Novel Tracers Created for Hormone Field Studies

The hormone 17β-estradiol (E2) is a potent endocrine-disrupting chemical, produced by all vertebrate animals, including livestock. Part per trillion E2 concentrations can have negative impacts on aquatic organisms, and even small releases from livestock wastes are concerning. Studies have been limited by the inability to discern de novo from previous and uncontrolled inputs of E2.

In an article recently published in the *Journal of Environmental Quality*, researchers from North Dakota State University and the Red River Valley Agricultural Research Center (USDA-ARS) in Fargo synthesized and evaluated novel E2 tracers for use as E2 surrogates to advance the understanding of E2 fate and transport in field situations.

Three brominated congeners of E2 were synthesized; one having similar soil:water distribution characteristics as native E2. Additionally, this surrogate is easily distinguished from native E2 by high-performance liquid chromatography (HPLC).

Using this novel tracer, scientists will be able to distinguish between current, experimentally applied E2 and those originating from wildlife or previous animal or municipal waste applications.


Water Quality Impacts of Willow in an Agricultural Landscape

Multifunctional landscape design in the agricultural sector attempts to improve the resiliency and sustainability of agricultural systems while providing additional benefits. However, as new strategies are developed to address multiple needs associated with the water, energy, and food nexus, the effectiveness and efficiency of such designs need to be evaluated.

In a paper recently published in the *Journal of Environmental Quality*, researchers report on a six-year field study that assesses how the strategic placement of short-rotation shrub willow buffers into a continuous corn rotation field in central Illinois affects water quality and biomass production for bioenergy. This design reduces land conflicts with grain crop production by targeting marginal land (underproductive or of high environmental risk) where placement of willow on the landscape has the highest potential to reduce nitrate nitrogen leaching while boosting bioenergy production (as a nutrient reduction and recovery system).

This ongoing study found that willows reduced nitrate leaching into the shallow subsurface water by 88% by the end of their first growth cycle, suggesting that this is an effective nutrient reduction strategy. Additional benefits of willow production may include soil health benefits, such as increasing subsurface soil organic matter. However, low calculated willow biomass will need to be readdressed in the future to assess major contributing factors.

Adapted from Zumpf, C., H. Ssegane, M. Cristina Negri, P. Campbell, and J. Cacho. 2017. Yield and water quality impacts of field-scale integration of willow into a continuous corn rotation system. J. Environ. Qual. 46. View the full open access article online at http://dx.doi.org/doi:10.2134/jeq2017.02.0082

Animal waste spread onto fields as fertilizer contains the endocrine disruptor 17β-estradiol (E2). A brominated analog of E2 may serve as a field tracer, providing high confidence in E2 field fate and transport.

Willow buffer planted next to corn field. Photo by Colleen Zumpf.

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