DSU Extension water management engineer Chris Hay and his colleagues have been busy installing “bioreactors” on agricultural land in eastern South Dakota. By the end of 2013, five demonstration sites will be established showcasing these conservation drainage systems which are designed to reduce nitrates that may be in drainage waters.

“Protecting surface waters from excess nutrients is the goal,” explains Hay. Jeppe Kjaersgaard, an assistant professor of agricultural and environmental water management with the South Dakota Water Resources Institute at SDSU and Erin Cortus and Todd Troien with SDSU’s Department of Agricultural and Biosystems Engineering have also helped coordinate installation of the demonstration sites.

Hay explains that traditional subsurface tile drainage systems are effective in reducing sediment and phosphorus losses, however many studies indicate that subsurface drainage enhances the movement of nitrate-nitrogen to surface waters.

He notes that while improved management of nitrogen fertilizer and animal manure is one important method for reducing nitrate losses, good nutrient management is not always enough, and bioreactors are being studied as a management tool to help remove additional nitrate from drainage water that would otherwise leave the field.

A bioreactor includes a subsurface trench located along the edge of a field and filled with a carbon source, typically wood chips, through which the drainage water is passed. The carbon source in the trench serves as a material for soil microbes to colonize. The microbes feed on the carbon source and ‘breathe’ the nitrate converting it into nitrogen gas. This process is called denitrification, which releases nitrogen gas harmlessly into the atmosphere.

Control structures are used to control the flow of water through the bioreactor and to allow excess flows to bypass the system so that drainage isn’t restricted.

Hay reports that much of the initial research with bioreactors has been conducted in Illinois and Iowa. Results of research on pilot scale and field scale bioreactors indicates that they can reduce nitrate levels in drainage water by 30 to 70%.

The demonstration sites established in South Dakota have all been on private landowner properties with funding through a Conservation Innovation Grant through the Natural Resources Conservation Service (NRCS).

Hay says these sites will be monitored for their performance in removing nitrates and the information will be utilized in helping establish best management practices and potential cost-
Photos from left to right depict the process to install a bioreactor along the edge of a field. First, excavation occurs to create a large trench. Second, the trench is lined with non-permeable plastic and filled with wood chips which provide a carbon source for the denitrification process. Lastly, a control structure is installed, topsoil is backfilled over the wood chips and the area is reseeded.

A collaborative effort has made these demonstration sites possible. The effort involves researchers from the Department of Agricultural and Biosystems Engineering and Water Resources Institute at SDSU and is supported by a grant from the USDA Natural Resources and Conservation Service. Additional support comes from South Dakota Corn Utilization Council, East Dakota Water Development District, the South Dakota Farm Bureau, the South Dakota Soybean Research and Promotion Council and the Vermillion Basin Water Development District. Learn more about this research at www.sdstate.edu/abelsw트/research-projects/bioreactors.cfnn.