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Plant Nutrition TODAY
Better Crops, Better Environment...through Science

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ADAPTIVE MANAGEMENT FOR CORN NITROGEN

Agronomists have long sought to improve N recommendations for corn. While it is well known that yields depend strongly on N input, the precision on the amount recommended is often less than desired. The optimum rate for a given field can vary year-to-year by 60 lb/A or more, owing to weather. A wide variety of decision support systems are available for choosing the right source, rate, timing, and placement of N. To make the most progress in improving N use efficiency, these support systems need to be tested on-farm through adaptive management.

Applied N can go in many possible directions. The intent is to feed the crop. But there are many paths leading it astray. Some gets held up by microbes as they decompose crop residues. Some of it is lost to the air as one of several gases. Some leaches away in water as nitrate. Getting a bigger proportion to the crop reduces the amount potentially harming the environment.

Decision support systems range widely in complexity. They are designed to help you choose the source, rate, timing, and placement that will get the most N to the crop and the least to the other paths. The simplest are guidelines based on previous crop, expected yield, and expected prices, or on a single indicator like a soil test. More sophisticated systems may address spatial variability using real-time or remote sensing and may address weather variability through the use of computer models predicting crop growth and soil processes. A decision support system that integrates information on crop demand, soil supply, and loss processes is a powerful tool essential to improved N management.

Adaptive management is an on-going process. No matter how sophisticated, a decision support system needs to be evaluated and adapted to meet the needs of your specific operation—your soils, microclimate, business environment, and enterprise goals. Adaptive management aims to develop improved practices for efficient production and resource conservation by use of participatory learning through continuous systematic assessment. Adaptive management of N involves a continuous cycle of planning, evaluating, learning, and making adjustments to choices of source, rate, timing, and placement.

Nutrient balance serves as an important measure to evaluate in adaptive management. Achieving high yields with a minimal surplus of N input over crop removal is a particularly difficult challenge, because N is easily lost. Response trials often show that the economically optimum rate for yield exceeds nutrient removal by a considerable amount. The optimum rate is often close to a pound of N for each bushel of yield, but a typical bushel contains only about two-thirds of a pound of N. The goal is not just a more precise decision for rate on a fixed response curve; it is to alter the response curve through better choices for source, time, and place for nutrients applied, and better choices for soil and crop management.

Tools for on-farm evaluation abound. Soil nitrate tests, tissue tests, visual observations, sensors, aerial photos, satellite photos, and stalk nitrate tests can all provide useful input to the decision support system. But the requirements for evaluating nutrient balance and progress toward potential yields, while simple, involve diligence and hard work. Yield measurement, weigh wagons, some means of measuring N contents, and good records are essential. And it is hard to avoid replicated test strips for making comparisons. In addition, an adaptive approach needs to consider the logistics of operations on the farm and how choices fit into the farm's crop and soil management.

Adaptive management involves collaboration. Involve experts. By giving crop advisers, extension agents, and research scientists opportunity to provide suggestions, and by engaging the most powerful decision support tools, you will find ways to manage N with enhanced efficiency.

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Abbreviation: N = nitrogen.

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