

First Results From The Illinois Soil Nitrogen Monitoring Project

URBANA, ILL.

The first results from a project to sample soil this fall to see how the dry growing season and low corn yields affected nitrogen levels are now available, said University of Illinois crop sciences professor Emerson Nafziger.

One of the reasons for conducting the study was to see how much nitrogen is in the soil now to estimate the likely nitrogen loss over the winter and early spring.

“November was relatively dry in Illinois, and there have been few reports of tile lines running,” he said. “Now that soils have cooled down, the nitrogen, mostly in the form of nitrate, that is in fields most likely will stay in the soil until and unless tile lines run, when we can expect some of it to exit in tile drainage water.”

The second reason was to estimate how much nitrogen is available to next year’s crop, especially if corn is planted in the same fields.

“It’s typical for some loss to take place if we have normal precipitation from fall to early spring, but if this winter is dry, some of the nitrogen there now should be available for next year’s crop,” Nafziger explained. “We can’t know how much will be there in the spring without taking soil samples at that time, preferably close to planting.”

Many people volunteered to take samples. Participants were asked to take 0- to 1-foot and 1- to 2-foot samples at a single site. Site information, including how much nitrogen had been applied in 2012 and what the yield was, was sent with the samples, which were tested for both nitrate and ammonium. About 130 sites have been sampled to date in the U of I part of this project.

Nearly all of the samples were taken following corn in 2012, many from fields where 2012 yields were low due to dry weather. Previous sampling work, while not as comprehensive as this study, has typically shown nitrate-N levels of less than 10 ppm.

Although a large number of samples came from central Illinois, there was a good distribution from east to west. Average nitrate-N levels in the top foot of soil were 26, 16, and 18 ppm in northern, central, and southern Illinois, respectively, and ranged from near zero to 89 ppm. The 89 ppm sample, from a field in the northern part of the state with a reported yield of 175 bushels per acre, was the only one with a value above 50 ppm and is probably an outlier.

The data from the sampled fields reflect the dry growing conditions over much of the state in 2012. Some of the fields in southern Illinois

yielded little or nothing, while several fields in central and northern Illinois yielded from 180 to 200 bushels per acre.

Average nitrate-N levels in the 12- to 24-inch samples were 16, 12, and 18 ppm in northern, central, and southern Illinois, respectively. These values are as high as those in the top foot of soil in southern Illinois and not much less than in the top foot in central Illinois.

The weighted average of nitrate-N in the top 2 feet of all fields sampled was 136 pounds of nitrogen per acre. Nafziger said that, while the sampled fields probably do not accurately represent all fields in Illinois, 12 million acres of corn with 136 pounds of nitrogen in the top 2 feet indicates that some 800,000 tons of “labile” (able to move and be taken up by plants) nitrogen are in Illinois fields now.

As expected when water limits yields, the amount of nitrogen used in a field did not seem to affect its corn yield. A few fields with very high nitrogen rates had low yields. The association between the amount of nitrogen applied and the amount present in the fall was, however, not strong. Low yields were not associated with high amounts of leftover nitrogen.

Finally, nitrogen removal in the grain was estimated by subtracting 0.75 pounds of nitrogen per bushel from the amount of nitrogen applied as fertilizer. The results were not helpful for predicting the amount of remaining nitrogen.

How can it be that the combination of low yields due to dry conditions and high application rates of nitrogen fertilizer seem unrelated to the amount of soil nitrogen found after the season?

“This shows how complex the nitrogen interactions are in the soil,” Nafziger said. “In a year such as 2012, there is little nitrogen loss, uptake ends early as the crop stops taking up water, and fall rainfall can produce new flushes of mineralized nitrogen long after crop uptake stops. We think that soil moisture was the main factor determining both yield and the amount of nitrogen in the soil and that these two factors had independent effects in the tough year that was 2012.”

Nafziger hopes that fields sampled this fall can be sampled in the spring of 2013 to see how much nitrogen remains. Where corn in 2013 will follow corn in 2012, nitrate-N present at planting should be available to the 2013 crop unless high loss conditions prevail after planting.

The Council for Best Management Practices provided funding for this project. Δ