From Forest Nursery Notes, Winter 2012

291. Pipe helps boost yields and reduce nitrogen discharge. Cooper, S. Land and Water 22(3):31-33. 2011.

Pipe Helps Boost Yields and Reduce Nitrogen Discharge

Some of the best corn and soybean crop land in the world is in the United States and being drained with an underground system that keeps soil moisture at the required level.

According to the results of practical application studies which commenced in Illinois during 2009, the use of a farm drainage system made from corrugated high-density polyethylene (HDPE) pipe, along with a new bioreactor, helps to stem the amount of migrating nitrogen while increasing crop yield. Managing the nitrogen, a residual of fertilizer, before it travels with water from the fields and is carried downstream has been one of the goals of the project. The Agricultural Drainage Management Coalition (ADMC) is leading the on-going research with support from other organizations such as the Agricultural Watershed Institute (AWI) and the Plastics Pipe Institute, Inc. (PPI). The PPI is a non-profit trade association representing all segments of the plastic pipe industry.

"We've been looking at drainage water control structures and bioreactors where the drainage water control structure helps to direct the nitrate flow through the unit," stated Steve John, executive director of the AWI. "We've been working on that issue in various ways for quite some time. It certainly involves work to try and manage fertilizer as efficiently as possible and not apply it at rates exceeding recommendations. There have been some projects using inhibitors. But it's pretty widely accepted that cornfields are going to lose nitrogen. And, that on some tile-drained farms, nitrogen will be found in the system. Since 2006 we've been focusing on ways to address that."

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"The tiles are a pathway for nitrates to leave the field," according to AWI's John. "I view it as a process of recognizing it as an issue, quantifying it as an issue, and then developing the industry, farmers, land owners and conservation organizations to effectively deal with it. I view drainage water management and bioreactors, and additionally, wetlands and saturated buffers as all potential ways to deal with nitrogen in tile water.

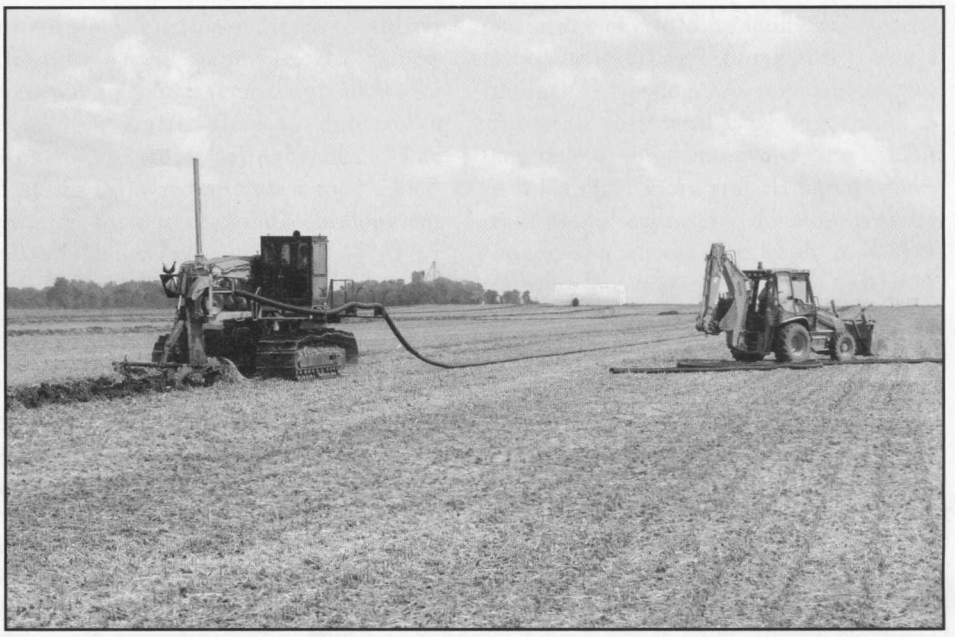
"It starts with trying to manage the fertilizer as effectively as possible. But even with the most conscientious efforts in fertilizer management, some nitrogen will be lost. So developing a way to deal with the nitrates once they reach the tiles provides a highly beneficial and environmentally positive solution."

One of the industry manufacturers who is leading and helping with the study is Steve Baker of Springfield Plastics, a PPI member company. Baker is the chairman of the PPI's CPPA Division's Agricultural Committee. "Using drain

