

# Integrated Pest & Crop Management

## Is My Nitrogen Still There?

By John A. Lory and Peter Scharf

We have had a wet winter in most of Missouri. Dr. Pat Guinan, State Climatologist, said that the period from December 1, 2007 through March 31, 2008 was one of the wettest winter periods on record for most of Missouri. The wet weather included heavy rains across most of the southern two-thirds of the state March 17 to 18. The above average precipitation raises questions about potential loss of nitrogen applied before the storms.

Precipitation has followed the normal winter pattern, with greatest precipitation in the southeast. Since November first, parts of southeast Missouri have had well above 30 inches, while the extreme northwest corner is closer to 8 inches. There is a fairly smooth gradient from southeast to northwest. So, although most of the state has been wetter than normal, risk of N loss is lowest in northwest Missouri and increases as you move to the southeast.

Predicting nitrogen losses on a specific field is always difficult and an imperfect art. Understanding the risk factors can help you determine whether your fields are at risk and, if so, which ones are most likely to need additional N. We will consider two management scenarios: fall-applied and spring-applied nitrogen.

### *Fall-applied nitrogen*

Loss of fall-applied nitrogen is a two-stage process. First, the anhydrous ammonia (or manure) must convert to the nitrate form. This stage depends on soil temperature. Fall-applied nitrogen is at risk for loss if it is applied too early or if an extended winter warm spell allows significant conversion of nitrogen to nitrate. The recommended strategy is to apply nitrogen after average six-inch soil temperature has dropped below 40 degrees in northern Missouri where soil temperatures stay cold enough to reliably prevent conversion to nitrate.

Average daily soil temperatures dropped below 40 degrees across northern Missouri in the last week of November. After that date soil temperatures stayed close to the freezing point for most of the winter. A short January warm spell created a short-term spike in soil temperature but it was not long enough to allow much nitrate formation. For those who waited until late November to apply their N, it's likely that no more than half of the fertilizer had converted to nitrate by April 1.

This was the case for 17 fields sampled in spring 2004, also following a cooler than average winter.

The second step in the loss process is to get excess rainfall. Counties where roughly 1000 tons or more of anhydrous ammonia were applied last fall, and where more than 15 inches of rain have fallen since November 1, include: Audrain, Barton, Boone, Callaway, Lincoln, Monroe, Montgomery, Pike, Ralls, St. Charles, and St. Louis. These counties are particularly at risk for loss of fall-applied N.

The less water moves through the soil, the less N is lost. Much of the landscape in the counties listed

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above consists of claypan soils with low permeability. Water moves through these soils slowly. This will also help to protect the nitrogen from loss. Whether enough N can still be lost to reduce crop yields is not known. On soils with good drainage and high permeability, potential for leaching is higher. In the counties listed above, these soils will be mostly in river and creek bottoms.

Excess water also can cause the nitrate in the soil to be lost by either leaching or denitrification. Denitrification losses typically are important when soil temperatures are 65 degrees or higher. Average daily soil temperature at six inches were between 40 and 50 degrees throughout most of the state on April 14.

In summary, the highest risk situation for loss of fall-applied N in Missouri right now is: early fall application (before November 20); in Audrain, Barton, Boone, Callaway, Lincoln, Monroe, Montgomery, Pike, Ralls, St. Charles, St. Louis and counties south of these; on well-drained fields.

Any fields with all three risk factors is likely to already have significant nitrogen losses this spring.

### *Spring-applied nitrogen*

Spring rains have followed the same pattern as winter rains, heaviest in the southeast. Producers north of the Missouri River have probably not yet lost much N from the root zone, regardless of N source.

South of the river, risk of loss depends on N source and on soil drainage characteristics. For anhydrous ammonia applied this spring, risk of loss is low. Other nitrogen forms (urea, ammonium nitrate, and urea-ammonium nitrate solution) applied before mid-March should be considered at risk in well-drained fields that received heavy rains. Of these forms, urea is least at risk and has a somewhat protected window that we guess would extend roughly from 3 to 14 days after application. During this time, much of the N is in the ammonium form, which is not subject to leaching loss.

### *What should I do?*

Do not assume that all nitrogen has been lost. If the discussion above suggests that the risk in your fields is low, you don't need to do anything except watch for future weather that could cause more N loss. If you find in the discussion above that you have multiple risk factors for your fields, you

need to be prepared to evaluate your fields and apply more nitrogen if needed to protect your yields.

One tool for evaluating fields is a soil nitrate/ammonium test (see MU G9177, <http://extension.missouri.edu/explore/agguides/soils/g09177.htm>). This test estimates the amount of fertilizer nitrogen still available in the soil for rowcrops such as corn. It is only useful if you are able to sample to at least two feet deep. With the weather that we've had, you can't expect all of the N to still be in the top foot. It's a fair amount of work to get this kind of sample, but can pay off if it helps you make the right decision.

The other way to evaluate fields is simply to watch the appearance of the crop. This is easier but gives you fewer options for applying N in those fields where you see a need. It is easy to miss problem areas in roadside surveys. A quick aerial survey of your fields with a camera in hand can be quick and help to protect your investment in your crop.

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