Woodchip Bioreactor Fact Sheet: Eastern Shore, MD

Introduction

Eastern Shore Rivers continue to show very high nutrient levels as the Chesapeake Bay cleanup effort continues. Great progress has been made, especially through the widespread use of cover crops across the Eastern Shore. Despite the progress, shallow groundwater continues to contribute approximately 70% of the agricultural nitrate load to Eastern Shore Rivers and Chesapeake Bay. Woodchip bioreactors offer a mechanism to treat the nitrates in shallow groundwater.

Woodchip Bioreactor Basics

A woodchip bioreactor is an edge-of-field practice designed to treat agricultural water from drainage tile lines (under-ground pipes to help drain fields), drainage ditches, or ponds. The main component of a woodchip bioreactor is a buried trench filled with woodchips. Using an in-line water control structure, water is diverted from the tile line, ditch, or pond to the woodchip trench. The trench provides the proper environment (carbon from woodchips, nitrate-nitrogen from agricultural drainage, and low dissolved oxygen) to promote denitrification-a process that converts nitrate to harmless nitrogen gas that makes up 78% of the air we breathe.

Two control structures are important parts of the bioreactor design, and each structure plays a different role. The inflow control structure is responsible for routing water into the bioreactor and for allowing stormwater to bypass the bioreactor during high flow events. The outflow control structure establishes water elevations in the trench and helps to retain water in the bioreactor so the water is held long enough for the bacteria to remove nitrate from the water before it leaves. Water quality data shows that this innovative technology is highly effective at reducing nitrate with a greater than 90% removal rate.





Figure 1. (Above) Woodchips being placed in the lined bioreactor trench at Fair Hill Farm, Kent County, MD.

Figure 2. (Left) Descriptive illustration of a woodchip bioreactor (Image by John Petersen and research completed by Laura Christianson, Ph.D.).

Benefits of Woodchip Bioreactors

- ⇒ These practices are passive; the construction of the practice creates the conditions that biologically converts nitrate to nitrogen gas.
- ⇒ Very little tillable land is taken out of production for construction. Most installations are approximately 100 to 120 feet long and 15 to 30 feet wide.
- ⇒ Low maintenance. Sediment must be cleaned out of the diversion box once or twice a year.
- ⇒ The estimated cost per pound of nitrogen is roughly \$7-10/lb. With little to no maintenance costs, they are one of the most cost-effective agricultural best management practices (BMP) available.
- ⇒ They are one of the only agricultural BMP's that treat nitrate in shallow groundwater, which is the source of approximately 70% of agricultural nitrate load.
- ⇒ This practice was developed in Iowa and extensive data exists on their efficiency in the Midwest and similar results have been found on the Eastern Shore. NRCS adopted a provisional standard for bioreactors as they are EQIP eligible.



Figure 3. (Above) The woodchip bioreactor on Oakland View Farm in Ridgely, MD has removed an average of 98% of the nitrate that entered the system.

Figure 4. (Left) High resolution LiDAR (Light Detection and Ranging) data, can show drainage patterns on farms that have very subtle topography and helps to identify the best location for a woodchip bioreactor. Meadow View Farm is located in Talbot County.



Contact Drew Koslow, Restoration Ecologist at Ridge to Reefs for more information on woodchip bioreactors by email at drew@ridgetoreefs.org or by phone at 410-533-2753.









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