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RAISE NITROGEN USE EFFICIENCY: REMEMBER THE BASICS

Every farmer wants to optimize crop recovery of their applied fertilizer nitrogen. The common goals are to maximize profits, while also sustaining soil organic matter and minimizing losses of nitrogen to the environment. Some relatively small nitrogen loss back to the environment is natural and not unexpected. For example, when soils become wet and stay waterlogged for days, nitrate-N (NO_3^-) is converted by soil microorganisms to di-nitrogen gas (N_2) through the denitrification process, especially under warm conditions. This soil microorganism-mediated process is part of the natural nitrogen cycle, which helps explain why our atmosphere is 78% N_2 . Because it is not possible to completely control the complex microbial processes and related nitrogen losses in healthy, biologically active soils, it may always be necessary to provide just slightly more nitrogen than may be taken up and removed by the targeted crop to help sustain soil organic matter and soil organic nitrogen levels. Lesser amounts of nitrogen can lead to nutrient “mining”, which jeopardizes sustainability.

The sustainability objective is NOT to “maximize” nitrogen use efficiency, since the highest recovery percentage of applied nitrogen usually occurs with the first increment, or lowest rate, of nitrogen addition.

Instead, the sustainability goal should be to “optimize” crop yields and crop nitrogen recovery, while minimizing its loss to the environment. More and more farmers are working with their crop advisers and agricultural retailers to develop and implement a robust 4R nitrogen management system to achieve such optimization.

Here are some suggested basics to improve cropping system nitrogen recovery and profitability in your fields:

- **Know** and understand the soils in each field and their physical and biological characteristics that impact crop rooting, water availability, and movement.
- **Identify** the dominant nitrogen loss pathways (i.e., leaching, runoff, volatilization, denitrification) in each field or dominant portions of each field.
- **Provide** other essential nutrients in balance with nitrogen needs; don't let other nutrient shortages limit your “bang for the buck” with each unit of nitrogen applied.
- **Work with** a knowledgeable crop adviser to develop a good 4R nitrogen management plan.
 - Implement the plan with conviction and commitment to include appropriate soil and water conservation practices (*conservation tillage, cover crops, controlled subsurface drainage, improved irrigation management, etc.*)
 - Evaluate the success of your plan by monitoring the crop's nitrogen status (*in-season plant tissue samples, chlorophyll or greenness-sensors, end-of-season corn stalk nitrate, and appropriately calibrated soil nitrogen and nitrate tests.*)
- **Track** your crop yield per unit of nitrogen applied, over a period of years (at least three) and see if the trend is up, down, or flat.
- **Estimate** the crop nitrogen harvest removal-to-use ratio, and evaluate it over time (*IPNI offers an i-OS and web-based app for estimating crop harvest nitrogen removal at <http://ipni.info/nutrientremoval>*).
- **Investigate** your cropping system response to nitrogen management changes (source, rate, timing, or placement) using replicated strip trials.
- **Become** part of on-farm networks in your area, and learn from other successful farmers.

Think about these nitrogen management basics to get more of your applied nitrogen in the crop.

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For more information, contact Dr. Clifford S. Snyder, Director, IPNI Nitrogen Program, Ph: (501) 336-8110, E-mail: csnyder@ipni.net.

Note: *Plant Nutrition TODAY* articles are available online at the IPNI website: www.ipni.net/pnt