5-21-2007

Corn response to supplemental nitrogen

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Corn response to supplemental nitrogen

Abstract
Once you have determined that enough nitrogen (N) loss has occurred and that supplemental N application is needed, what's next? Rainfall after supplemental N applications will be important for plant uptake. If the applied N is within the active root system, and if there is a need for the N, corn yield can be increased with N applied until shortly after silking. If the supplemental N stays near the soil surface, and is not available to the plant, then the application will be wasted.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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Corn response to supplemental nitrogen

by John Sawyer, Department of Agronomy

Once you have determined that enough nitrogen (N) loss has occurred and that supplemental N application is needed, what's next?

Corn yield response to supplemental N

Rainfall after supplemental N applications will be important for plant uptake. If the applied N is within the active root system, and if there is a need for the N, corn yield can be increased with N applied until shortly after silking. If the supplemental N stays near the soil surface, and is not available to the plant, then the application will be wasted.

Yield responses that return income greater than the costs for application and fertilizer have been observed for N applied up to and slightly beyond the tassel stage. The magnitude of yield increase is dependent upon the severity of N deficiency, when the N is applied, and the ability of the crop to recover and respond to applied N (the growth and yield potential left after water damage and early-season N deficiency). Rainfall is important to have the supplemental N in or move into the zone of active root growth. Dry soil conditions will limit response.

Several studies in Iowa have documented yield increase from N application after periods of
In late spring 1995, four fields with a full rate of fall-applied N in Boone County, Iowa, had additional N sidedress injected as anhydrous ammonia. The data showed an average yield increase of 15 bu/acre from addition of 50 to 75 lb N/acre (A.M. Blackmer, 1996 Integrated Crop Management Conference proceedings, see Estimating Nitrogen Losses pages 55-59). In similar studies, significant yield responses in some fields to additional N (urea-ammonium nitrate solution--UAN) injected when corn was 1-foot in height or surface banded at the R1 growth stage were measured in 1999 after the warm fall-winter and wet spring (Ellsworth et al., 1999, Integrated Crop Management Conference proceedings, pp. 301-304).

A recent study conducted in 2004-2006 at 30 sites in Iowa with corn following soybean (J. E. Sawyer and J. P. Lundvall, project progress reports located at the Iowa State University Agronomy Extension Soil Fertility Web site, nitrogen topic area) indicated an 8 bu/acre yield increase (177 vs. 185 bu/acre) from supplemental N applied at the V15 to R1 growth stages in response to corn plant N-deficiency stress sensing. A reduced preplant or early sidedress N rate of 60 lb N/acre had been applied, the corn N-deficiency stress was monitored, and then supplemental N was applied as indicated by plant sensing. The supplemental N was applied with high clearance sprayers equipped with drop nozzle or coulter injection bars at 28 sites with an average rate of 55 lb N/acre. While these sites were not subjected to excessively wet conditions, the reduced rate treatment in the study does simulate potential for N-deficiency stress development and yield response to N applied in the mid- to late vegetative growth period. While the yield was increased with the supplemental N, applying 120 lb N/acre preplant or early sidedress had a 7 bu/acre higher yield (192 vs. 185 bu/acre) and no need for supplemental N application. In this study, the best response to supplemental N occurred with earlier season application and good rainfall after N application to moist soils.

**Applying supplemental N**

When conventional application equipment can be moved through the field (i.e., the soils are dry enough and the corn is short enough), then injection of anhydrous ammonia or UAN solutions would top the list of best options. Next would come UAN surface dribbled between corn rows, then broadcast urea. Broadcast UAN solution should be avoided on corn larger than the V7 growth stage. With tall corn, supplemental UAN will need to be applied with high-clearance equipment. Injection coulters or drop tubes between every other row or every row should work equally well. Urea can be broadcast with a buggy, if it can be driven between corn rows, or aerially applied.
Supplemental N being applied with high clearance equipment. (John Lundvall)

John Sawyer is an associate professor with research and extension responsibilities in soil fertility and nutrient management.

This article originally appeared on pages 153-154 of the IC-498(10) -- May 14, 2007 issue.

Updated 05/17/2007 - 11:31am