

## SOIL FERTILITY MANAGEMENT ISSUES FOLLOWING DROUGHT DAMAGED CROPS – NITROGEN

John E. Sawyer, Professor, Department of Agronomy, Iowa State University

Antonio P. Mallarino, Professor, Department of Agronomy, Iowa State University

The dry growing season in 2012 has raised several soil fertility questions. In some cases, there has been relatively normal crop production and no need for management changes. In other situations with severely damaged crops, there is potential for adjustments for the 2013 corn crop.

### **Soybean Yield and Next Year Corn N Rate**

In Iowa we no longer use the soybean yield to adjust nitrogen (N) rate recommendations for the next-year corn crop. The reason, there is no relationship between soybean yield and the rotation effect on corn N fertilization rate for the next year. Would the same hold for drought damaged soybean in 2012? Yes, even with very low yields. What is important is that soybean was the previous crop. Soybean does not leave “extra” N behind at the end of the season. The reason for the difference in N rate requirement between corn following soybean and corn following corn is complicated, but important reasons deal with the difference in amount and quality of crop residue, and how that affects soil microbial processing, soil mineralization, and N for crop residue decomposition. Also, there would not be carryover nitrate-N following soybean. So, just use the normal rate recommendation system ([Corn N Rate Calculator](#), MRTN rate or profitable N rate range) for corn following soybean.

### **Corn Yield and Next Year Corn N Rate**

This is more complicated than the soybean crop question. In general, as long as plant vegetative growth and/or grain yield was not drastically affected by the dry weather, then use the normal rate recommendation (Corn N Rate Calculator, MRTN rate or profitable N rate range) to determine the needed fertilization rate for continuous corn in 2013. In that situation, corn production of vegetation/grain would use much of the N applied. If there is uncertainty about unused N, and if less than normal rainfall persists into next year, one could use the low end of the Corn N Rate Calculator profitable range for the 2013 rate recommendation.

### **Residual Soil Nitrate**

If the corn plant vegetation and/or grain yield was drastically affected by drought conditions, then N uptake would have been reduced and unused nitrate-N could be accounted for in determining the N fertilization rate for the 2013 corn crop. There are two methods to estimate carryover N. The direct method is to sample the soil profile (a minimum of two feet) after harvest and measure the nitrate-N concentration. Sampling would be by one-foot increments. If dry conditions persist, most applied N should remain in the top two feet. Sampling to three feet would be preferable, especially where rainfall was enough to move nitrate deeper in the profile. To add up nitrate-N in the sampled profile, multiply the concentration in each foot by four to get the nitrate-N amount per foot and then add the amounts together. One would not want to account for all of the nitrate-N as a subtraction from the next crop N recommendation as there is always some nitrate in the profile at the end of the season. A suggestion from research conducted in

Wisconsin (which should be appropriate for Iowa) is to only account for nitrate-N greater than 40 lb nitrate-N (two foot depth) or 50 lb nitrate-N/acre (three foot depth), with the remaining amount then subtracted from the normal rate recommendation. A second method to estimate carryover nitrate-N is to use the 2012 corn grain yield. Take the total N applied for the 2012 corn crop and subtract the 2012 grain yield in bu/acre. Then assume 50% of that amount will remain available to the 2013 crop if precipitation is normal or below normal for the fall/winter/early spring. The remaining nitrate-N amount will vary depending on the actual rainfall and potential losses from fall through spring. For example, if the total N application for the 2012 crop was 190 lb N/acre and the 2012 corn yield was 50 bu/acre, then the unused N would be  $190 - 50 = 140$  lb N/acre. The 140 lb N/acre times 50% leaves 70 lb N/acre to subtract from the 2013 rate recommendation.

As a conservative approach, and due to uncertainty with either estimation method, a minimum rate recommendation of 50 lb N/acre should be considered. If fall/spring precipitation is well above normal, then the carryover nitrate would not be likely, especially in soils with high leaching potential. Sandy soils are not likely to retain carryover nitrate.

Spring soil profile sampling for nitrate-N is an option, especially with concerns about residual nitrate remaining after the fall/winter. In addition, such sampling could allow for a spring preplant or sidedress N application based on spring profile nitrate-N results, and instead of a fall application. Use of the late spring soil nitrate test (LSNT) to determine carryover nitrate may miss considerable nitrate deeper than in just the top foot. Therefore, it would be better to sample the deeper profile before planting.

There could be considerable variation in nitrate levels across fields, due to yield level, banded N application, and soil/topography. Therefore, many cores (at least 12) should be collected per sample, and multiple samples per field from representative areas. Since the cores are by one-foot depths, mixing in the field will be needed to obtain a representative sample for each depth. Keep the soil from each depth as a separate sample to send to the lab.

## **Stalk Nitrate Testing**

The end-of-season lower corn stalk nitrate test can be useful for determination of excess plant available N from the soil (i.e. concentrations above 2,000 ppm nitrate-N). However, that interpretation is for normal weather and production conditions. In 2012, test results could be abnormally high due to the dry conditions and severe impact on plant growth and grain production. Therefore, it is suggested to not use the stalk nitrate test this year, or to use it as a measure of potential nitrate carryover.

## **Timing of Fall N Application**

With the potential for early fall harvest this year, carefully consider the risks of early N fertilizer or manure application. With typical warm soils in the late summer and early fall, conversion of fertilizer and manure ammonium to nitrate will be rapid. This places the applied N at risk for loss if wet conditions develop. For many years now the ag industry in Iowa has followed the “wait

until 50 °F and cooling” before fall anhydrous ammonia application. That would also be a good practice for manure with high ammonium-N content.

### **Dry Periods**

Corn yield response to N rate and needed fertilization rate decreases in years with below normal rainfall. This effect can persist across periods (years) of dry conditions, and even for year(s) after rainfall returns to normal (but not excessively wet). If below normal rainfall conditions continue, then consider using the low end of the Corn N Rate Calculator profitable range for corn N rate recommendations.