The Future of Spatial N Management

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There continues to be a large interest in variable rate N application. The producer adoption rate of the technology has, however, been very slow. There may be many reasons for the slow adoption rate, but many of the perceived reservations revolve around our ability to predict and apply the appropriate amount of N for the crop of interest.

The appropriate rate of N to apply may vary spatially because of soil variability or temporally because of site-specific weather conditions. Soil variability may influence organic mineralization of N as well as other N transformations, while weather factors such as temperature and moisture influence these same reactions as well potential losses of N from the soil via leaching and denitrification. Interaction of these factors with crop growth, development, management practices, and N needs and the uncertainty of accurate N rate predictions become apparent.

Currently two major approaches are being used to make variable rate N application recommendations. The first uses a predictive approach that takes into account soil variability via soil testing and or remote images and ties that together with potential crop demand. The second major approach uses an “in time” crop need strategy. This “in time” strategy attempts to let the crop express its needs for N. This latter strategy typically uses some type of sensor either close to the crop canopy or at some remote distance.

The predictive approach has many advantages associated with it, of which the most important is the increased amount of time available for making a decision. Since it is not possible to predict long range weather conditions, the predictive approach may be open to temporal instability. Although in theory the “in time” approach may appear to be the answer, it also has severe limitations. The “in time” approach is dependent upon an accurate assessment of the future crop N needs at a time when the crop is usually small. Time management decisions will be limited, and will be highly dependent on sensor calibration and interpretation. Since many crops do not express N deficiencies problems until the latter stages of crop development, early sensor readings may not be able to predict future N needs.