Woodchip Bioreactors for Improved Water Quality

Issue: An edge-of-field practice outlined in the Iowa Nutrient Reduction Strategy’s scientific assessment for nitrate removal is denitrification woodchip bioreactors. These bioreactors are widely reported to reduce 15 to 60 percent of the annual nitrate load from treated drainage water. Yet field bioreactor performance varies greatly, and is influenced by temperature, influent nitrate concentration and hydraulic retention time (HRT). Also, recent questions have emerged regarding ‘pollution swapping’ in bioreactors, where nitrate may be converted to something other than a harmless gas.

Objective: The goal of this project is to evaluate nitrate fate in woodchip bioreactors over a range of HRTs, which will lead to improved bioreactor design for field implementation.

Approach: Previous funding made it possible to install nine experimental bioreactors at the Iowa State University Agricultural Engineering/Agronomy Research Farm. The bioreactors are designed to allow for differing HRTs, influent nutrient concentrations and fill materials. Sampling ports are located at two locations within the reactors, to provide access to water and fill materials, plus at the effluent location. Experiments over a range of three HRTs, conducted in triplicate using these pilot-scale bioreactors, will begin in spring 2016 and run until mid-July when edge-of-field flow typically ceases.

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