

# Consider Temperature When Applying Anhydrous

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**N**ow that soil temperatures 4 inches below the surface are cooling down to 50°F or lower, some will soon be busy applying anhydrous ammonia in preparation for next year's corn crop. I think it is worth repeating the reason for this tempera-

ture threshold for fall nitrogen applications. It is important to wait until soil temperatures fall below 50°F because the activity of nitrosomonas bacteria – responsible for transforming ammonium to nitrite, which is then rapidly transformed to nitrate – is reduced substantially. Where temperatures do not get cold long enough in winter (in Illinois, roughly south of Route 16), fall N application is not an option because the risk of N loss is too great. Because soil temperatures vary as a result of many factors (including soil color, amount of crop residue, and moisture content), it is best to check the temperature in the field of interest. You can get a general idea of soil temperatures at this link.

The question I have been asked most often in the last week or so is whether soils are too dry to apply anhydrous ammonia. As Illinois farmers know, some parts of the state received very little rain in July and August. While some locales have received rain lately, there are areas that are still very dry.

Is it too dry to apply anhydrous ammonia? It doesn't take much moisture for ammonia (NH<sub>3</sub>) to react with H<sup>+</sup> ions from water to convert to ammonium (NH<sub>4</sub><sup>+</sup>). The biggest concern should be not so much whether there is enough moisture in the soil to react with ammonia, but rather how moisture conditions impact the sealing of the ammonia knife track. When soils are dry, sometimes big clods are formed, leaving large channels through which ammonia can move quickly and escape to the atmosphere – the loss can be substantial. If soil conditions are such that the knife track is sealed with loose soil, you can expect ammonia to be retained.

How deep should I apply anhydrous ammonia? In dry soils anhydrous ammonia will move in the soil a little farther than when there is good moisture content. In very dry soils you can expect it to move about 5 to 6 inches from the point of application. Applying to a depth of 8 inches would be advisable in such conditions to ensure that ammonia does not diffuse all the way to the soil surface in search of water. That said, deep application can mean a longer time

next year for corn roots to reach the nitrogen band, so I suggest applying no deeper than about 8 inches. If you apply deeper than that, it would be advantageous to reduce your fall nitrogen rate and apply that nitrogen near the soil surface in spring so it is close to the newly developing root system.

How long should I wait to till after applying anhydrous ammonia? You can combine shallow tillage (field cultivation, disking, etc.) with ammonia application in fine-textured soils so long as the soil has adequate moisture and ammonia is applied behind the tillage operation at sufficient depth to ensure that ammonia diffusion does not reach the soil surface (see the earlier discussion). If deeper tillage is needed after the application, it is important to wait at least 5 to 8 days so the ammonia has time to react with soil water and form ammonium. The reaction is typically very fast, but the speed depends on soil conditions.

How do I know if I am doing the right thing? Once you evaluate your situation and decide how to best ensure a successful anhydrous ammonia application (rate, depth, tillage, etc.), the best and easiest test is to go back to the field after an application path and smell for ammonia, as the human nose is very sensitive to its aroma. Though you can't quantify how much is being lost, if you can smell ammonia a few hours after application, you should wait for better conditions. If there is no smell, nitrogen loss from the application is probably minimized.

Some worry about losing ammonia in the white puffs they see during application, but what you see is water vapor-ammonia gas is colorless. The cloud of water vapor forms because anhydrous ammonia when it is applied rapidly cools the warm air around it, causing water condensation. Again, as long as ammonia smells do not persist after application, any clouds you see should not be a major concern.

## Consider Your Options

Most of the points I have outlined relate to minimizing nitrogen loss during or soon after application. It is important to realize that volatilization losses are not the only concern with fall nitrogen applications. Because of the long time between application and when the corn plant uses nitrogen, fall applications are typically riskier in terms of nitrogen loss than preplant or sidedress applications, so they should be considered carefully. In issue 22 I provided additional information on applying nitrogen in the fall.  $\Delta$

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