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A Late Spring - Nitrogen Considerations

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Abstract
Winter seems to be never ending, and spring not arriving. This could lead to a compressed period for field work before corn planting begins. There are conversations underway about switching planned spring preplant anhydrous ammonia to another nitrogen (N) product like urea-ammonium nitrate solution (28 or 32% UAN) or granulated urea. And likely discussions about changing from preplant to sidedress applications. What should be considered? Perhaps the most important item is to have a conversation between dealer and farmer to ensure product availability when desired, equipment needed for application, and any associated change in costs.

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Preplant Applications

Urea, urea-ammonium nitrate solution, and other products

If planned N fertilizer applications can be made without an undue delay in planting, then go ahead and make the applications. For materials such as urea or UAN solution, or polymer coated urea, those can be broadcast and incorporated with normal tillage before planting. Incorporate or inject rather than leaving the fertilizer on the soil surface to avoid volatile N loss from granulated urea or urea in UAN as it converts to ammonium, or runoff if a rapid rainfall (or snowmelt) event occurs. If time is critical and UAN application is to be made with preemerge herbicides, then surface application is an option, although more risky due to potential volatile N loss from being sprayed/broadcast and the applied N remaining on the soil surface (especially in no-till) if there is not sufficient rain to move the urea into the soil. A rainfall of at least 0.25 to 0.50 inch within approximately two days after application will eliminate volatile loss concern. UAN is half ammonium nitrate and half urea, therefore volatile loss potential from UAN is half of that with urea. Banding UAN on the soil surface will also reduce volatile loss to about half that with broadcast application. Predicting the amount of volatile N loss is difficult, but increases with high surface crop residue (especially no-till), moist-to-drying soils, warm soil temperatures,

many days without rainfall, high soil pH, low soil cation exchange capacity, and higher N application rates. Although an added cost to decrease risk of volatile loss, a urease inhibitor can be added to slow urea conversion which provides time for rainfall to move urea into the soil. Preplant or preemerge applications can be part of a weed-and-feed or split-N system, with a full N rate or rate to supply part of the total N application need and the remainder applied sidedress.

Another fertilizer option is polymer coated urea, designed to delay urea release until soils warm. To avoid product runoff, incorporate into the soil. Surface broadcast options, especially adapted to no-tillage that generally do not have volatile loss concern, are ammonium nitrate and ammonium sulfate. These products are not used extensively in Iowa as a primary N material, so would likely have limited availability.

If disturbing soil is a concern in no-tillage from injecting N, then broadcast application is an advantage but also has the large disadvantage of potential volatile losses, surface runoff, or immobilization of N with surface residue, and is not a highly recommended application.

Anhydrous ammonia before planting

Anhydrous ammonia has certain considerations. It must be injected, and the ammonia band will initially have high pH and considerable free ammonia which can damage (burn) corn seedlings and roots. There is no exact “safe” waiting period before planting, and injury can happen even if planting is delayed for a considerable time period. The risk of ammonia injury depends on many factors, with several that are not controllable. Risk increases if application is made when soils are wet and then dry (ammonia moving up the injection track), with higher application rates, when soils with high clay content are wet (sidewall smearing of the injection track and ammonia moving toward the soil surface during application), and when soils are very dry and coarse textured (larger ammonia band). A few management practices can reduce the risk of ammonia damage. Wait and apply when soil conditions are good, have a deep injection depth (six to seven inches or more), or wait several days until planting. If the injection placement relative to future corn rows can’t be controlled, apply at an angle to reduce entire sections of corn rows from being damaged. If the injection track can be controlled with GPS guidance positioning technology, then offset a few inches from the future corn rows – with this guided system no waiting period is needed. There would be a similar free ammonia and/or salt issue with shallow banded urea or UAN solution. Anhydrous ammonia nitrifies more slowly than products like urea or UAN solution, so is a preferable fertilizer for soils with greater potential for losses in wet conditions.

Sidedress Applications

Best options for sidedressing, in approximate order from most to least preferable (and depending on crop emergence and size):

- injected anhydrous ammonia, UAN, or urea.
- broadcast granulated ammonium nitrate or ammonium sulfate.
- surface applied urease inhibitor treated urea or UAN.
- surface dribble UAN solution.
- broadcast urea.
- broadcast UAN.

