Nitrogen Management in Illinois Intensifies as State Implements Nutrient Loss Reduction Strategy

By Jean Payne and Emerson Nafziger

A N management program named N-WATCH™ is helping farmers and regulators track changes in soil N concentrations during the year. This on-farm research is leading to better management decisions and improved engagement with policy makers.

Illinois is an intensively tile-drained state with an estimated 11 million sub-surface drained acres that produce high-yielding corn. As farmers invested in additional tile drainage in recent years when commodity prices were high, they improved production on Illinois soils but also created a new challenge in terms of managing N loss to water.

Illinois' newly implemented Nutrient Loss Reduction Strategy estimates that Illinois contributes 7% of the water flow to the Gulf of Mexico, but 20% of the N load to the Gulf—approximately 410 million pounds of N (IL EPA, 2014). The nutrient strategy estimates that tile drainage, which exists mainly in the upper two-thirds of the state's geography, is the largest contributor to N loss, and that agriculture is responsible for 80% of the state's overall N load to rivers, streams and lakes. This is a serious challenge for Illinois agriculture, but one that has been met with a new investment in research that focuses on N management in intensively tile-drained systems.

The Illinois Nutrient Research & Education Council (NREC) collects 75 cents per ton on nearly 4.5 million tons of plant nutrients sold annually in Illinois. A significant portion of these funds is directed at determining how agricultural retailers and farmers can use voluntary approaches to better manage N to reduce losses and enhance crop yields. If this voluntary system fails to make progress in reducing losses, nutrient regulation in Illinois becomes a real probability.

One of the NREC-funded programs directed at N management is N-WATCH™; a management tool that involves sampling soils to depths of 0 to 1 ft. and 1 to 2 ft. at a minimum of four times: 1) at application (fall or spring), 2) in the spring, 3) during the summer, and 4) after crop harvest. Samples are analyzed for ammonium and nitrate, which can be tracked over time, under various environmental conditions. While soil N measured as nitrate or ammonium reflects N from applied fertilizer, it also reflects contributions from N in manure (current or recent) and also N mineralized from soil organic matter. These non-fertilizer sources of available N can be substantial—and difficult to predict—in manured soils and in soils with more than 3 or 4 % organic matter.

N-WATCH™ is not a N recommendation system, but rather a soil N data collection and outreach tool that provides a new level of information for farmers to consider when determining or modifying their N application programs. The idea of tracking N movement in the soil originated during the drought of 2012, and was put into place to determine how much N remained in the soil following low yields or crop failure that year. We were particularly interested in assessing the environmental risk posed by leftover soil inorganic N and how agriculture might be ready to respond if NO_3^--N losses were significant in the spring of 2013.

Abbreviations and notes: N = nitrogen; NO_3^--N = nitrate nitrogen.

N-Watch™ on-farm field research site.

N-WATCH™ assists the industry and producers in making N management decisions, but equally important is the opportunity it creates for agriculture to provide leadership on N issues and to develop practical nutrient policy. As an example, sampling over 150 N-WATCH™ sites in the fall of 2012 showed that on average, 140 lbs of NO_3^--N per acre was present in the top 2 ft. of soil. These data made it clear that NO_3^--N was left over from the 2012 cropping season; fall-applied N was nearly all in the ammonium form when fields were sampled. This also meant that any potential NO_3^--N losses from tile lines in the early spring would likely be coming from leftover N, not from fall-applied N.

The agricultural industry shared their analysis with the University of Illinois, Illinois Environmental Protection Agency, and water supply officials to prepare them for the possibility of high NO_3^--N levels in surface water supplies in 2013. This revelation was met at first with trepidation, but then with appreciation as it helped officials prepare for the possibility of elevated NO_3^--N (i.e., above 10 mg/L NO_3^--N) in their water supplies. This turned into reality, when under high precipitation and tile line flows in late winter and early spring of 2013, surface water NO_3^--N concentrations rose to some of the highest levels of recent years. This transparency by agricultural leaders, combined with credible information

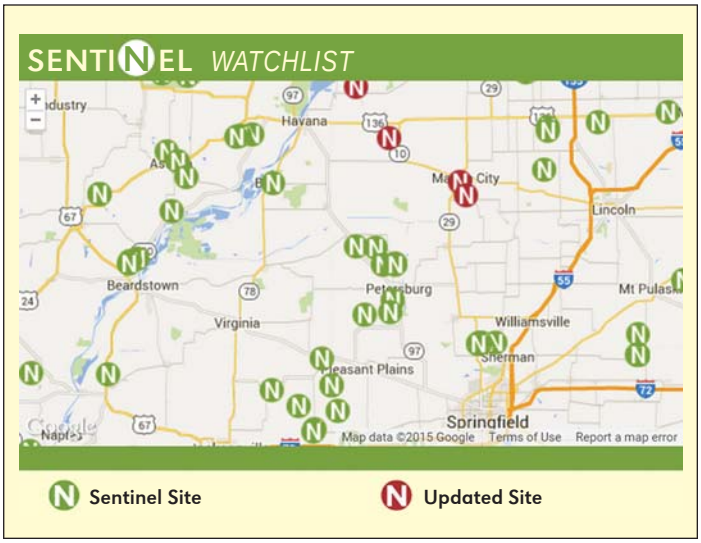

Figure 1. View of N-Watch™ website designed to allow public monitoring of soil ammonium- and nitrate-N levels. http://www.illinoiscbmp.org/Nitrogen-Management/N-Watch/

