NITROGEN FERTILIZATION OPTIONS WITH DELAYED OR RESCUE APPLICATIONS

John Sawyer, Professor, Department of Agronomy, Iowa State University

It's been a wait-go-stop (repeat) corn planting season this spring. Whether you planted early or are just now getting corn planted, it seems every planting window was short and planting rushed. In some cases this meant planting (corn/soybean) and worrying later about getting nitrogen (N) applied. And in some areas of Iowa, wetter than normal conditions are raising questions about supplemental N application. What are options for sidedress N?

Typical Sidedress Application Timing

If decisions were made to plant corn and then apply N sidedress, be certain to check that fertilizer products and application equipment being considered will be available. Sidedressing options are listed below in order from generally most to least preferable; however, product/equipment availability and personal preference often constrains fertilizer/application choice:

- Injected anhydrous ammonia, urea-ammonium nitrate (UAN) solution, or urea.
- Broadcast dry ammonium nitrate or ammonium sulfate.
- Surface banding UAN.
- Broadcast urease inhibitor treated urea.
- Broadcast urea.
- Broadcast UAN (depends on plant size, see below).

Sidedress injection can begin immediately after planting if rows are visible or GPS guidance positioning equipment is used. Be careful so that soil moved during injection does not cover seeded rows or small corn plants. It is easiest to inject in the row middle and generally there is no season-long advantage to place an N band close to the row. Corn roots will reach the row middle at small growth stages. In cases where no N was applied preplant, no starter N applied, or preplant N injected deep into the soil, a dribble application close to the corn row may help with early N availability and corn early growth. We may see streaking in fields with preplant anhydrous ammonia application; due to wet soils restricting early corn growth and low soil nitrate this spring (especially in corn following corn). Sidedress injected or dribbled N can also be applied between every-other-row.

Broadcasting dry urea, ammonium sulfate, or ammonium nitrate across growing corn might cause some leaf spotting or edge browning where fertilizer granules fall into the corn whorl. The chances of this happening increases with larger corn and high application rates. As long as the fertilizer distribution is good and not concentrated over plants, leaf damage should only be cosmetic. Ammonium nitrate and ammonium sulfate will cause more leaf tissue damage than urea, however, supply is typically limited for those fertilizer products.

Since UAN solution is comprised of one-half urea and one-half ammonium nitrate, it has less volatile ammonia loss concern that dry urea. Surface banding UAN will reduce loss potential. A urease inhibitor with surface applied and non-incorporated urea and UAN will help reduce volatile loss (product labels often state up to 10 days, with loss ramping up over time). The rate of N applied, i.e. the amount of potential N loss, has to be large enough to offset the urease inhibitor cost. Conditions increasing chance of volatile loss include: no precipitation for many days after application, high surface residue, warm temperature, high surface soil pH, moist-to-drying soils, and low soil cation exchange capacity. Precipitation within 2-3 days of application (about 0.25-0.50 inch) will stop volatile loss as urea is moved into the soil. Also, precipitation is needed to move surface applied N into the crop root zone.

Broadcast application of UAN solution across growing corn has the potential to cause leaf burn and reduced early growth. Research conducted in Minnesota indicated that when corn plants were at the V3 growth stage (vegetative leaf stage defined according to the uppermost leaf with a leaf collar visible – in this case three leaf collars visible), phytotoxic effects were worse at rates greater than 60 lb N/acre (rates applied were 0, 60, 90, and 120 lb N/acre), but damage was not permanent and did not adversely affect stand or yield. When plants were larger than the V3 stage, plant damage was worse and some yield depression occurred with the 120 lb N/acre rate. Broadcast UAN applications beyond the V7 stage are not recommended, and the risk of injury increases during hot, dry conditions. Many preemergence herbicides are applied using UAN as the carrier to minimize trips across fields. However, this strategy is only recommended prior to crop emergence. Most herbicides prohibit application in N solutions after corn has emerged. Check herbicide labels closely.

Mid-to-Late Corn Vegetative Stage Applications

If corn becomes too tall for normal sidedress equipment, it is possible to use high clearance equipment to apply N. The N sources typically will be UAN solution, with equipment available to either dribble the solution onto the soil surface with drop or drag tubes or shallow inject with coulter-shank bars (coulter-disk injected), and dry urea which can be broadcast spread across the top of corn. Leaf tissue symptoms from broadcast dry urea can be more than with smaller corn, especially with full N rates.

Research in Iowa has shown corn can respond to mid-to-late vegetative corn growth stage N application when there is deficient N supply, but there can be loss in yield potential. Reduced yield occurs more frequently and to a greater extent when soils are dry at and after application (applied N not getting into the root zone) and with severe N stress. Best responses occur with sufficient precipitation shortly after application to move N into the active root zone. If late N application is needed, it should be applied as quickly as possible, and not later than approximately the tassel stage. Having some non-N limiting (approximately 25% more than normal rate) reference strips or small areas are helpful for comparisons. These areas can be used to visually (or with sensing tools) determine if corn would respond to additional N, as a check to see if earlier N applications are not sufficient, and to determine that a crop color or growth issue is due to N deficiency and not some other stress. These reference areas should be planned and N

applied early in the season if possible, small areas with N applied now to check plant visual response, or field areas that are known to be non-N deficient.

Summary

Most important is to get N applied to corn. While all product/method/timing options may not be ideal, not getting N applied is a much greater concern. Across the Corn Nitrogen Rate Calculator database in Iowa, corn yield increase from N application (yield at optimum N minus yield with no N) averages 100 bu/acre in continuous corn and 70 bu/acre in corn following soybean (standard deviation approximately 35 bu/acre for each rotation). Fine –tuning applications certainly helps insure best yields possible for the year, but sometimes risk of not getting N applied should also be considered. At this time there is still a wide window for getting successful sidedress N applications completed.