There is a wide time period for sidedress applications. Sidedress injection can begin immediately after planting if corn 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 there is no advantage in attempting to place the injected band close to the corn row. Corn roots will reach into the row middle at a small growth stage. Injected N can also be applied between every-other-row, and this will provide equivalent response as when placed between every row. For many soils, when planting corn after soybean there can be adequate N in the root zone to meet the needs of small corn plants. For corn after corn, there is a greater likelihood that additional N is needed for early growth. Preplant or starter N can help meet early plant needs, and is especially important if sidedressing is delayed significantly or there will be a planned mid-to-late vegetative growth stage application in either rotation.

With sidedressing, a urease inhibitor with surface applied and non-incorporated urea and UAN could help reduce volatile loss, similar to that described above with preplant applications. A dry soil surface may be more common within the growing season, which will reduce volatile loss potential. The rate of N applied, and hence the amount of potential N loss, has to be large enough to offset the inhibitor cost. Rainfall will eliminate volatile loss and is needed to move surface applied N into the root zone.

Broadcasting granulated urea, ammonium sulfate, or ammonium nitrate across growing corn can cause leaf spotting or edge browning where fertilizer granules fall into the corn whorl. Damage will be greatest with ammonium nitrate, but that product is not readily available or used in Iowa, with damage from ammonium sulfate more than urea. The chance of damage increases with larger corn and higher application rate. As long as the fertilizer distribution is good, not concentrated over plants, and the rate reasonable, the leaf damage should only be cosmetic.

Broadcast application of UAN solution across growing corn has the potential to cause leaf burn and reduced early growth. Depending upon the severity of damage, reduced plant growth may be visible for several weeks after application. 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. Many herbicides are applied using UAN as the carrier to minimize trips across fields. However, this strategy is only recommended prior to crop emergence. Almost all herbicides prohibit application in N solutions after corn has emerged. Check herbicide labels closely.

If N is going to be sidedress applied, then rates can be adjusted from results of the late spring soil nitrate test (LSNT). Soil samples, 0-12 inch depth, are collected when corn is 6-12 inches tall with rate adjustment based on the measured nitrate-N concentration.

If corn becomes too tall for normal sidedress equipment, it is possible to use high clearance equipment to apply N. The N source often will be UAN solution, with equipment available to either dribble the solution onto the soil surface with drop tubes or shallow inject with coulter-shank bars (coulter-disk injected), and urea which can be broadcast spread across the top of corn.

Research in Iowa has shown corn can respond to N application at mid-to-late vegetative corn growth stages when there is deficient N supply, but there can be loss in yield potential. Reduced yield occurs more frequently 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 rainfall shortly after application to move N into the active root zone.

If attempts to get N applied preplant or early sidedress have failed, or there are concerns about N supply from early fertilizer or manure applications, then mid-to-late vegetative stage application can be a helpful rescue. Having some non-N limiting (approximately 50% more than normal rate) reference strips or areas in fields are helpful for comparisons. These areas can be used to visually determine if corn would respond to additional N, as a check to see if earlier N applications are not sufficient, and determine if plants are showing growth or coloration symptoms that are not due to N deficiency. These reference areas are also needed for N stress sensing tools (such as chlorophyll meters, active canopy sensors, or satellite images) to help guide application rates and understand N stress across landscapes. These reference areas should be planned and N applied early in the season, or be field areas that are known to be non-N deficient. Plant and canopy sensing can begin

when corn is at approximately the V8-V10 growth stage. If late N application is needed, it should be applied as quickly as possible and not later than the tassel/silking stage.

In Summary

- Fertilize before planting if it does not greatly delay corn planting; otherwise consider split or sidedress N.
- If you decide to change planned N applications, make certain needed N fertilizer products and sidedress or high-clearance equipment will be available; or if hiring applications the dealer/custom applicator can accomplish the applications.
- Consider the N volatilization potential of different N materials when applying without incorporation or injection into the soil.
- Try not to make poor N management decisions just to get applications completed.
- Communication between farmer and dealer is key.

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Crop:

Corn

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