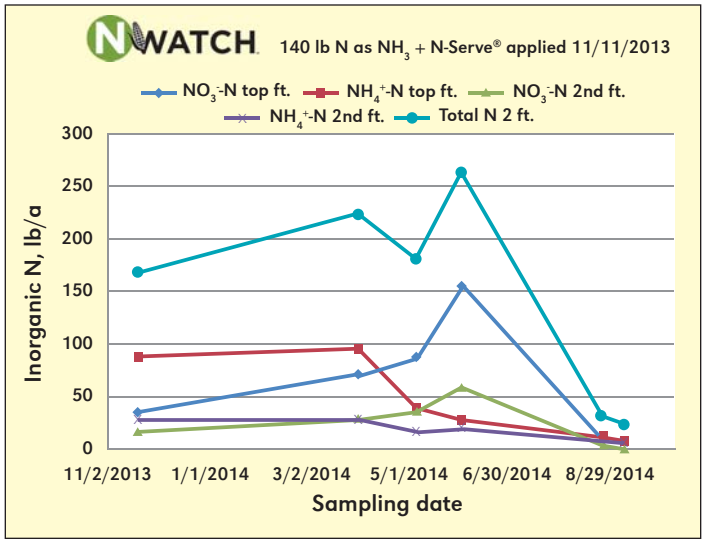

Figure 2. Soil profile nitrate (NO_3^-) and ammonium (NH_4^+) trends during the 2014 growing season (November to August). N-Serve® is the trade name for Nitrapyrin - a nitrification inhibitor.

provided by N-WATCH™ fostered a productive working relationship between agriculture leaders, water providers and policy makers that has continued through the development of the state's nutrient loss reduction strategy.

Two years later, N-WATCH™ continues to provide valuable information on soil ammonium and nitrate concentrations through the season across several hundred sites. In 2015, the Illinois Council on Best Management Practices (a consortium of Illinois agricultural organizations) hosted an N-WATCH™ "sentinel" website as an educational tool, to allow anyone interested, a glimpse into soil N levels at anonymous sites (**Figure 1**). Additionally, the industry shares analysis of N-WATCH™ findings at conferences with retailers and farmers to educate on N management and pique interest in the program (**Figure 2** is an example). A new database management system called N-WATCH™ Online allows for participants to review results in a timely manner and share findings with the participating farmers. Output from a current 2015 N-WATCH™ site in central Illinois illustrates the impact of record rainfall in June 2015 (**Figure 3**).

The N-WATCH™ program has also provided impetus for new research initiatives in Illinois on soil N and corn yield responses, designed to show how various 4R application practices (source, rate, time, place) influence plant-available N under varying soil, crop, and weather conditions. Dr. Emerson Nafziger and colleagues at the University of Illinois initiated a project in 2015 entitled "Tracking Soil Nitrogen Loss and Availability." This work is designed to combine some of the data collected under the N-WATCH™ project with more frequent sampling data from trials comparing different N forms

