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Research Substantiates that Saturated Buffers at Field Scale do Reduce Nitrates from Subsurface Field Drainage Systems

Illinois (July 13, 2016) - The Agricultural Drainage Management Coalition (ADMC), Agricultural Drainage Management Systems Task Force and Dr. Dan Jaynes with the National Laboratory for Agricultural & The Environment collaborated to demonstrate and evaluate saturated buffers at field scale to reduce nitrates and phosphorus from subsurface field drainage systems.

With many of the row-crop agriculture fields in the Midwest being located adjacent to ditches, streams, rivers and lakes, it is no surprise that nutrient transport from agriculture lands is a major concern. Large areas of the Midwest are intensively tile drained and it is assumed that many of the vegetated buffers adjacent to waterways are being under-utilized, because the tile outlets quickly move large amounts of subsurface flow past the buffer and into the receiving waterway without any opportunity for treatment by the buffer.

The project collaborators sought to demonstrate and evaluate the effectiveness of a new conservation practice commonly referred to as a Saturated Buffer (SB). The goal of a SB system is to hydrologically reconnect a subsurface drainage outlet with an edge-of-field buffer. This practice takes advantage of both the denitrification and plant nutrient uptake opportunities that are known to exist in buffers with perennial vegetation.

To accomplish the goals of this demonstration project, fifteen monitoring sites were selected in four different states (IA, IL, IN, and MN). A variety of site characteristics, not all considered "ideal", were chosen to demonstrate the effectiveness of the practice if implemented at a large scale. This also afforded the opportunity to explore why some sites had SB systems that were more effective at removing nutrients than others. Water flow rates from the subsurface drainage systems were monitored, and water samples for nitrate and phosphorous analysis were taken from September 2012 through September 2015.

The data from this study confirm that, when proper site conditions and design considerations are met, the SB practice can be an effective method for reducing nitrate transport from subsurface drainage systems. Phosphorus loads, however, appear to be generally unaffected by this practice.

Furthermore, using the ultra conservative estimates for the cost of installation for the sites that proved effective in removing nitrate, assuming a 50 year effective lifespan for these installations, and a 4% inflation rate or cost of money, the costs ranged from $0.55 to $4.64/lbs-N with an average of $2.13/lbs-N removed. This compares to $1.38/lbs –N for denitrification bioreactors, $5.06/lbs – N for nitrate removal wetlands and $3.21/lbs – N for rye cover crops (tile drained acres). (Source: IL Nutrient Loss Reduction Strategy). Thus, given the conservative cost estimates derived in this study, the effective saturated buffers had a cost range similar to these other field edge practices and much less than fall-planted cover crops. In addition, the practice takes no more land out of production than already used for the riparian buffer.

The following list contains some insights about the site selection process that were gained from this research:

1. Get in the channel and walk the section of ditch/stream where the proposed saturated buffer will go, preferably when the water level is at base flow or lower. Look for and mark all outlets.
2. Verify the tile system you are intercepting has a large enough drainage area to justify the cost of installing a saturated buffer treatment system.
3. In addition to using soil maps, take soil cores to verify high organic matter and lack of coarse materials within the buffer.
4. Sites with shallow ditches that are frequently flooded may not produce satisfactory results.

To view the full research report and find additional information and videos pertaining to saturated buffer systems, please visit www.saturatedbufferstrips.com

About the Project Collaborators

The Agricultural Drainage Management Coalition (ADMC) is a nation-wide group of agricultural, industry, and environmental interests that have come together to promote drainage water conservation practices. The ADMC includes over 60 key stakeholders, including individual farmers, industry manufacturers, and environmental groups like The Sand County Foundation. The Agricultural Drainage Management Systems Task Force (ADMSTF) is a multi-agency and university collaboration that has met regularly since 2003 to develop a national effort for implementing improved drainage water management practices and systems that will enhance crop production, conserve water, and reduce adverse off–site impacts on water quality and quantity. The National Laboratory for Agriculture and the Environment generates information, which addresses critical problems in agriculture and watershed management leading to the development of innovative solutions, which increase the efficiency of agriculture systems and reduce environmental risk. Transdisciplinary teams address this mission through coordinated research addressing problems in abiotic and biotic systems that underpin agricultural and watershed systems.

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