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Soil Nitrogen and N Management Following the 2016 Crop

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The 2016 growing season has been a very good one for corn in Illinois, with the November yield estimate of 202 bushels per acre, slightly higher than our previous best of 200 bushels per acre in 2014.

In sharp contrast to the wet June of 2015, most of Illinois received below-normal rainfall in June 2016, with parts of western and southwestern Illinois receiving less than an inch for the month. With May rainfall close to normal across the state in 2016, the wet soils and N loss conditions that we saw over most of Illinois in 2015 never materialized in 2016.

2016 Nitrogen Rate Studies – N Timing and Uptake

In our N-tracking project funded by the fertilizer assessment (Nutrient Research & Education Council), we apply 200 lb. of nitrogen per acre as fall-applied ammonia, early spring-applied ammonia, fall ammonia plus spring-split UAN, or spring-split UAN. We then sample during the spring to see how much N remains in the top 2 feet of soil.

Averaged over three locations, we recovered about 70 and 42 percent of the amount of N applied as fertilizer in mid-June and at tasseling, respectively, in 2015. In 2016, we found a little more N than this – about 76 percent in mid-June and 47 percent at tasseling. Grain yield levels didn't differ greatly between the two years, but more of the N needed by the crop was taken up by tasseling in 2016 compared to 2015. Yields were similar in both years, though, so having more N taken up by tasseling did not mean higher yields.

Warm soils and wet weather in December 2015 caused a lot of concern about loss of fall-applied N in 2016. But we did not find lower amounts of soil N following fall N applications than following spring applications in 2016. There were, however, some differences between the two years in how much of the N recovered was in the ammonium form (coming directly from ammonia application) and how much was nitrate. Nitrate can move in the soil and be lost.

In both 2015 and 2016, about 80 percent of the N recovered in early May following fall ammonia application was nitrate. Following spring ammonia application, 59 percent of the nitrogen was nitrate in 2015 and 39 percent in 2016. By early June, when N uptake by plants began, 80 to 90 percent of the recovered N was nitrate regardless of timing of application.

It's clear from these numbers that applying ammonia in the fall versus spring might not have much effect on how well the nitrogen is protected by remaining in the ammonium form, at least by the time N uptake begins. That means that N loss is tied more closely to conditions during uptake (June) than to N timing, although sidedressing ammonia, which we did not do in this study, should increase the amount present as ammonium.

Most N rate trials in 2016 are showing yields leveling off at considerably lower N rates than we saw in 2015. It was common in 2016 to see yields leveling off at N rates of only 140 to 160 lb. N per acre, at yield levels of 230 to 250 bushels per acre. We think that this speaks both to a large supply of N from mineralization of soil organic matter under the favorable conditions of May and June, and to the absence of large amounts of rainfall that can lead to N loss. Another sign of a good supply of N from the soil was the delay in development of N deficiency symptoms in corn grown without fertilizer N. It was common in 2016 to see unfertilized corn as dark green as fertilized corn in mid-June, when the crop was 3 feet tall or taller.

Nitrogen in the Soil

One might expect that less N loss might lead to higher amounts of N left over at the end of the season. We aren't seeing this in most cases. Dan Schaefer of IFCA took soil samples at the time of crop maturity at a number of on-farm sites, nearly all of these showed soil N levels of less than 6 or 7 ppm, which we consider to be baseline levels. We're also finding low soil N levels in samples taken following harvest in our N-tracking trials. The only place we're seeing elevated levels is at N rates considerably higher than those needed to maximize yield.

Those who added N late this year in addition to normal rates applied earlier might well have ended up with more soil N than usual after harvest. A vigorous cover crop like cereal rye will take some of this up, while the low levels of soil N in fields where lower rates of fertilizer N were used may not have enough N to produce vigorous cover crop growth. Trying to "prime" cover crop growth by applying fertilizer N this fall will increase N uptake, but may not necessarily increase net uptake after subtracting the amount applied.

Despite slow cooling at the start of November this year, soil temperatures are now below 50 degrees over most of northern and central Illinois, and ammonia application has gotten underway. Soils are mostly in good shape for this, but some delay is helpful in fields with wet surface soils.

Nitrogen Management Considerations for 2017 Crop

We can think of no good reason to adjust nitrogen rates, unless planned rates are substantially higher than the 175 (155 in northern Illinois) and 210 lb. N per acre or so calculated by the N rate calculator for corn following soybeans and corn following corn, respectively, in the region of Illinois where fall N is used. If planned rates are higher than this, a downward adjustment is in order.

If the plan is to apply some N in the spring after fall application, consider subtracting that amount from the fall application rate in order not to exceed the suggested rate. If 2017 is like 2016 with regard to N nutrition, using more than suggested rates will do nothing to increase yields, but will increase both economic and environmental costs.

-Emerson Nafziger