

Should you use an N stabilizer?

By MICK LANE

NITROGEN management continues to be an important issue for Iowa growers. "As if economics weren't enough of a reason to improve nitrogen management, factors like the hypoxic zone in the Gulf of Mexico, greenhouse gases and cap-and-trade legislation have only elevated the importance," says Tracy Blackmer, director of research at the Iowa Soybean Association.

One reason growers are questioning their nitrogen management is because wetter weather across most of Iowa in recent years has resulted in more yellow, or nitrogen-deficient, corn than in the past. Also, there's been a huge increase in the availability and marketing of N stabilizing products. Several of these products have some potential to conserve N. But while they have gained attention, they have also added to the confusion. Blackmer says products that affect N loss fall into three main categories:

■ **Process inhibitors** are products that slow the transformations of N into forms that are likely to be lost.

■ **Controlled-release products** affect when the fertilizer will be released to the soil and environment, which delays the other processes that can lead to N loss.

■ **Binding agents** is a broad category usually used in the context of a microbial product that "ties up" N so it won't be "available" for loss.

The one common reason to use any of these products is to reduce the presence of N in the forms that are more easily lost. "All of this sounds great in theory. But like most things in farming, a great theory is often trumped by the realities of weather, insects, equipment imperfections, human frailties, etc. The reality is that some pieces of this puzzle make sense and some don't," adds Blackmer. "The challenge growers face is sorting out which is which."

The table below shows specific products intended to help retain nitrogen in the soil, how they work and which nitrogen forms they can be used with. It's important to note that the information in this table was provided by the manufacturers. Not all of this is backed by research, and even less by Iowa research.

"While there is scientific theory behind all these products, there are some other theories that need to be dis-

Key Points

- Farmers want to improve their nitrogen management for a number of reasons.
- The availability and marketing of nitrogen stabilizer products has increased.
- Understand what these products can and can't do, and how to use them.

cussed as well. For this discussion, let's focus on the process inhibitors [the top five in the table] and make some broad generalizations that are not always realized in every situation," says Blackmer.

While many of these nitrogen loss prevention products can show a difference in the laboratory, there can be big differences under field conditions where they're expected to perform throughout the whole season. "There's a difference between the rate at which ammonia is converted to nitrate in the soil over three to five weeks when temperatures are cooling in the fall and over the same length of time when they're warming in spring. Leaching rains during May-June changes the picture," Blackmer says.

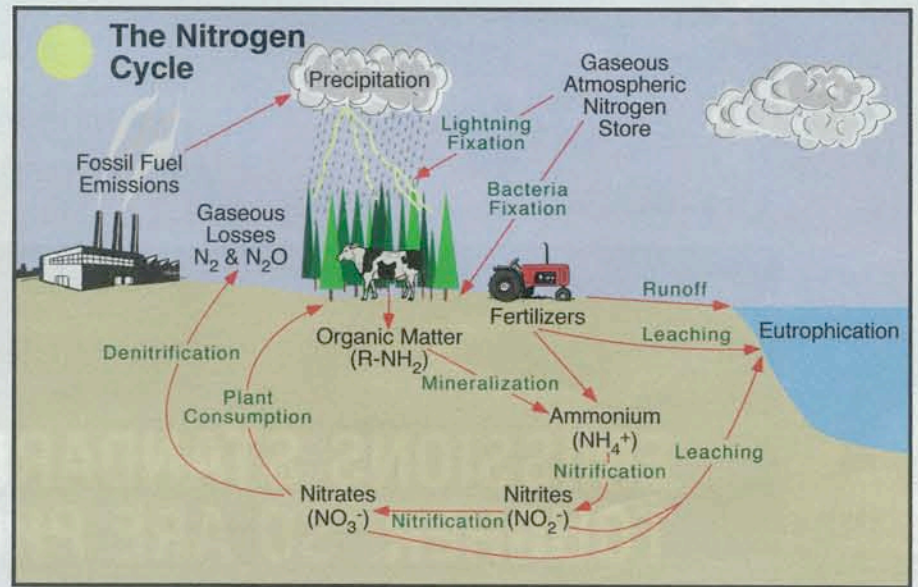
"If we don't know the correct N rate to apply, protecting the portion of N that is overapplied from loss for a few weeks longer will not only be unprofitable, but will likely end up as an environmental detriment. We know the risk of loss is greater with some forms of fertilizer and application methods or timings. So assuming that a nitrogen stabilizer will protect all the N applied from loss when we're using these more risky practices could lead to a worse situation," he adds.

