Potential For N Loss With Heavy Rains On Wheat

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With the recent heavy rains wheat producers have questions about nitrogen losses. If the question is "Did I lose nitrogen?" the answer is: "Yes." However if the question is "How much nitrogen did I lose?" This answer is: "That depends." It's a very complicated question.

The short answer is that I'd worry the most about:

1. Folks who applied urea right before the rain on well-drained soils.

2. Folks who top-dressed a month ago, regardless of how they did it.

The long answer: It depends on N source & time of application, and soil type & rain fall pattern. Let's look at these factors.

Nitrogen fertilizer in the soil is found as either nitrate (NO3), ammonium (NH4), or urea. Ammonium will not move far in the soil under heavy rain conditions, but either nitrate or urea will move freely with water.

The nitrate contained in both ammonium nitrate (50 percent of N) and UAN solutions (25 percent of N) would be immediately at risk of loss due to heavy rains immediately after application and until taken up by the crop. The ammonium in ammonium nitrate (50 percent of N) and UAN solutions (25 percent of N) is not immediately at risk, but will convert to nitrate within a few weeks in the soil, and is then at risk.

Urea is at risk of loss immediately after application, but within 3 to 10 days is mostly converted to ammonium, which is safer because it is attracted to soil particles. As mentioned above, this ammonium then converts to nitrate and is subject to loss. Roughly speaking, urea is vulnerable for the first 3 days following application, and then it is safe for 10 days (ammonium form), and then after 14 days is vulnerable again (nitrate form).

Whether nitrogen was lost depends on how the water left the field. Water running off the top of the field probably did not contain much nitrogen. Water moving down through the field is where the real threat of lost N is found. Well-drained fields will have the biggest problems. If drainage was slower than rain, and water ran across the top, that's good. Every inch of water running across the top is an inch that's not flushing nitrogen out of the field.

Course textured soils will usually have little or no runoff no matter how hard it rains. Thus they are prone to leaching of nitrogen. A rule of thumb is that for every inch of water moving down through a coarse textured soil, the nitrogen will move down six inches. This may leave it still within reach of the wheat roots.

Medium and fine textured soils are more complicated. They have channels that carry most of the water. Nitrate and urea that is close to these channels will be lost, and will move farther than in coarse textured soils. But some of the N will not be near water channels, and will be fairly protected.

You may have heard about denitrification as a way that nitrogen is lost to the air when soils get wet. This process is mainly a problem when soils are warm. Losses with the big rains from March 18 to 20 should not be large.

Back to the short answers:

Fields where urea was applied urea right before the rain on well-drained soils.

Urea can move with water as it flushes down through soils. Urea applied less than three days before the rain started should be considered at risk of having been lost. This is especially true on well-drained fields.

Fields that drain slowly are at less risk. They will have more surface runoff. I wouldn't worry too much about losing N in runoff, even if there was a lot of runoff. This would be especially true in the southern Boot heel region where the rain started slowly and moved the N down into the soil well before any runoff started. Once it's down in the soil, it shouldn't end up in the water going across the top of the field.

If rain hit hard from the beginning, and runoff started soon after the rain, there is some chance that N was lost across the top if it was applied very recently. Most fields probably do not have this situation.

Fields that were top-dressed a month ago, regardless of what N source was used.

My guess is that people who top-dressed early are at high risk of running short of nitrogen and limiting yields. Even for top-dress two weeks before the rain hit, this is likely to be the case. Here I'd look at another 30-40 lbs of N. However, once we get past the first joint, I'd say it's no longer worth doing. The cool temperatures this past month probably have kept most wheat fields from developing this far, but getting more N on soon should be a priority.

Can I test my soil to see how much nitrogen is there?

The Delta Regional Soils Testing Lab can give you an answer as to how much N the soil contains. Virginia research suggests that if early spring N is around 150-160 lb N/acre, that is enough to maximize yields. My best guess is that if your wheat is before first joint, it has not begun to rapidly uptake N from the soil. The amount of N found in the top 2 feet of soil should be close to the amount applied plus 50 lbs/a for native soil N. A good strategy for producers might be to collect soil samples 2 foot deep from selected representative wheat fields. These samples would be tested for NO3 and NH4 and the results compared to lbs of N applied. If you applied 100 and didn't lose any, you should find about 150 (including the 50 lb of soil N that was probably there before top-dress). If you only find 100, another 30 to 50 will probably pay off. Δ

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