

# Nitrogen on Corn: Serious Deficiencies in 2010, plans for 2011

By Peter Scharf

2010 was another year of serious nitrogen deficiencies across the Missouri corn crop and through much of the midwest. That makes three straight years of widespread nitrogen deficiency in many parts of Missouri. The deficiencies were caused by high rainfall in spring and early summer, leading to loss of nitrogen fertilizer applied before the crop was planted.

The excessive rainfall affected the northern two-thirds of the state, with counties in the northeast corner most severely affected. Western Illinois and southeastern Iowa were also in the highest rainfall zone. Judging from aerial photographs, parts of western Illinois experienced the most widespread and severe N deficiencies.

Despite the nitrogen deficiencies, Missouri corn yields were better than average but 25 bushels below the yields realized in 2008 and 2009 when heavy rains also caused nitrogen deficiency. Similarly, Illinois corn yields were 20 bushels below the 2008-09 average. The reason for the yield drop in 2010 is not clear, but it seems likely that the string of three wet years affected the soil in a way that hurt corn production. Yield in plots receiving no N fertilizer declined from 104 bushels in 2007 to 8 bushels in 2010 in an experiment near Columbia. This suggests that the three wet years depleted soil nitrogen reserves dramatically. We expected soil nitrogen to be depleted when no N fertilizer was applied, but we didn't expect it to go this far in a few years. Some factor other than N limited corn yields in

2010, because even with high N rates applied sidedress yields were still well below 2008-09 levels. I don't know what that factor was, and like many producers, I expected higher yields than we got.

In all three years, water availability to the corn crop was excellent. Over decades, insufficient water is our most limiting factor for corn production in Missouri, so by rights we should have had top yields all three years. Yields in 2008 and 2009 WERE very good, but based on aerial photos and roadside surveys in August of both years I estimated that nitrogen deficiency reduced Missouri's corn crop by 180 million bushels over this two-year period. I did not do a careful accounting for 2010, but the weather was if anything more extreme and many aerial photos revealed N-deficient fields. I feel confident in saying that **untreated N deficiency would have caused at least 90 million bushels of yield loss again in 2010.**

The good news is that more fields with N deficiency were treated in 2010 than ever before. I have talked with people who have first-hand knowledge of rescue N application on about 40,000 acres in Missouri in 2010, and I've heard indirectly of about 15,000 more acres. MFA organized aerial N applications for their customers at the Macon, Labelle, and Memphis locations, and Ricketts Farm Services applied N with a high-clearance spinner. David Edwards, an ag pilot from Richmond, applied N on about 15,000 acres. Several producers with high-

clearance injectors or sprayers did extensive custom work as well as their own fields. I applaud all those organizations and individuals who took effective steps to deal with N deficiency in 2010. **Still, there were probably twenty times as many fields that should have been treated.**

Are rescue N applications really effective? And how late can they be effective? I worked with several producers to conduct a total of six rescue N experiments in Missouri and Illinois in 2010. **The average yield response to rescue N in these experiments was 34 bushels/acre.** In all of these fields, the N was not applied until the corn was tasseling. Earlier application would have been desirable, and may have produced a bigger response, but when N stress is

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*Nitrogen-deficient corn northeast of Monroe City in late June 2010. Streaks are due to uneven N fertilizer application. Streak width is 40 feet (16 rows) which may indicate an anhydrous ammonia toolbar or a small spinner spreader.*

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present it's clear that tasseling is not too late to apply rescue N. Limited data from Nebraska suggests that large responses can occur until two weeks after tasseling.

Multiplying an estimated 55,000 acres of rescue N applied by a measured response of 34 bushels/acre in the six tests we did gives a state total yield benefit of about 1.9 million bushels. Probably there are more acres that received rescue N than I have estimated.

Over my career I've been involved in 11 rescue N experiments, and the pattern that emerges is that the size of the response depends on the degree of N stress. In the experiments with high N stress, average yield response has been 57 bushels, in those with medium stress it has been 41 bushels, and in those with low stress it has been 14 bushels. Profit to rescue N applications at the low-stress sites has been modest, but **with medium or high stress the profit to rescue N applications is huge.**

I've heard many producers (and researchers) say that the severely N-deficient corn will never catch up and yield well, so there's no point in putting N on it. This statement is half true. In fields where we did more than one response experiment, the less stressed area usually yielded more even with generous rescue N applications to the more stressed corn. However, **the more stressed corn always gave a bigger yield response to rescue N.**

What is the take-home message as you plan for your 2011 corn crop? **Be ready to apply N in-season. And plan how you would do it NOW.** It is almost impossible to make all the logistics come together when you start working on it after you see N deficiency in June.

If you get wet weather and are wondering whether your N is in danger, I suggest that you check my Nitrogen Watch web feature. It launches in late April each year and is located on my Nitrogen Loss web page: <http://plantsci.missouri.edu/nutrientmanagement/nitrogen/loss.htm>

This site uses rainfall maps to track areas at risk for N loss and deficiency. The 'danger areas' shown are not areas that already have a problem, but are areas that are on track to have a problem.

Several producers have switched to planned in-season N applications in response to multiple years with N deficiency. Their approaches have emphasized speed, because the years that cause N loss are also the years when it's hardest



*Nitrogen deficient corn fields north of Canton, Missouri in late June 2010.*

to get sidedressing or topdressing done. High-clearance spinners can cover a lot of ground (but be careful to make sure they have good-quality material in them to avoid streaking). The number of retailers and producers with this type of machine is increasing. Pull-behind spinners offer many of the same advantages at lower price. Liquid N systems that dribble or inject N are often faster and wider than the anhydrous ammonia toolbars that come to mind when someone says 'sidedress'. Even with anhydrous, new equipment from John Deere is shallower, faster, and wider to speed up the operation. Applying in-season N is more practical now than ever before.

No one knows what the future holds for us in terms of weather. But the people who study climate and create computer models of climate suggest that wet springs and summers in the midwest are likely to become more common than they have been in the past. If they are right, we need to take action to avoid the yield losses (I estimate 500 million bushels/year across the whole midwest) that have plagued us the past three years.

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