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Integrating Mineralizable Nitrogen Indices into Fertilizer Nitrogen Recommendations

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In most agricultural soils and cropping systems, additional fertilizer, manure, or legume N must be supplied to optimize crop yields. Before the production of nitrogenous fertilizers in the 1940s, farmers relied upon legume crops, manure, and soil organic matter as the primary N sources to support crop production. Mineralization of soil organic N historically has been a significant source of crop N; however, with increased crop productivity, mineralized N from soil usually cannot meet the entire N needs of a crop. Quantification of mineralized N from the soil has regained value for efficient use of N to lower production costs and decrease risks to the environment.

Determination of the fertilizer N requirement of crops depends on an estimate of the quantity of N needed by the crop and an estimate of both inorganic and organic soil N sources. Nitrogen rates are commonly determined by models represented by:

\[
N\text{ recommendation} = a(\text{yield goal}) - b(\text{soil test N}) - c(N_{\text{min}}) \tag{1}
\]

In the above model, yield goal influences the quantity of fertilizer N recommended more than any other term. Thus, determination of optimum fertilizer N rates requires good estimates of realistic yield goals for each field (Jackson et al., 1987). Yield goals usually are determined by adding 5 to 10% to the average yield during the last 5 to 7 yr. Results from North Dakota suggest that nearly 80% of growers overestimate their yield goal (Goos & Prunty, 1990). In a 4-yr Nebraska study, only 10% of 158 farmers surveyed reached their yield goal, and half produced <80% of their yield goal (Schepers et al., 1986).

Soil test N (Eq. [1]) represents extractable inorganic N and is used in making N recommendations in the Great Plains and other arid environments. This test quantifies the soil profile NO$_3^-$ or inorganic N content at sampling time and is subject to considerable error in fields where NO$_3^-$ is lost prior to plant uptake (Hergert, 1987).

The N mineralization (N$_{\text{min}}$) term in Eq. [1] should include adjustments for N$_{\text{min}}$ from previous legume crops, manure applications, soil organic matter, and