

# IN TOUCH & IN TUNE by Truterra

## Understanding and Preventing Nitrogen Loss

**Brought to you by Jennifer Wells, Ph.D.**  
**Senior Agronomist for Truterra**

Nitrogen is an essential nutrient in plant growth and development. Nitrogen loss can be one of the most yield limiting factors a grower can face in the field, not to mention the detrimental effects this loss has on water and air quality. The extent to which nitrogen is lost is generally based on fertilizer management practices, such as timing, source, placement and rate, and environmental conditions, such as soil type, moisture and weather patterns. A nitrogen stabilizer can help prevent nitrogen loss from fertilizers through the processes of urease production, nitrification, denitrification, or ammonia volatilization. Understanding how these products work, and the scenarios where they will provide the greatest benefit, will help growers maximize profits, reduce nitrogen loss and improve nitrogen use efficiency.



### **Types of Nitrogen Stabilizers**

Nitrogen stabilizers can be classified into three major types: *nitrification inhibitors*, *urease inhibitors* and *slow-release coated fertilizers*, which are also called polymers.

Nitrification is a two-step process in the nitrogen cycle that converts ammonia or ammonium into nitrite and then to nitrate. Denitrification is the process that converts nitrate to nitrogen gas, removing available nitrogen from the soil and returning it to the atmosphere. *Nitrification inhibitors are compounds mixed with ammonium-containing nitrogen fertilizers to decrease the rate of transformation of ammonia or ammonium to nitrate.* Both nitrogen forms are plant-available, but nitrate is more soluble and mobile, which leads to leaching and denitrification. Nitrification inhibitors are most useful when the soil is moderate to well-drained and is in an area of heavy rainfall or frequent flooding. They should be used when nitrogen is applied in the fall or early spring when ammonium forms of nitrogen have more time to convert to nitrate forms.

Urea is the most widely used form of nitrogen fertilizer, and can be formulated as dry granules, prills, or as a fluid alone or mixed with ammonium nitrate (UAN). All forms of urea have the disadvantage of significant nitrogen loss as ammonia gas if not incorporated into soil soon after application. *Urease inhibitors are compounds mixed with urea-based fertilizers to decrease the rate of urea hydrolysis by temporarily blocking the active site of urease enzyme.* They can reduce urea hydrolysis for up to 7 to 14 days. Urease inhibitors can be especially important when urea-based fertilizers are surface-applied on high-pH soil and in high-residue conditions like no-till as crop residue contains high concentrations of urease.

*Slow-release coated fertilizers are conventional fertilizers such as urea coated with sulfur, polymers, or both.* This coating protects the nitrogen loss and releases nitrogen in response to soil temperature and moisture. Once urea is released through the coating, it is exposed to the same transformations in the soil as non-coated fertilizer. The coating technology can provide a gradual supply of N for the developing crop. Slow-release coated fertilizers have the advantage of protecting against nitrogen loss for a longer time than nitrification or urease inhibitors.

## Recommendations

As with any tool, the biggest benefits and greatest efficacy are generated by using the right tool, in the right place, and at the right time. Below are some recommendations for helping you decide which (if any) is the right stabilizer for your situation:

- Nitrogen stabilizers will only have a positive impact on yield if weather conditions are conducive to nitrogen loss, to the point of it becoming limiting in relation to crop demand.
- Nitrification inhibitors work best when applied to ammonium-forming fertilizer on irrigated fields. The timing of the nitrification inhibitor used should plan for high effectiveness in May and June when greatest nitrate leaching commonly occurs.
- Urease inhibitors are more likely to have a positive impact when urea-based fertilizer is surface-applied where no incorporation (mechanical or rainfall) occurs in the first five days after application on a drying soil.
- Slow-release coated fertilizers are more likely to have a positive impact when field and weather conditions are highly prone to risk of nitrogen loss to leaching, volatilization or denitrification.

<https://cropwatch.unl.edu/2018/nitrogen-fertilizer-stabilizers-corn>

<https://www.nature.com/scitable/knowledge/library/the-nitrogen-cycle-processes-players-and-human-15644632/>

<https://cropwatch.unl.edu/2019/nitrogen-inhibitors-improved-fertilizer-use-efficiency>

[http://www.thisland.illinois.edu/50ways/50ways\\_5.html](http://www.thisland.illinois.edu/50ways/50ways_5.html)

[http://www.ipni.net/publication/nss.nsf/0/EA265C5FE184D4F285257C8300753585/\\$FILE/NSS-25%20Urease%20inhibitors.pdf#:~:text=Urease%20inhibitors%20are%20potentially%20useful,to%20further%20restrict%20ammonia%20losses.](http://www.ipni.net/publication/nss.nsf/0/EA265C5FE184D4F285257C8300753585/$FILE/NSS-25%20Urease%20inhibitors.pdf#:~:text=Urease%20inhibitors%20are%20potentially%20useful,to%20further%20restrict%20ammonia%20losses.)

