Burrus Buzz

Delivering more than just seed!

January 12, 2016

Nitrogen Loss

by Matt Montgomery

Recent Rainfall – Is it bad news for nitrogen?

Christmas did not look and did not feel like Christmas in much of the Burrus footprint this year. Fields were wet and temperatures were spring-like (particularly in the southern half of Illinois and much of Missouri). This has increased concern that nitrogen may have been lost. Did we lose nitrogen over the past few weeks? Should we prepare for some rescue N on those fall-applied fields?

The Burrus agronomic team does not believe much nitrogen loss occurred during recent rainfall, and our team believes it is way too early to call for rescue N.

We developed a detailed explanation for this position and submitted our arguments to some trusted industry experts. We have included a selection of their comments with each of our bullet points.

Point Number 1: Residual N was low, so we probably did not see lots of residual N movement during recent rainfall.

There are two batches of nitrogen that can be lost over the winter: Residual nitrogen and fall applied nitrogen. We will start with the first, often less intense, loss pathway – residual nitrogen.

One can lose residual nitrogen (the fraction of N converted to nitrate yet unused by the crop in-season). While we may have lost some "leftover" 2015 nitrogen, we probably did not lose much. Why would that be? Simply put, 2015 nitrogen probably did not make it to the last quarter of the calendar. According to Dr. Howard Brown (GROWMARK, Inc.) "Overall, there was little residual N in the soil profile following harvest so there should be relatively little loading."

Nitrogen is converted to its nitrate form rapidly during the growing season, and nitrates are rapidly converted to easily lost gaseous forms when soils are saturated during the summer months.

Only a small amount (a fraction of a fraction) of the annual N application is typically left for the next growing season (note we stress the word "typically" here and note that residual N is typically so low that many tend to discount it). By the late summer of 2015, that small fraction was already disappearing due to record breaking rains.

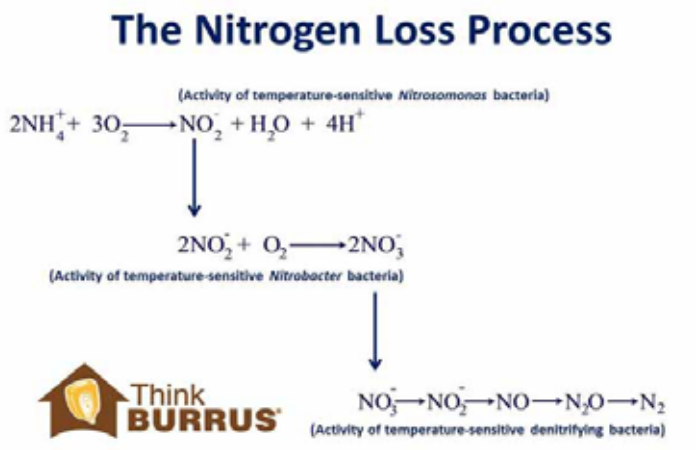
Point Number 2: Rainfall was exceptional and our thermometers ran high over the last month. However, soil temperatures lagged behind. Soil tempertures likely did not warm to critical levels, long enough, to see much fall nitrogen loss.

Dr. Fabian Fernandez of the University of Minnesota stressed, during his conversation with Burrus, that nitrification and denitrification (the two critical steps in the nitrogen loss process) are both "dramatically reduced below 50 degrees" (50 degree soil temperatures).

Both steps must occur (nitrification must occur first and then denitrification must occur) before fall applied N can be lost in significant quantities. Since mid-December, northern Missouri and central Illinois clocked in about one day of soil temperatures near or just above 50 degrees. Central Missouri clocked in about 3 to 5 days. That means there were only a few days, and in some places less than a few days, for bacteria to convert nitrogen to nitrate and then for other bacteria to denitrify that converted nitrogen. That is a lot of activity that would need to happen during a pretty narrow window.

Add in some saturated conditions, and the probability of significant nitrogen loss reduces further. As Dr. Fernandez noted, that first step in the nitrogen loss process (nitrification) "is an aerobic process." It requires plenty of oxygen. Oxygen would have been low during many of those warm, field saturated days.

It is also important to note another fact. We typically apply nitrification inhibitors that reduce the population of those troublesome bacteria during the fall. For those that followed Best Management Practices (for those that waited to apply nitrogen until late October/early November in northern Missouri and Central Illinois and applied that N alongside an inhibitor), the number of bacteria is low, their recovery is sluggish, and their numbers must now build back up before they can siphon away N. Before nitrification and denitrification can occur, this recovery process must first occur. That means an even narrower window for nitrogen loss since mid-December.



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Point Number 3: The next couple months will determine our fall nitrogen loss risk. It is therefore way too early to project a need for rescue N.

A continuation of this "warm" winter trend represents the larger potential issue facing fall-applied nitrogen reserves. In other words, should our December warm up be combined with warm soil temperatures over the next two months, our risk of "right out of the chute" spring N loss could increase. This means that it is way too early to say we need rescue N. Consider the following comments:

"Like you, I'm not as concerned about the most recent rain events as I am about future (early spring rain events)… I am encouraging farmers to consider alternate plans… be made closer to planting." - Russ Higgins, Crops Educator, University of Illinois Extension

"My concern is more January and February, as soils warm up and as rain comes in." - Dr. Fabian Fernandez, University of Minnesota

"Above average late winter/spring temperatures and precipitation will have much more impact… than recent rains." - Dr. Joel Gruver, Western Illinois University

We should note that while warm January/February conditions could occur, history does not favor such a scenario. The likelihood of that happening is probably less severe than one might think (given past trends) as noted by Dr. Emerson Nafziger, University of Illinois:

"I would point out that soil temperatures in January and February are low enough (on average) that even if they stay a few degrees above normal in January and February there still won't be many days above 50. I went back to 2014 & 2013 and there were hardly any days with soil temperatures above 50 in either year…. as you point out, there has probably been some priming for nitrification to take place if soil temps get into the 50s in March."

Point Number 4: Our arguments hold true for fall-applied anhydrous only, and (while insignificant) we should note another minor pathway for fall N loss.

One of the biggest issues associated with recent rain has been erosion. Because fall applied anhydrous is in a state held by the soil, erosion will move very small amounts of N off of the field (Phosphorus is also lost in this manner).

Dr. Joel Gruver (WIU) noted the potential for nutrient loss, associated with erosion, in "localized" areas (specific portions of a field prone to exceptional erosion) when he responded to our comments. While a minor field-wide source of N loss, erosive loss does qualify as a pathway for N loss, and it is an exceptional method of N-loss in such localized extremely erosive areas.

The story for N loss looks positive, so far, if the nitrogen source was anhydrous. Dr. Howard Brown (GROWMARK, Inc.) noted little concern with loss (so far) if anhydrous was applied using nitrogen best management practices (BMPs). However, he also noted significant loss concerns associated with other nitrogen sources (sources in what Burrus might call the "less than BMP" category for fall applications in corn). "The exception will be with any ammonium sulfate applications (by-product) applied this fall or anything applied to frozen and/or snow-covered soil this winter," notes Dr. Brown. "There will likely be a higher risk of loss with fall/winter applications using that specific product."