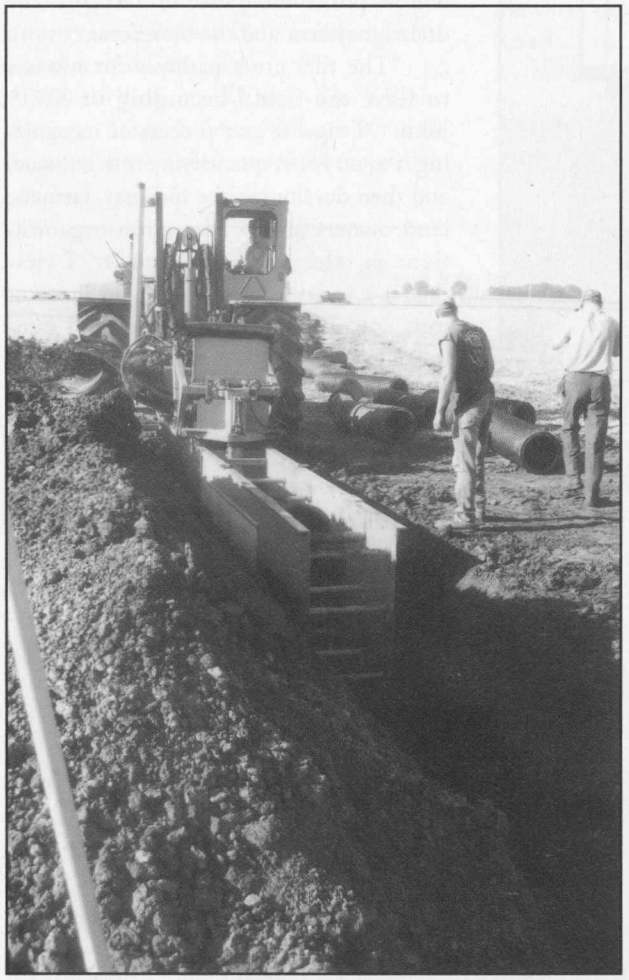
water management techniques helps to hold nitrogen and phosphorus on the farm. And that's the whole issue.

"For a farm field that has a bit of slope to it, structures such as dry dams or terraces can be put in so that when the water runs off it can be slowed down and the silt is kept on the farm. That's a typical conservation practice," Baker explained.

"But when you have land that is flat as a pancake, and there's no water running off, those fields must be tiled. When you tile them, they are very high producing. Some of the best corn and soybean crop land in the world is here in the United States being drained with underground pipes. The water percolates through the soil and if it has nitrogen, it goes into the pipe...the whole idea is to get rid of the excess water...it runs through the pipe and off the farm. The drainage water management practice that we've studied with the ADMC and the AWI has shown that when we keep the water up here at the right time, we keep that nitrogen here. We have studied and put to the test sound drainage water management practices and the bioreactor. This combination works."



Corrugated HDPE pipe has a perforation pattern for subsurface drainage. Typically, four-inch diameter pipe is used, delivered in 3,000 foot-long coils and installed with a self-contained plow.



A tiling drainage system is usually set on a grid pattern and also uses larger diameter corrugated HDPE pipe as main outlet lines installed by cut and cover.

The bioreactor unit helps to remove nitrates from the water carried in the tile drainage system.

One of the researchers leading the program is Dr. Richard Cooke of the Department of Agricultural and Biological Engineering at the University of Illinois, Urbana-Champaign.

"The bioremediation technology works at the end of the system by removing elements in the water through the metabolism of stationary microorganisms as the water flows past," he explained.

"The bioreactor consists of a buried trench with woodchips through which the water flows before entering the surface water. Microorganisms from the soil colonize the woodchips. These microorganisms eat the carbon from the woodchips and take in the nitrate from the water. Just as a human being breathes in oxygen and exhales carbon dioxide, these microorganisms breathe in nitrate and exhale nitrogen, which exits the bioreactor and into the atmosphere as an inert gas. Through this mechanism, called the denitrifcation pathway, nitrate is removed from the tile water before it can enter the surface water."

Baker noted that tests show a substantial result. "The research and a program of 'in-the-field' studies show that when the water flows in it might have 20 milligrams of nitrogen per liter, but when it comes out, it will have just two milligrams. And the research is very strong for totally reducing the nitrogen loss."

According to Baker, the Plastics Pipe Institute's members are supporting the research efforts. "Our industry is behind it 100 percent."

The PPI Agricultural Committee is made up of corrugated HDPE pipe and resin manufacturers and others to work with various organizations such as the ADMC and the AWI. "Our work as the Agricultural Drainage Management Coalition and task force has gathered scientists, chemists, famers, fertilizer manufacturers, conservationists, environmentalists and university researchers and teachers to develop sound drainage water methods and this bioreactor."

A bioreactor removes nitrates from water carried in a tile drainage system and cuts down on the amount that is lost. Studies calculate the reduction to be as much as 90 percent.

Even the bioreactor was designed with environmental considerations. "We're using woodchips," Baker explained, "not taking live trees. It's all dead wood mostly from storm damage that is going to be chopped up anyhow. Why throw a match to them; use them for something constructive."

"The main question," according to PPI's Executive Director Tony Radoszewski, "farmers ask is 'Will a tile drainage system using corrugated HDPE pipe help my crop?' The answer is an emphatic yes! It's a proven fact that crop yields are improved. The next question is 'Will adding drainage management tools and the bioreactor help the environment?' Again, the answer is yes!" **L&W**

by Steve Cooper

For additional information about water management systems using corrugated HDPE pipe, go to: www.plasticpipe.org/drainage or contact Steve Cooper at (516)623-7615.

About the PPI

The Plastics Pipe Institute Inc. (PPI) is the major trade association representing all segments of the plastic pipe industry and is dedicated to promoting plastics as the material of choice for pipe applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in development and design of plastic pipe systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.