



Agronomic Alert

Anhydrous Ammonia Injury to Corn

- Proper application of anhydrous ammonia along with good soil conditions usually provides a positive crop response without injury.
- 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 is rapidly converted 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 which can cause 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. When the ammonium undergoes nitrification, conversion of NH_4^+ to NO_3^- , the free hydrogen lowers the soil pH; therefore, the net effect of the anhydrous ammonia application is a lower soil pH.



Figure 1. Anhydrous ammonia burn on corn radical.

Anhydrous Ammonia Injury

Anhydrous ammonia injury to corn can occur over the ammonia knife track and result in poor corn emergence. This crop response can often be seen by following the direction of the anhydrous ammonia application through the field. Anhydrous ammonia injury results in uneven corn seedling emergence, slow growing plants, and seedlings may show wilting in drier weather. Anhydrous ammonia injury is generally more pronounced in dry weather since injured corn seedlings have root systems that are slow to develop or become damaged “stubby” root systems that limit water uptake (Figure 2).

Even in dry soils, the conversion of ammonia to ammonium occurs rapidly. However, nitrification can occur relatively slowly when dry soils are also cool. Severely damaged roots turn black and may appear as if they have been burnt. If injury to the corn stand is severe, replant decisions based upon the plant distribution as well as costs of the seed and re-planting will need to be made as early as possible.



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

Anhydrous Ammonia Injury to Corn



Figure 3. Anhydrous ammonia burn resulting in uneven corn emergence.
Source of photo on left: John E. Sawyer, Agronomy Extension, Iowa State University.

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 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 middle of the row. Corn roots will reach the row middles at a fairly early growth stage (approximately V8 for 30-inch row width).

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 reduce the risks, apply lower rates of ammonia when soil conditions are favorable. Inject at a depth greater than five inches and apply the anhydrous diagonal to planned corn rows. 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 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 shallow injection bands. Waiting as long as possible to plant after anhydrous ammonia is applied can also help minimize the risk of injury.

Sources:

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Websites verified 4/13/15.

For additional agronomic information, please contact your local seed representative.
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