Purdue University Department of Agronomy
Soil Fertility Update

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Anhydrous Ammonia Applications in a Dry Fall

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If you typically apply anhydrous ammonia (AA) in the fall, you are aware of the rule of thumb – do not apply AA until soil temperatures at the 4" depth fall below 50 °F and are becoming colder. Low soil temperature hinders the bacterial conversion of ammonium nitrogen (NH_4^+) to nitrate nitrogen (NO_3^-). Slowing this reaction is critical to the efficient use of AA because NH_4^+ is retained in the soil whereas NO_3^- is easily lost from the soil by leaching to tile drains and/or by denitrification to the air. The longer nitrogen (N) remains in the NH_4^+ form in the fall, the lower the potential for N loss in the early spring when warm soil temperatures and excess soil moisture invariably occur.

Normally soil temperatures in northern Indiana at this time of year have fallen to 50 °F by the time AA applications have started. This year soil temperatures at 4" remain in the mid 50's to low 60's. With an early harvest and dry fields many farmers are eager to begin applying AA, but they are concerned with the unusually warm soil temperatures and dry soil conditions. Warm soil temperatures coupled with extremely low soil moisture across much of Indiana can certainly be problematic for producers that are planning fall applications of AA this year.

The first step to insuring the efficient use of AA is to keep it in the soil during application. Soil moisture helps the soil seal and also functions to capture ammonia (NH_3), enabling its reaction with water to form NH_4^+. Currently some soils may be too dry to seal properly and capture all the NH_3 that will be applied, especially if the soils are loosened by tillage prior to AA application. It is not advisable to apply AA to soils in this condition irrespective of soil temperature.

If soils are in suitable condition to capture AA, then soil bacteria will begin to convert NH_4^+ to NO_3^- shortly after application. Fortunately, the rate of conversion will be relatively slow if soil moisture is low even though temperatures are still warm. The 'early' application of AA may or may not result in greater N loss in the spring. The outcome depends on the weather over the next couple of weeks. If it remains warm and rains, rewetting soils to the depth of AA application, then NO_3^- will form and increase the potential for N loss in the spring. However, if it becomes cold before the next soaking rain then little NO_3^- will be formed and potential N loss will be no greater than usual.

Since the weather is so unpredictable, consider applying the nitrification inhibitor nitrapyrin with AA to delay the conversion of NH_4^+ to NO_3^-. Nitrapyrin is often used with fall-applied N in the eastern Corn Belt to provide insurance against fluctuating soil temperatures in the fall and early winter.

Bottom Line

Before applying anhydrous ammonia make sure the soil is moist enough and in good enough physical condition to capture the ammonia regardless of the soil temperature. Hope soils become cold before they become wet. Apply a nitrification inhibitor with anhydrous ammonia to delay the conversion of ammonium to nitrate and buy more time for cold weather to arrive.