

## Nitrogen Practices for Late Planting Scenarios

There have been limited opportunities to operate machinery in the field this spring. As a result, when soil conditions are right, planting should take priority over applying nitrogen (N). Growers may consider changing from pre-plant nitrogen to side-dressing anhydrous N (or UAN liquid solutions) and applying a minimum of 30 lbs N per acre broadcast or banded to stimulate early seedling growth<sup>1</sup>. If the decision is made to apply N as pre-plant anhydrous, growers should wait 7 days before planting to reduce the risk of potential injury to emerging corn<sup>1</sup>.

### Anhydrous Ammonia Burn to Corn

Anhydrous ammonia burn to corn roots occurs when the corn seedling comes into contact with high concentrations of free ammonia ( $\text{NH}_3$ ). Anhydrous injected into the soil begins to convert to ammonium ( $\text{NH}_4^+$ ) by associating with hydrogen ions. Most hydrogen ions come from water molecules and some come from soil cation exchange sites. When the hydrogen ions leave the water molecule, hydroxyl ion ( $\text{OH}^-$ ) concentrations gradually increase in the soil solution. This reaction temporarily increases the soil pH at the point of injection and allows some free ammonia to exist in the soil; thus, possibly causing injury or burn (Figure 1). High ammonium concentrations and high pH in the anhydrous band initially retard the conversion of ammonium to nitrate due to the influence on soil microbes and their ultimate role in nitrification. Nitrification then lowers the soil pH so the net effect of anhydrous ammonia is to lower the soil pH.

### Anhydrous Ammonia Injury

Anhydrous ammonia injury to corn can result in poor corn emergence over the ammonia knife track. This crop response

often appears as diagonal streaks through the field, following the direction that the anhydrous was applied. Anhydrous injury results in uneven corn seedling emergence, slow growing plants, and in drier weather seedlings may show wilting. Ammonia injury is more pronounced in dry weather since injured corn seedlings have root systems that are slow to develop or damaged “stubby” root systems that limit water uptake (Figure 2), and also in soils that are lower in water holding capacity because less total water is available to help buffer the influence of ammonia application and pH change in the localized area.

In dry soils, the conversion of ammonia to ammonium also occurs more slowly. Severely damaged roots turn black along the root up to the seed and may appear as if they have been burnt. If injury to the corn stand is severe, replant decisions based upon the plant distribution, cost of the seed, and planting cost will need to be made as early as possible.



**Figure 1.** Anhydrous ammonia burn on corn radical.



**Figure 2.** “Stubby” corn roots caused by injury from anhydrous ammonia.

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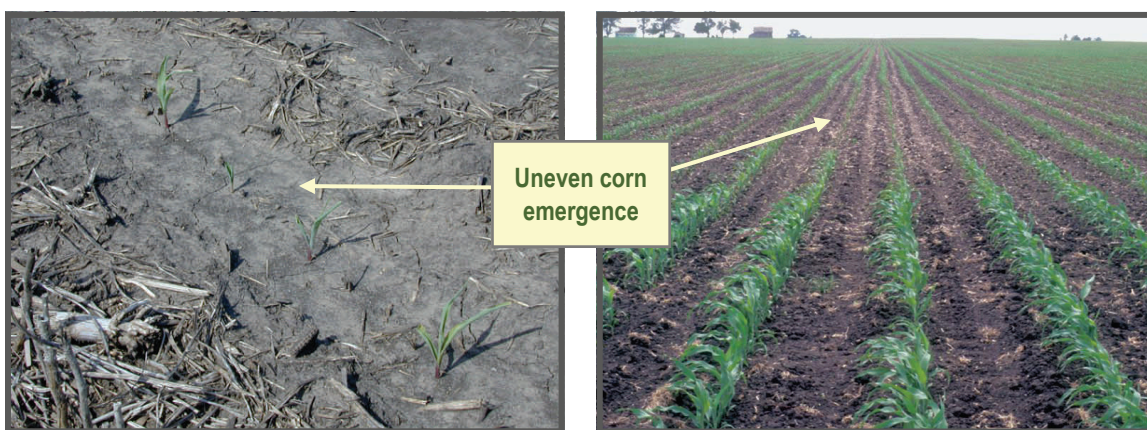
### If utilizing a pre-plant application, what can be done to reduce the potential for injury from anhydrous ammonia?

Many factors determine the risk of ammonia injury. If you decide to apply anhydrous ammonia pre-plant, there are several guidelines that can help to minimize injury. To minimize the risks, apply lower rates of ammonia when soil conditions are favorable. Inject at 7 inches or more and apply the anhydrous at an angle. To minimize upward mobility of the ammonia and injury to the seed, make sure the soil closes after the knife passes through the soil. After ammonia is injected into the soil, there is a zone of ammonia concentration of approximately four inches in radius. In sandy soils and in dry soils, ammonia moves further away from the injection point. This can make the zone of concentration oblong versus a circular concentration. In wet soils, the injection knife may smear the sidewall and allow ammonia to move back up the knife slot. As wet soils begin to dry, ammonia can also move up the knife track.

For all of these reasons, it is best not to plant on top of the injection bands. Waiting at least 7 days to plant after anhydrous ammonia is applied can also help minimize the risk of injury.

### Side-dress applications of anhydrous ammonia or UAN liquid solutions after corn emergence can significantly reduce crop injury potential.

Utilizing a planned side-dress N application can create efficiencies in crop establishment and increase yield potential caused by further delays in planting date. UAN liquid solutions and anhydrous ammonia are excellent N sources for feeding the crop. Care must be taken to avoid injury from side-dressing with anhydrous ammonia. Vapor damage to the corn leaves can occur if ammonia escapes from applicator knives that are close to or above the soil surface. If only a portion of the corn leaves are damaged, corn plants will usually grow out of the injury. There is no advantage in trying to place the side-dressed nitrogen close to the corn seed. It is a better agronomic practice to inject nitrogen in the row middles so the risk of damaging the developing root structure of the crop is reduced. Corn roots will reach the row middle at early growth stages (approximately V8 for a 30-inch row width). One can avoid the crop injury potential from anhydrous ammonia all together by using UAN liquid solutions. Potential loss of N through volatilization provided by UAN liquid applications can be significantly reduced by utilizing application tools that inject the UAN solution below the soil surface.



**Figure 3.** Anhydrous ammonia burn resulting in uneven corn emergence.  
Photos © John E. Sawyer, Agronomy Extension, Iowa State University.

Additionally, be sure to wait to do any type of field operation, including planting, until soil conditions are fit. The damage from compaction can be felt beyond this season, so it is better to have patience than cause potential problems in the future.

Sources: <sup>1</sup>P. Thomison and R. Mullen. *Adjusting corn management practices for a late start.* C.O.R.N Newsletter, The Ohio State Univ. April 26, 2011 - May 2, 2011. Additional references: C. Laboski. *Planting corn immediately after anhydrous ammonia application, am I in for trouble?* Wisconsin Crop Manager. May 11, 2009. J. Sawyer and R. Elmore. *It's a late spring: should you apply nitrogen or plant corn?* Iowa State University Extension. May 4, 2008.

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