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Diversified organic farming reduces nitrogen leaching losses

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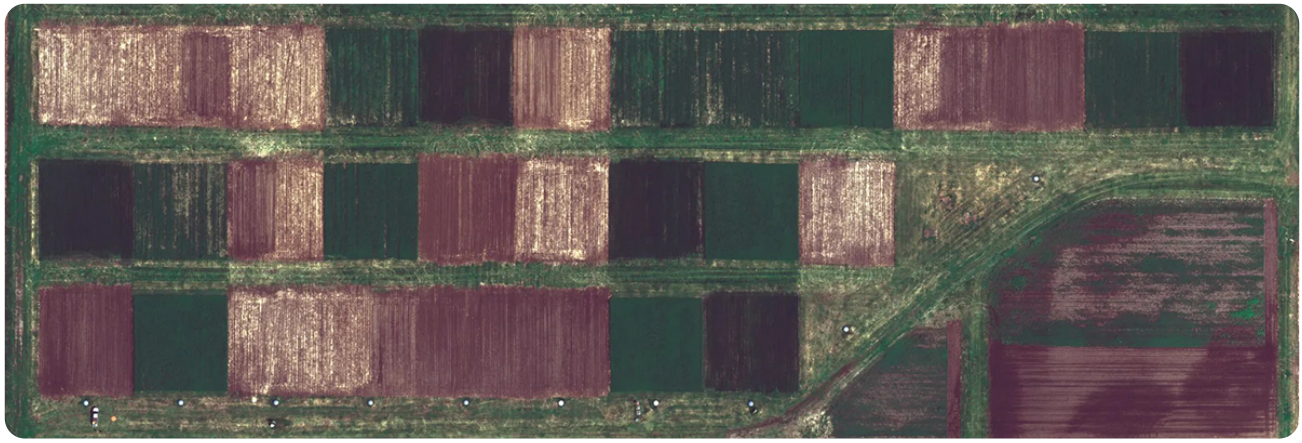

PRESSURE

Tile drainage sump pit for monitoring water flow and collecting samples for nitrate analysis. Photo courtesy of Sabrina Ruis, USDA-ARS (Boone County, IA).

Use of synthetic nitrogen (N) fertilizers intensified agricultural production in order to meet global food, fuel, and fiber demands. However, the use of synthetic N is linked to nitrate (NO_3^-) contamination of ground and surface waters, which poses human and environmental health risks. Therefore, it is important to identify and adopt production systems that sustain crop yields while reducing nitrate pollution.

In a collaborative nine-year study, USDA-ARS and Iowa State University scientists evaluated how organic farming affects nitrate losses and crop production in artificially drained soils of the U.S. Midwest, an area where such studies are few. The team looked at changes in N loading and crop yields for a diversified organic rotation (corn–soybean–oat/alfalfa–alfalfa), an organic perennial pasture system, and a conventional corn–soybean rotation.

The diversified organic rotation and the perennial pasture reduced N loads in tile drainage by 50 and 93%, respectively, relative to the conventional system. Importantly, organic corn and soybean yields were equivalent to conventional yields in most years. While yields in both systems were lower than county averages, this research provides strong evidence that organic farming systems, when designed with diverse rotations and organic nutrient sources, can substantially reduce nitrogen pollution in groundwater while maintaining food production.



Aerial view of the organic water quality plots, May 2025. Photo courtesy of Kevin Cole, USDA-ARS (Boone County, IA).

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Rogovska, N., Ruis, S. J., Carney, D. B., Delate, K., Wacha, K. M., Kovar, J. L., O'Brien, P. L., & Cambardella, C. A. (2025). Organic production reduces subsurface nitrate leaching and maintains crop yields in a US Mollisol. *Journal of Environmental Quality*, *54*, 1875–1887. https://doi.org/10.1002/jeq2.70085

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