



WATER MANAGEMENT

IOWANS USING NEW DRAINAGE TECHNIQUES, TECHNOLOGY AND EQUIPMENT TO IMPROVE WATER QUALITY.

By Matthew Wilde

Expectations about water quality have changed. So should farm drainage systems.

More than a century ago, Iowans used shovels, steam power and clay tile to drain millions of acres. Making swampy, mosquito-infested yet organically-rich land tillable, productive and inhabitable was their only concern.

The original installers of drainage infrastructure didn't have the technology and knowledge about hydrology and nutrient processes available today.

"They didn't know they would be creating the ideal nutrient loss mechanism," says Chris Jones, Iowa Soybean Association (ISA) environmental scientist. "We created a system tailor made to transport nitrates."

Today, the state's 3,000 drainage districts consisting of 9 million acres — a little less than one-third of Iowa's

farmland — are under a microscope. The Des Moines Water Works in March sued boards of supervisors in Sac, Calhoun and Buena Vista counties for allegedly allowing nitrates coming from 10 drainage districts they control to pollute the Raccoon River, a primary source water for 500,000 customers. The utility wants to recoup costs for removing nitrates and a judgement requiring the districts to cease all discharges of nitrates not authorized by a federal pollutant discharge permit. Additional regulation on agriculture is also an intended consequence of the suit, according to water works officials.

The Iowa Nutrient Reduction Strategy was implemented nearly two years ago to reduce nitrate and phosphorous loads entering Iowa's waterways from point (mostly factories and wastewater plants) and nonpoint

(mostly farmland) sources by 45 percent. Farmers are learning about and implementing conservation practices to help meet that goal.

Drainage tile enhances crop productivity and profit potential so farmers aren't going to quit tiling or rip it out. But existing systems can be modified and new ones designed with drainage water management in mind to curb nutrient runoff.

Installing drainage control structures and edge-of-field practices like saturated buffers and bioreactors in concert with drainage systems can mitigate nutrient loss.

Jones says the public wants farmers to deal with the negative consequences of today's production systems, and ISA member Nick Meier of LaPorte City is doing just that.

Meier is installing a saturated



Nick Meier of LaPorte City stands in a grass buffer strip that will be turned into a saturated buffer this spring.



buffer and a bioreactor on his land this spring. Both filter nitrates from water flowing out of tile lines before it enters a waterway using either a grass buffer or underground bed of woodchips.

"I'm trying to avoid future regulation. I'm doing this so we can learn and not go that route," Meier says. Iowa State University (ISU) researchers will monitor the effectiveness of the saturated buffer.

According to the strategy, a bioreactor and saturated buffer reduces nitrate loads, on average, by 43 percent and 50 percent, respectively.

Proactive solutions

The ISA Environmental Programs and Services (EPS) team is devoted to helping members and all farmers improve environmental performance and productivity in a sustainable way. EPS operates a certified water testing lab run by Jones and develops tools, programs and services for conserving and protecting natural resources.



Theo Gunther, EPS resource management specialist, says it's well documented that optimizing corn and soybean

production presents risk of nutrient loss.

"With that knowledge, we should be looking to put infrastructure in place," Gunther says. "If we're going to address the losses, it needs to be considered at the time the work is being done."

That's what Nathan Utt, an agriculture engineer with Ecosystems Services Exchange (ESE) in Adair, specializes in. He designs managed drainage and subsurface irrigation systems.

Utt says mechanization and technology — GPS, topographical mapping, laser levels and computers, to name a few — changed the way drainage systems are designed and installed for the better. A few laterals running up the slope with long, straight main lines at the bottom and direct outlets to the creek have given way to contoured and pattern tiling with structures and practices to hold back water and filter it.

"Systems are more finely tuned to match the goals of the producer," Utt says.

Farmers can install controlled drainage structures, Utt adds. Agri Drain of Adair, an ESE sister company, is a popular manufacturer.

Though an added expense — structures range from a few hundred

dollars to more than a thousand — compared to conventional drainage, farmers can control how much water leaves the field.

"From a water quality perspective, holding water back that won't damage the crop keeps nitrates and nutrients in the field," Utt says. "You're slowing down the process enough so Mother Nature can take care of the nitrate. Plus, there's the potential for yield increases because more water will be available to plants when they need it."

Jones says there's evidence controlled drainage and installing tile lines shallower than normal will reduce nitrate loss because there's less distance for water to percolate through the soil profile and dissolve nitrogen.

Proven potential

A study on modified drainage management systems was conducted at the ISU Southeast Research Farm near Crawfordsville from 2007-14. Results show controlled drainage and shallow drainage reduced annual nitrate losses, on average, by 49 percent and 42 percent, respectively, when compared to the conventional drainage.

"Moving forward there is a need for implementation of a broad range of practices to reach the Iowa Nutrient Reduction Strategy goals, says Matt Helmers, ISU agricultural engineer and drainage expert.

"Drainage water management through controlled drainage and shallow drainage has been shown to reduce nitrate-nitrogen export," he continues. "There is growing interest in these practices across the Corn Belt and in the future there may also be greater interest in capturing the water from the drainage system for potential supplemental irrigation use."

Jones says farmers need to ACT (avoid, control and trap). Sometimes efficient nutrient management and controlling nutrient movement using cover crops, controlled drainage and extended rotations isn't enough.

Trapping nutrients before they reach streams by using wetlands, bioreactors and saturated buffers is the third line of defense.

"Every farm will need all three," Jones says. "It makes the most sense to incorporate systems that meet our water quality objectives while optimizing crop production."



"I believe that Iowa farmers are doing a better job of conserving and improving our natural resources every year. They know that their healthy soils and clean abundant water are essential to their success.



They realize that sustainability is not good enough so the farmers I know are striving for continuous improvement in every aspect of their operation. With advancements in agricultural equipment, information capture and analysis, coupled with integrated management tools, producers are taking the guesswork out of farming. It's much more science than art today."

— CHARLIE SCHAFER, *President, Agri Drain Corporation, Adair, Iowa*