

Efficient Nitrogen Use

Trial Reveals Best Practices To Prevent Nitrogen Volatilization

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Research on preventing nitrogen losses and using nitrogen fertilizers more efficiently was presented to a group of farmers recently by Dr. Steve Ebelhar, University of Illinois Crop Sciences Department, Dixon Springs Ag Center.

He addressed the issue of all the soil N loss mechanisms that are important. "Primarily we need to be concerned about volatilization losses of ammonia and gas at or near the soil surface when we apply compounds such as urea, UAN which contains urea and then anhydrous ammonia. All of these can lose nitrogen if they're applied when the soil is either too dry or too wet, and the fertilizer is not adequately placed or incorporated into the soil."

Because most of the fertilizer or soil mineralized N is eventually converted to nitrate, other loss mechanisms to be concerned about include leaching where nitrate leaches out of the soil profile or goes through tile drains; and denitrification occurs when water logged soils convert the nitrate back into a gaseous form of nitrogen which can leak into the atmosphere. Those three nitrogen loss mechanisms account for as much as 25 percent of the nitrogen loss in any given year, especially in southern Illinois.

"We want to try to reduce those losses and by using some of the additives on the market and some of the technology that exists today I think we can do a better job of handling these nitrogen losses," Ebelhar added.

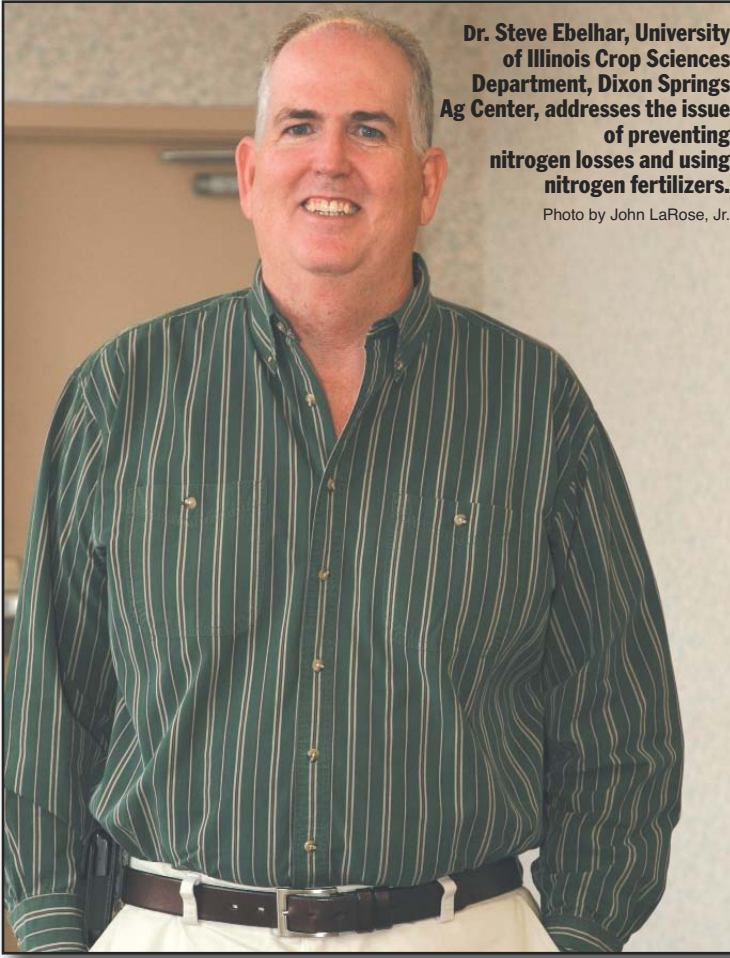
The latest technology is applying a polymer coating on the outside of urea. That coating prevents water from dissolving it and allowing it to break down into gases, so basically we're putting a physical barrier around it, a polyurethane that very slowly allows water to penetrate and dissolve the urea. Then that urea is released into the soil slowly, preventing volatilization loss.

"The product we've been working with is ESN, from Agrium. It's also a very slow process, so it's like a slow release nitrogen fertilizer; it's timing it closer to when the corn needs to take it up and that's usually at about the fifth or sixth week after emergence," he said. "That's when corn starts rapidly growing and taking up nitrogen. So if we can time our release of nitrogen to that point then we get a very efficient use of that nitrogen."

"Another technology out there is an urease inhibitor (predominately the active ingredient in Agrotain {produced by Agrotain International}) which blocks the urease enzyme from breaking urea down into gases, including ammonia. Agrotain allows you to put urea on the surface and it keeps it in the urea form until we can get rainfall or we can do tillage to move it into the soil. Because, once urea is in the soil and it releases ammonia, it is quickly converted to ammonium, NH_4^+ , which is a stable nitrogen source that's held by the negative charge in the soil. But over time the ammonium will convert to nitrate in the soil and so our next class of inhibitors is to prevent that process, the nitrification process, from occurring. And so we're blocking the conversion of ammonium to nitrate and, by doing that, we can prevent leaching losses and denitrification losses because they only occur with nitrate forms of nitrogen. These inhibitors have been effective for us. Keeping N in the ammonium form, which is more stable

and will stay in the soil and not leach or denitrify. Products such as N-serve and DCD that prevent nitrification and stabilize the nitrogen in ammonium form, will keep it around until the corn plants can take it up.

"All of these products are made to enhance the uptake of nitrogen by corn and ultimately, if we can do that, we're going to have less of an im-



Dr. Steve Ebelhar, University of Illinois Crop Sciences Department, Dixon Springs Ag Center, addresses the issue of preventing nitrogen losses and using nitrogen fertilizers.

Photo by John LaRose, Jr.

pact on the environment, because we'll have less N leaking into the environment but also more efficient nitrogen uptake so that we can probably get by with less nitrogen," he said.

Most of these products cost about 8 to 15 cents premium above the cost of nitrogen itself and that equates to about three to four bushels of yield, depending on the price of the grain.

"With corn prices high right now, it only takes about three bushels of yield response to be economical, so these products are economical, especially for no-till farmers," he said. "We found anywhere from an 8 to 20 bushel increase in yield with these products under the right environmental conditions. Now in some environments we don't see any response but over some 50 site-years of research with these products we found on average about a 6 to 7 bushel increase in yield. That's taking in the good years and the bad years. The only drawback that I've seen with one product, the ESN, is that if we have really dry conditions it does not release as well. So in a dry or a drought year the yield response is not as good with ESN as it normally would be. However, when you average all the years together it's still about a six bushel increase in yield when using the ESN so it is an economical addition, especially under no till."

Ebelhar said that as there's more and more push from regulatory agencies to manage nitrogen effectively, and this trial can help farmers select the process best suited for their own environment to manage nitrogen loss.

"Let's look at all the processes out there, and try to find ones that fit your situation and manage your nitrogen to prevent as much loss as possible," he said. "If we use it as efficiently as possible, ultimately that allows us to police ourselves and keep the regulators away from us." Δ

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