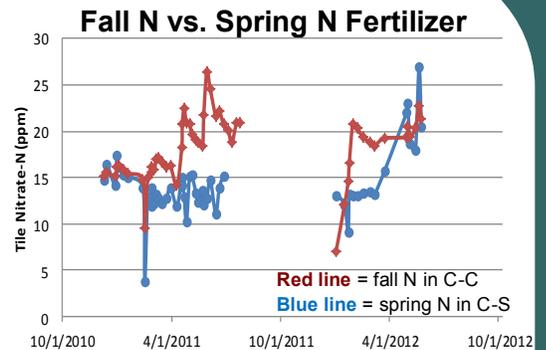


REPORT TO LOCAL STAKEHOLDERS

Nitrogen Fertilizer Timing

This figure shows tile nitrate from two adjacent fields with two different cropping systems: 1) fall N fertilizer application in continuous corn (C-C); and 2) spring N application in a corn-soybean rotation (C-S) where corn was planted in 2010 and 2012 and soybean in 2011. More than 100 tile water samples were collected during the two year study. Tile flow began in Dec of 2010 and both tiles had nitrate concentrations about 15 ppm. Tile nitrate began to separate in mid-Feb with

concentrations rising above 20 ppm in the tile draining the field with fall N application following rain events in late April and May. During the next year, we experienced a warm winter and the field that received fall N fertilizer produced tile nitrate concentrations that reached 20 ppm two months earlier than the year before (Feb. 2012 vs. April 2011). Following spring N fertilization in the corn-soybean rotation, tile nitrate increased during two rain events in May at which time both tiles were



transporting drainage water containing more than 20 ppm. These results show how tile nitrate concentrations respond to differences in timing of N fertilizer applications and suggest that fall N application may lead to greater tile nitrate loss.

Water Quality Management Decisions & Practices

A majority of farm operators surveyed were the sole decision maker when it comes to nutrient management, soil conservation practices, and government program participation. There was, however, an increase in responses for shared decision making in drainage management.

The top three factors (according to importance)

influencing water quality management decisions were improving/maintain their farm for future generations, improving bottom line, and promoting conservation.

The top three barriers to implementing water quality conservation practices were concerns for reduced yields, personal out-of-pocket expenses, and environmental damage

- caused by the practice. Percent of respondents using the following practices:
- Soil testing: 81.8%
 - Grassed waterways: 65.1%
 - Filter strips: 60.0%
 - Have a nutrient management plan: 57.6%
 - Conservation tillage: 53.5%
 - Variable rate application technology: 50.6%
 - Following U of I recommended rates: 46.0%
 - Field terraces: 20.8%

"If we can use cover crops and still maintain yields and get by with less inputs and at the same time you are building your soil. And if you can hit all of those and maybe we got some more work to do as far as preparing. It is still worth it. And there are some people I think that are on board, but I don't think it is as many as we would like to see."
- Farm operator

Next Steps...

Currently, project researchers are in the process of securing more funding to continue monitoring these farms and are willing to add other farms to the project. Our studies emphasize the need for long-term data collection. Too often studies are conducted for only two or three years and then the funding ends and so does the data collection. We believe the best way to determine measureable change in water quality is through long-term monitoring. With the variability in weather from year to year and in soil type and landscape from field to field, long term datasets are critical for assessing effects of management on water quality. Researchers are also interested in examining how a combination or "suite" of practices can reduce nutrient loss from tile drained fields.



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Also check out our website for more information about the project:

<http://saltfork.nres.illinois.edu>

Upcoming Field Demonstration Day

We will be hosting a field demonstration day on August 20, 2013 at the community building in Royal, IL. Topics covered will be nutrient management and water quality monitoring results, cover crop testing site, and a wrap-up summary of the Upper Salt Fork watershed project.

There will be a morning bus tour to the USGS gaging station near St. Joseph, a stop at the new USGS gaging station on the Spoon River, a stop at a demonstration plot of a drainage water management site, and a final stop at a cover crop testing plot. Lunch will be provided.

For more information contact Lowell Gentry at 217-333-1769 or the Champaign County SWCD at 217-352-3536 ext. 3.

WHEN: August 20, 2013

Registration will begin at 8 a.m. & meeting at 8:30 a.m.

WHERE: Community Building in Royal, IL

Please RSVP with Champaign County SWCD by August 16

