Science Societies

Inexpensive Bioreactors Remove Nutrients from Drainage Water in Corn–Soybean Systems

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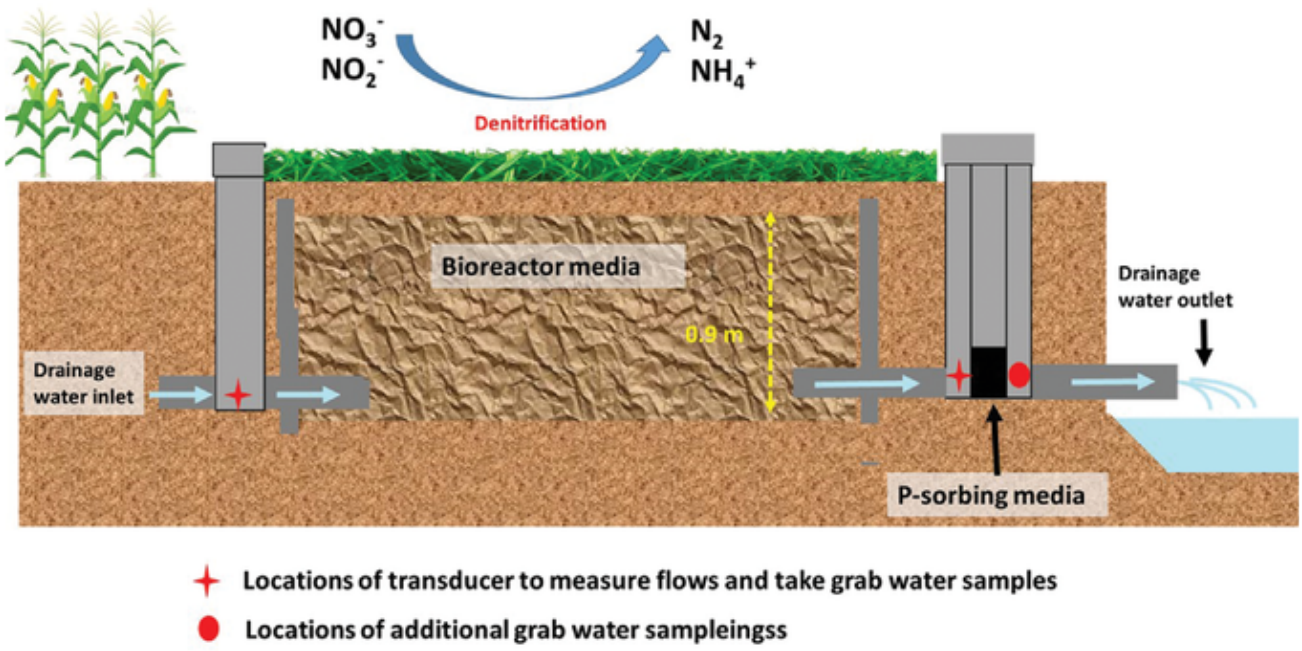

A schematic drawing of a denitrification bioreactor and P-sorbing media (not drawn to scale) installed at the edge of agricultural fields. Illustration by Olawale Oladeji.

Climate change is projected to increase precipitation and add to the millions of acres of artificially drained agricultural land in the midwestern U.S. Farmers need best management practices to curtail export of nitrogen (N) and phosphorus (P) from drainage to surface water.

Illinois researchers evaluated how simple bioreactors made with local materials could mitigate nutrient losses in these scenarios. They created denitrifying bioreactors at the edge of corn–soybean fields by filling trenches with woodchips, corn stover, or a mix. Drainage water from the fields was routed there, where denitrifying bacteria used energy from the carbon substrate to convert nitrates into N gas.

The water then passed through a second chamber containing iron fillings that sorbed P from the water. The combination of woodchips with iron fillings removed more than 70% of N and 19% of P from the draining water. When corn stover was in the mix, however, both ammonium nitrogen and P were released as the material decomposed. The researchers recommend using no more than 10% of corn stover in a bioreactor mix.

Adapted from Oladeji, O., Tian, G., Cooke, R., El-Naggar, E., Cox, A., Zhang, H., & Podczerwinski, E. (2023). Effectiveness of denitrification bioreactors with woodchips, corn stover, and phosphate-absorbing media for simultaneous removal of drainage water N and P in a corn-soybean system. Journal of Environmental Quality, 52, 341–354. https://doi.org/10.1002/jeq2.20449

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