

## COMPRESSED SPRING WORKLOAD IN 2014? WHAT ARE NITROGEN APPLICATION OPTIONS?

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It was a long winter, with conditions this spring suitable for field work perhaps being later than normal. Also, some areas of Iowa did not have the typical amount of fall anhydrous ammonia applied. Questions are already coming about options for nitrogen (N) fertilization this spring, and the usual question should time be taken to get N applied or plant corn and apply N later.

### Preplant Applications

#### *Urea, urea-ammonium nitrate solution, and other materials.*

If planned fertilizer applications can be made without a delay in planting, then go ahead and make the applications. For materials such as urea or UAN solution (urea-ammonium nitrate 28% or 32% solution), or polymer coated urea, those can be broadcast and incorporated with normal tillage before planting. Incorporate rather than leaving the fertilizer on the soil surface to avoid volatile N loss from dry urea or urea in UAN. 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 loss and the applied N remaining on the soil surface (especially in no-till) if there is not sufficient rain to move it into the root zone. A rainfall of at least 0.25 to 0.50 inch within approximately two days after application will eliminate volatile loss concern. Or, use a urease inhibitor to slow urea conversion, which provides more time for rainfall to move urea into the soil. Preplant or preemerge applications can be part of a split-N or weed-and-feed system, with a 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 runoff loss, incorporate into the soil. Surface broadcast options, especially fertilizers for 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 disadvantage of potential losses or immobilization of N with surface residue.

#### *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 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. For example, 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 things 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); wait several days until planting; if the injection placement relative to future corn rows can't be controlled, apply at an angle; if the injection track can be controlled with GPS guidance positioning technology then split future corn rows – with this guided system no waiting period is needed. Anhydrous ammonia nitrifies more slowly than products like urea or UAN solution, so is a preferable N fertilizer for soils with greater potential for losses in wet conditions.

## Sidedress Applications

If decisions are made to plant corn and then apply N sidedress, be certain to check that needed fertilizer products and application equipment will be available. Best options for sidedressing, in order from most to least preferable:

- injected anhydrous ammonia, UAN, or urea.
- broadcast dry ammonium nitrate, ammonium sulfate, or urease inhibitor treated urea.
- surface dribbling UAN solution.
- broadcast UAN.
- broadcast urea.

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 band close to the row. Corn roots will reach the row middle at a small growth stage. Injected N can also be applied between every-other-row. That technique 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 chance that additional N is needed for early growth. Preplant or starter N can help meet those needs, and is especially important if sidedressing is delayed significantly or there will be a planned mid-to-late vegetative stage application in either rotation.

Broadcasting 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 higher application rate. As long as the fertilizer distribution is good and not concentrated over plants, the leaf damage should only be cosmetic.

Since UAN solution is comprised of one-half urea and one-half ammonium nitrate, it has less volatile loss concern than dry urea. A urease inhibitor with surface applied and non-incorporated urea and UAN will help reduce volatile loss. 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.

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 preemergence 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.

### ***Mid-to-Late 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 source typically 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 dry urea which can be broadcast spread across the top of corn.

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 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 the field are helpful for comparisons. These areas can be used to visually determine if corn would respond to additional N, or as a check to see if earlier N applications or carryover N is not sufficient. These reference areas are also needed for N stress sensing tools (such as chlorophyll meters or active canopy sensors) to help guide application rates. 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 stage.

### **In Summary**

- Fertilize first if it does not delay corn planting, in other situations split or sidedress apply N.
- Make certain needed N fertilizer products and sidedress or high-clearance equipment will be available.