Splitting Nitrogen Applications Reduced Nitrous Oxide Emissions

While many soils in the Upper Midwest of the U.S. are extensively tile drained, substantial cropland remains poorly drained, negatively affecting nitrogen (N) fertilizer use efficiency and possibly degrading the environment. Increasingly, farmers are using split N fertilizer applications, instead of a single early-season application, to enhance fertilizer efficiency and minimize environmental impacts. Despite an intuitive linkage between soil drainage, N fertilizers, and nitrous oxide (N₂O) emissions, evaluation of N₂O emissions of single and split applications under different soil drainage conditions are lacking.

A recently published article in the Journal of Environmental Quality reports on a two-year study in south-central Minnesota where single and split N applications for corn production were evaluated under drained and undrained conditions in soils with natural poorly to somewhat-poorly drained characteristics.

Regardless of drainage condition, N fertilization increased N₂O emissions, but undrained soil emitted 1.8 times more than the drained soil (2.11 vs. 1.15 lb N ac⁻¹). Further, the single application produced similar grain yield but emitted 35% more N₂O than the split application, which also employed a urease inhibitor.

Given the need to reduce environmental impacts while enhancing crop productivity, split N application combined with a urease inhibitor may be a valuable approach, but further evaluation is needed in the context of previous studies suggesting that benefits of alternative N application timing on N₂O emissions may be site and management specific.


Revealing Three-Dimensional Biogeochemical Patterns in the Forest

Biogeochemical soil processes and fluxes are governed by physical, chemical, and biological properties, which can highly vary in space and time. Current knowledge on biogeochemical processes and fluxes in forested systems is, however, hampered by the scarcity of datasets that can provide such information.

The January–February 2017 issue of the Journal of Environmental Quality contains a new biogeochemical dataset that provides a high-resolution, three-dimensional view on soil properties in forested ecosystems. The dataset includes 604 sampling locations in a 27-ha region, including a variety of soil chemical parameters (pH, P, K, Mn, Fe, Na, C, N, S, Ca, NO₃⁻N, and SO₄²⁻) and soil physical information (bulk density, texture, and soil description).

Using an exploratory analysis, the research team shows the manifold of potential applications of the dataset, which provides information on the spatial variability of biogeochemical soil properties within a single soil horizon and among layers. Additionally, the dataset can be combined with additional hydrological flux information from the TERENO portal (www.tereno.net), thus providing a unique input for future coupled hydrology–biogeochemistry modeling studies.


Increasingly, farmers are using split N fertilizer applications over the course of the growing season. Source: YouTube/philip healey.

Sampling undisturbed soil cores using a HUMAX soil auger. Photo courtesy of Ralf-Uwe Limbach.

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