

Start Right to Finish Well

Strategies for Corn N Management in Michigan

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Corn nitrogen (N) response is influenced by precipitation frequency and intensity. Increased weather variability has prompted growers to pursue improved N strategies to address economic, social, and environmental concerns regarding N management. Risks associated with early-applied N loss have increased interest in delayed N applications to help synchronize N availability with corn N uptake. However, corn N uptake prior to V6 emphasizes the importance of strategies to meet early N demands and maintain yield potential until sidedress (SD) time.

Recently, a three-year study supported by The Corn Marketing Program of Michigan (<http://www.micorn.org/>) was conducted investigating corn grain yield and profitability response to N placement and timing combinations applied at a single N rate (maximum return to N [MRTN]). The MRTN rates in Lansing and Richville, Michigan were 140 and 180 pounds N A⁻¹, respectively. Three N management strategies were utilized and included:

- Starter N (10-34-0) applied in-furrow (7 pounds N A⁻¹) with SD N (28-0-0) at V4, V10, or a 50/50 split at V4 and V10.
- Starter N (28-0-0) sub-surface banded as 2-by-2 (40 pounds N A⁻¹) with SD N (28-0-0) at V4, V10, or a 50/50 split at V4 and V10.
- Broadcast pre-plant incorporated N with 100 percent urea, 25/75 mix of urea and polymer-coated urea, and poultry litter applied at 1 T A⁻¹ plus SD N (28-0-0) at V10.

Success of SD applications can depend on seasonal weather patterns. When Apr. – June rainfall was near normal to deficit, in-furrow applications reduced grain yield up to 22 bu A⁻¹ when full SD was delayed from V4 until V10. Profitability was similarly reduced up to \$79 A⁻¹. Reduced N rates required by the in-furrow placement were not able to maintain yield potential until the V10 SD timing when rainfall was below normal.

Similar yield trends (although not statistically different) were observed with the 2-by-2 N strategy where yield was reduced up to 11 bu A⁻¹ when full SD was delayed from V4 until V10. Unlike the in-furrow strategy, profitability in dry years was not reduced using the 2-by-2 N strategy. Although the in-furrow or 2-by-2 strategies often achieved similar yields, both increased grain yield up to 18 bu A⁻¹ compared to pre-plant incorporated N.

When Apr. – June rainfall was above normal (i.e., wet year), similar yields were achieved when SD was delayed from V4 to V10 using the in-furrow or 2-by-2 N strategy. No yield difference suggested the risk of early applied N loss (i.e., V4) in wet years was less than the risk of reduced uptake with late applied N (i.e., V10) in dry years. In a wet year poultry litter plus V10 SD provided a slowly available N source and increased yield 17-27 bu A⁻¹ relative to the in-furrow or 2-by-2 strategies with V4 SD. Grower profitability using poultry litter will depend on the cost effectiveness of the litter source.

One point emphasized by the study was the adage ‘start right to finish well’. Canopy measurements collected at V6 indicated corn yield potential was influenced early in the growing season. Nitrogen management strategies (i.e., pre-plant incorporated, in-furrow, 2-by-2) must sufficiently supply N until SD timing to influence success of the in-season application (Fig. 1). Except for poultry litter + V10 SD in a wet year, no positive yield or profitability responses were observed when full SD was delayed until V10.



Figure. 1. Starting right to finish well. In both pictures, corn at V10 received in-furrow starter N (7 lbs N A⁻¹). [Left] Corn received V4 SD (total N=140 lbs A⁻¹). [Right] Corn awaiting V10 SD and displays signs of N stress (i.e., lower canopy firing) due to in-furrow strategy.

To increase corn N recovery, multi-pass N application systems are a recommended best management practice in Michigan. In 4 of 6 site years, multi-pass N strategies increased yield 9-30 bu A⁻¹ as compared to a single one-pass N application of urea or ESN/urea. While split-N applications generally increased yield over a one-pass approach, the in-furrow strategy increased risk due to reduced N rates and concern for seedling injury. The 2-by-2 strategy allowed for increased starter N rates and provided a more consistent yield response across site years. Growers splitting their N applications will minimize risk when applying SD at V4 and may want to consider late vegetative N SD timings as a rescue application for northern corn production regions instead of a standard practice.

For additional information on this research trial and others, please visit the MSU Soil Fertility Research website (<https://soil.msu.edu/>) and view our online video updates (<https://soil.msu.edu/resources/bulletins/>). Dr. Steinke's work is funded in part by MSU's AgBioResearch.