

AGRONOMIC ALERT



ANHYDROUS AMMONIA INJURY TO CORN

Anhydrous ammonia can be a good economical source of nitrogen for corn. Proper application and planting techniques along with good soil conditions usually provide good performance without crop injury. However, under some circumstances, growers may observe injury to corn seedlings from anhydrous ammonia applied prior to corn planting. Injury to corn from spring applications of anhydrous ammonia occurs most often under dry soil conditions, but ammonia injury can also be seen in wet soil conditions.

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 (NH_3). Anhydrous injected into the soil begins to convert to ammonium (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 ions (OH^-) are left behind. This reaction temporarily increases the soil pH at the point of injection and allows some free ammonia to exist in the soil and causes injury or burn (Figure 1). High ammonium concentrations and high pH in the anhydrous band initially slow the conversion of ammonium to nitrate. Soil microbes convert the ammonium to nitrate. Nitrification then lowers the soil pH so the net effect of anhydrous ammonia is to lower the soil pH.



Figure 1. Anhydrous ammonia burn on corn radical.

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. 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).



Figure 2. "Stubby" corn roots caused by injury from anhydrous ammonia.

In dry soils, the conversion of ammonia to ammonium also occurs more slowly. Severely damaged roots turn black back 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.

Care must also be taken to avoid injury from sidedressing with anhydrous ammonia. Vapor damage to the corn leaves can occur if ammonia escapes from applicator knives that are close

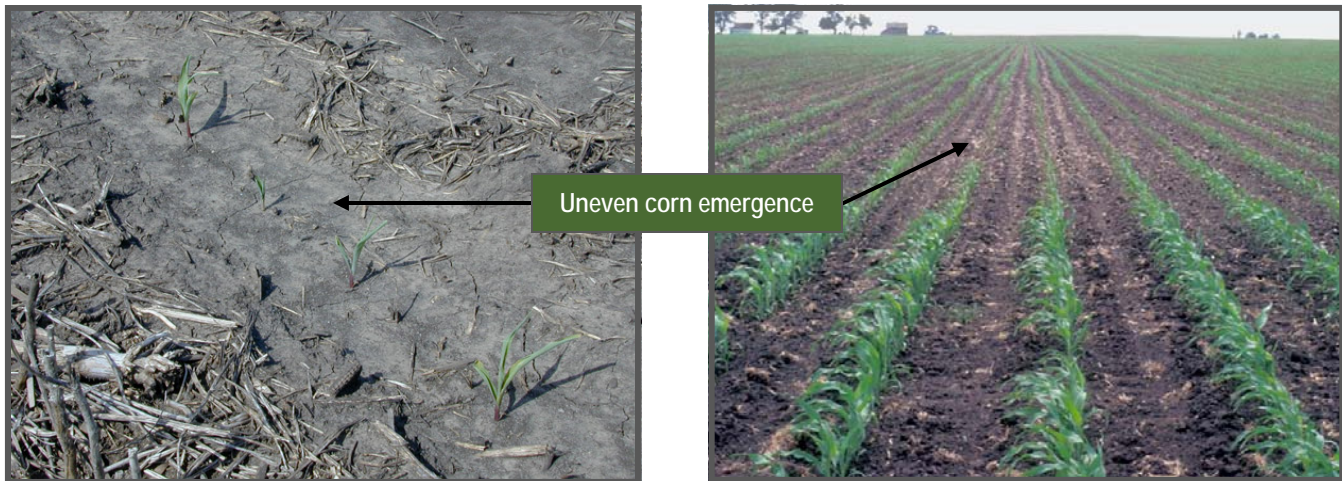


Figure 3. Anhydrous ammonia burn resulting in uneven corn emergence.
Photos John E. Sawyer Agronomy Extension, Iowa State University.

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 sidedressed nitrogen close to the corn seed. It is easier to inject nitrogen in the row middles. Corn roots will reach the row middle at early growth stages.

What can be done to prevent injury from anhydrous ammonia?

Many factors determine the risk of ammonia injury. There are several guidelines that can help to minimize injury from anhydrous ammonia application prior to corn planting. 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 for several days to plant after anhydrous ammonia is applied can also help minimize the risk of injury.

Sources:

<http://www.agronext.iastate.edu> (4/28/2010)

<http://sheridanexpress.blogspot.com> (4/28/2010)

R. Mullen and P. Thomison. *Delayed Application of Anhydrous Ammonia*. C.O.R.N Newsletter, The Ohio State Univ. April 11, 2005 - April 19, 2005.

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

Technology Development by Monsanto and Design(SM) is a servicemark of Monsanto Technology LLC. ©2010 Monsanto Company. 042810JMM