

IMPROVING DRAINAGE MANAGEMENT ON AGRICULTURAL LANDS

The cropland in the Midwest is among the most productive in the world, but only if adequate drainage is provided. Drainage reduces soil compaction, makes it easier for farm machinery to work the land, and decreases crop damage from excess moisture. Much of the region uses underground pipes or “tiles” to channel excess water from the field. Nitrogen, phosphorous, and bacteria can make their way into tile drainage systems and enter lakes, rivers, and groundwater. This pollution can be harmful to humans and can create “dead zones” where aquatic life cannot survive.

A team of 22 land-grant university researchers are working with USDA scientists and industry partners to develop new technologies and strategies that improve drainage. The project’s strong Extension component has increased farmers’ knowledge and confidence about drainage management and provided valuable information to industry professionals, educators, and policymakers.

Improved drainage management could significantly reduce water quality problems and related environmental and human health risks. Furthermore, improved drainage can boost crop yields and reduce variability from year to year, providing a more stable source of food for consumers and predictable profits for farmers.



Saturated buffers are placed at the edge of a field to divert tile drainage water so that it flows as shallow groundwater through the buffer's soil. Plants and microorganisms in the buffer remove excess nitrate, reducing the amount that enters downstream waters. Photo by Lynn Betts, NRCS/SWCS.



Researchers designed better drainage structures, such as bioreactors, saturated buffers, wetlands, and vegetated ditches, which are placed at the edge of fields to filter drainage water.

Many of the new structures use automation and other “smart” features to help farmers fine-tune drainage management and minimize time, labor, and costs.

Researchers recommended effective practices, such as planting living mulch, winter cover crops, perennial grasses, and other land covers, using lower fertilizer application rates, and avoiding fertilizer applications on wet ground and when rain is forecast within 24 hours.

Confined animal feed operations are paying more attention to vulnerable drainage outlets and adjusting manure application methods, rates, and timing accordingly.



New models help farmers make smart drainage management decisions. The group’s drain spacing calculator has been used in 44 countries and 36 states.

Better drainage models also help scientists and farmers monitor water quality and prepare for the ways climate change will affect agricultural drainage.



The U.S. EPA’s Mississippi River/Gulf of Mexico Hypoxia Task Force used the group’s recommendations to develop strategies for nutrient reduction. Between 2011 and 2017, farmers in the 12 states on the task force installed 32 denitrifying bioreactors and implemented drainage water management on more than 40,000 acres, preventing over 300,000 pounds of nitrate from entering the Mississippi River.

The group’s research also laid the foundation for three new USDA-NRCS conservation standards that detail design specifications for edge-of-field drainage management structures. With conservation standards in place, farmers can now apply for cost-sharing, and interest in these practices has increased dramatically.



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