

A Closer Look At

Nutrient Management

Soil testing and precision agriculture technology have created a significant opportunity for producers to reduce inputs and increase yields, all while implementing a system that benefits soil health and water quality.



What is nutrient management?

Nutrient management involves careful planning and the appropriate application of inputs to optimize operation efficiency, reduce runoff, and minimize negative environmental impacts.¹

Reducing nutrient runoff for cleaner water

By practicing nutrient management, producers can decrease the amount of excess nutrients in the soil that are later washed into local creeks and streams. While unintentional, this runoff of excess nitrogen, phosphorus, and manure can cause algae to grow and bloom at unnatural levels, cutting off light and oxygen needed by aquatic wildlife. This ecosystem imbalance can cause significant damage to waterways locally and downstream.

The significance of soil testing

Soil testing is essential to nutrient management, as results provide a look at current nutrient levels and soil pH. This information helps producers determine if nutrient levels are sufficient, too high, or too low so they can make adjustments to meet their crops' needs.² Advancements in grid sampling have allowed producers to take multiple soil samples from a single field and use the data to more precisely determine input rates across that tract of land.

4Rs of nutrient management

The 4Rs of nutrient management provide guidelines for producers to consider when developing a management plan. Paired with a strong understanding of current soil nutrient levels, these guidelines can reduce the amount of inputs needed for a successful crop and eliminate excess runoff.³

Right source: Many types of nutrient sources can be applied to a field, including livestock manure and synthetic fertilizers. Understanding what source is right for a given field can ensure its availability for crop intake and reduce the risk of overapplication.⁴

Right rate: Current soil nutrient levels are important to consider when determining application rates. This information helps producers establish what amount of individual nutrients are necessary to achieve desired yields across individual fields.⁵

Sources

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Right time: Applying inputs at the right time is essential to keep nutrients in the ground and available to plants. In addition to biological factors that influence a crop's nutrient intake, seasonal conditions, such as warm temperatures and rain, can have an effect as well.⁶

Right place: Nutrients need to be placed where they are accessible to crop roots. Some nutrients, such as nitrogen, move easily and should be placed carefully to ensure they remain available to the plant. Others, such as phosphorus, do not move easily and need to be placed deeper in the soil profile. Proper placement can decrease application rates without reducing yields.⁷

Nutrient management methods

Many tools are available for producers interested in the careful management of nutrient application. In addition to the 4Rs, producers can rely on the help of agronomists, soil testing, and technology to achieve their economic and conservation goals.

Precision application: Precision application—or variable rate application—is the targeted application of nutrients that is specific to location and individual crop needs. Along with soil testing, the practice requires the use of various technologies such as geographic information systems (GIS), Global Positioning System (GPS), and remote sensing to tailor input application.⁸

Split application: Split application helps producers meet the needs of their crops by applying inputs during the points of highest nutrient uptake. Some crops, such as corn, need little nitrogen when planted but require a considerable amount when the plants begin to elongate. By side dressing fertilizer on crops when it is most needed, nutrients are used more efficiently and fewer are leached from the soil.⁹

Benefits of nutrient management

Every operation is different. While one producer may practice nutrient management to save money on inputs, another may be invested in reducing pollution in local waterways. Regardless of motivation, nutrient management has the potential to benefit farms in multiple ways, including:

- Improves plant health and productivity
- Improves water quality
- Reduces emissions and odors
- Reduces particulate matter emissions
- Reduces runoff

How to get started

The U.S. Department of Agriculture's Natural Resources Conservation Service supports nutrient management through the Conservation Stewardship Program and the Environmental Quality Incentives Program, which provide producers with technical and financial assistance. To find your local office, visit offices.sc.egov.usda.gov/locator/app.

Sources

6 Ibid.

7 Ibid.

8 Varma, Devalaraju Janakinadh, et al. "Precision Nutrient Management for Enhancement of Nutrient Use Efficiency." Centurion University of Technology and Management, Odisha, India, December 2021, researchgate.net/publication/357421315_Precision_Nutrient_Management_for_Enhancement_of_Nutrient_use_Efficiency. Accessed January 2024.

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