Use with anhydrous ammonia

Anhydrous ammonia isn't as easily lost as other common N sources because it contains no nitrate, the form of N most easily lost; also, a high pH zone develops around the area in the soil where anhydrous is applied, temporarily preventing soil bacteria from rapidly converting ammonia into more easily lost forms of N.

The net effect is a longer period with the N in a form less likely to be lost than other common N sources.

The most common use of a nitrification inhibitor in Iowa is fall application of anhydrous ammonia with N-Serve. Blackmer says data to document the value of this has not been consistently positive. Based on Iowa replicated trials, mostly done through ISA's On-Farm



Network, here are some generalizations about use of N-Serve with fall anhydrous.

No yield response expected

Conditions in which you would not expect an economic yield response:

■ **Overapplication of N.** When much more N is applied than the crop will need, N losses might be quite high and there could still be more than enough N for the crop. In this case, even though the nitrification inhibitor works, it's unlikely it would make a difference in yield.

■ **Lack of leaching rain or denitrification conditions.** If environmental conditions do not cause a loss of nitrate from the system, delaying the transformation will have no benefit.

■ **Use of inhibitor too early, so its activity doesn't last long enough.** When warm winters combine with warm springs, the N-Serve in an early-fall anhydrous application may not last long enough to prevent nitrification until plant uptake in late spring or early summer.

Conditions for a yield response

Conditions in which you might expect an economic yield response:

■ **N fertilizer is applied at rates close to or below optimal.** When the applied N rate is not excessive, the action of a nitrification inhibitor will be more noticeable in the final yield.

■ **Conditions that create a high risk for leaching/denitrification loss.** The more loss of N from a soil (both fertilizer- and soil-based), the greater the likelihood of an economic response.

■ **Conditions with rapid nitrification and N loss potentials.** Warm soils, high soil pH, light-textured soils and adequate moisture can combine to increase the rate of nitrification and the likelihood of seeing a response from N-Serve. UAN, or urea ammonium nitrate,

(liquid, or 28%-32%) is a nitrogen fertilizer that contains three forms of N and has several issues, depending on application.

The first issue is 25% of the N in UAN is nitrate, which is easily lost from the soil. None of these stabilizers can do anything to protect this.

The second issue is 25% of N in UAN is in the ammonium form. In addition, urea (remember, half of the N in UAN starts out as urea) will eventually convert to the ammonium form (if not lost to volatilization). This means that 75% of the N from UAN can end up as ammonium in a matter of days or weeks. Ammonium, through the process of nitrification, is converted into nitrate. Nitrification inhibitors can slow down this process.

Most growers know about N-Serve, containing nitrapyrin, for use with anhydrous ammonia. Dow AgroSciences recently formulated nitrapyrin into a water-soluble product called Instinct to use with UAN and liquid manure.

DCD is another nitrification inhibitor that has been well-documented in laboratory studies. It is the "plus" in the product Agrotain Plus. There are disagreements about whether DCD is as effective as nitrapyrin, but there is no Iowa data available to weigh in on that.

Nutrisphere is sold as a product to inhibit nitrification. It's a newer product on the market, and Blackmer hasn't found any lab studies to confirm this mode of action and hasn't been able to document the effects in Iowa field trials in the first year of testing.

The third issue is that 50% of the N is in the form of urea. Urea is highly prone to volatilization if left on the soil surface. If the soils are wet and the temperature is warm, volatilization losses can be quite high. This is frequently an issue when UAN is applied on no-till fields.

Using Agrotain can help protect against volatilization losses for a period of weeks until rain can move urea into the soil profile. The effectiveness of the mode of action is well-documented by university lab studies. It's important to note that incorporation of urea by either injection or tillage eliminates the risk of volatilization. If UAN is incorporated, Agrotain isn't needed to protect it.

Keep in mind Instinct will not protect against volatilization losses from UAN.

Lane is research communications manager for the On-Farm Network.

■ For more on these products, go online to www.isafarmnet.com.

Nitrogen stabilizer products and how they work

Product	Category	Specific	Fertilizer applied
Nutrisphere	Conversion process	Nitrification/urease	UAN/urea/manure
Agrotain	Conversion process	Urease	Urea/manure (not incorporated)
Agrotain Plus	Conversion process	Urease/nitrification	UAN/urea
N-Serve (nitrapyrin)	Conversion process	Nitrification	NH ₃
Instinct (encapsulated nitrapyrin)	Conversion process	Nitrification	UAN/manure
Accomplish	Binding agent	Not specified	All sources?
Poly-coated	Urea controlled release	Delayed availability	Urea