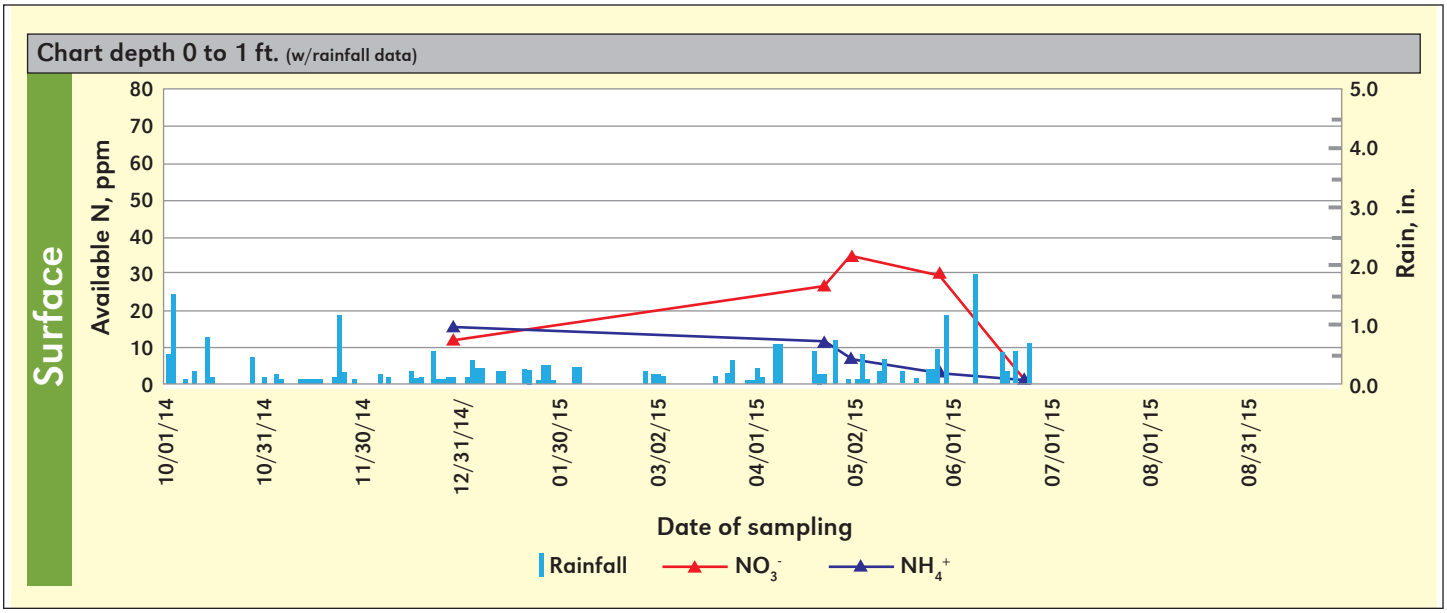

Figure 3. Field site data display from an N-WATCH™ site in central Illinois illustrating the impact of record rainfall, during June 2015, on available soil N (ammonium-N and nitrate-N) concentrations within the 0 to 1 ft. depth.

and timings of application. Results will be used both to report current soil ammonium and nitrate concentrations throughout the spring in order to advise on the need to apply supplemental N; and also to develop a model, to predict current available soil N, based on weather following applications of different times and forms of fertilizer N.

Summary

Improving N management while reducing N loss in Illinois will be neither quick nor easy. Getting enough N to the crop under a wide range of weather conditions will always be a challenge, and new technologies that might help do this bring added costs, the need for additional learning, along with difficult-to-assess capabilities of decreasing uncertainty related to crop response and N loss. However, we strongly believe that everyone—producers, officials, agricultural input suppliers, environmental groups, and the general public—are best served by programs that integrate findings and practices in a transparent fashion in order to bring everyone along on the ride. BC

Ms. Payne is President, Illinois Fertilizer and Chemical Association; e-mail: jeanp@ifca.com. Dr. Nafziger is Professor and Extension Specialist, Department of Crop Sciences, University of Illinois; e-mail: ednaf@illinois.edu.

The mention of any trade name does not necessarily imply any endorsement.

References

Illinois Environmental Protection Agency (IL EPA) and Illinois Department of Agriculture (IDOA). 2014. Available at http://www.epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/index (verified 30 Jun. 2015).

IPNI ANNOUNCEMENTS

IPNI Board of Directors Elects New Officers

Two new officers of the Board of Directors of the International Plant Nutrition Institute (IPNI) were elected in May 2015. The election took place at the IPNI Board meeting held in Istanbul, Turkey, in conjunction with the Annual Conference of the International Fertilizer Industry Association (IFA).

Mr. Oleg Petrov, Director of Sales and Marketing Uralkali, Moscow, Russia, was elected Vice Chairman. Mr. Petrov replaces Mr. Jim Prokopanko, CEO of Mosaic, Plymouth, Minneapolis, USA, who is retiring later this year, and who was recognized for outstanding leadership and service in his role.

Mr. Tony Will, CEO of CF Industries Holdings, Inc., Deerfield, Illinois, USA, was elected Chair of the Finance Committee. Dr. Mostafa Terrab, Chairman and CEO, OCP Group, Morocco, continues as Chairman of the IPNI Board.

"We look forward to continued great leadership on our Board and working committees," said Dr. Terry Roberts, President IPNI. "We will miss Jim and the many contributions he has made to our Institute, but are confident in the new leaders and the direction they will provide to IPNI going forward." BC

Dr. Mostafa Terrab
Chairman
of the IPNI Board

Mr. Oleg Petrov
Vice Chair
of the IPNI Board

Mr. Tony Will
Chair of the
Finance Committee

IPNI Appoints Phosphorus Program Director

The International Plant Nutrition Institute (IPNI) has appointed Dr. Tom Bruulsema as its Phosphorus Program Director.

"This change in focus reflects a need to devote greater attention to phosphorus, its role in global food security, and its potential for unintended environmental impacts," explained IPNI President Dr. Terry Roberts. "Tom has been directing IPNI programs in the Northeast for 21 years and will continue his involvement and leadership on 4R nutrient stewardship and sustainability issues."

All IPNI scientists' activities include agronomic programs that address phosphorus, nitrogen, potassium and other plant nutrients, and 4R Nutrient Stewardship is a strategic component of the Institute's regional and global tactical plans. Having a Phosphorus Program Director will provide a point person to lead the Institute's ongoing efforts in ensuring phosphorus is used effectively and efficiently.

Dr. Bruulsema has been recognized as a Fellow of the American Society of Agronomy, the Soil Science Society of America, and the Canadian Society of Agronomy. He will continue to be based in Guelph, Ontario, Canada. BC

©FAO/Annibale Greco

Dr. Tom Bruulsema
Phosphorus Program Director