Stabilized Nitrogen

The right form of nitrogen, producing healthy growth when your crops need it most.

TerraLink Stabilized Nitrogen (SN) is the flexible approach to feeding crops

By holding plant available nitrogen in the ammonium form plants take up only what they need when they need it to produce more healthy growth. This prevents luxury uptake of nitrate nitrogen which results in growth that is too lush and may cause disease and stress pressures on plants.

Stabilized N has two inhibitors for Dual Action

1. **Urease Inhibitor** which reduces ammonia N loss due to evaporation.
2. **Nitrification Inhibitor** which holds the N in the ammonium form, slowing the conversion to nitrate.

Stabilized N performs better compared to coated nitrogen products

While Stabilized N uses inhibitors to hold nitrogen in the desired form for longer periods of time, Polymer Coated Urea (PCU) relies on the right temperature to open the polymer to allow moisture into the coated granule, dissolve the nitrogen and let it diffuse out into the area surrounding the granule. Difficulties with this approach are:

- Should temperatures not be in the right zone the polymer may not open causing a lack of available N or it may open too much causing excessive available N.
- Once the urea is released from the PCU granule it quickly converts from urea to ammonia (it is then subject to evaporative losses) and then quickly to nitrate (subject to leaching or denitrification losses and the lush growth problem).

TerraLink stabilizes nitrogen fertilizers at our own facilities

- **Flexibility:** by operating our own Stabilized N treatment facility we can adjust the amounts of each inhibitor to reflect the climate at any given time of the year in order to meet the needs of the crop or application. This flexible approach to managing nitrogen inhibitors is an important feature of the program.
- **Results** for the end user:
  - » reduced nitrogen losses to the environment;
  - » more of what growers want when they need it;
  - » nitrogen applications that are safer for plants and more economical;
  - » a reduction in the surge growth problem crops face.
  - » more flexibility in temperatures for Stabilized N to work, compared to polymer coated N products.

Stabilized N results in healthy, consistent and dependable nitrogen available to plants as they need it. [1]

[1] *User to apply the correct amount of fertilizer at the right rate, put in the right place, at the right time. Always obtain the advice of a qualified agronomist or industry professional prior to using these products.*

SN Performance Levels:

SN 56: 5 - 6 weeks inhibition

SN 78: 7 - 8 weeks inhibition

SN 910: 9 - 10 weeks inhibition

Stabilized Nitrogen - The Nitrogen Cycle

Stabilized Nitrogen differs from slow release nitrogen in that it delays parts of the nitrogen cycle in the soil.

Unlike slow-release nitrogen, in which urea slowly diffuses through a polymer coating, stabilized nitrogen works by delaying the nitrogen cycle. Under normal conditions, urea molecules, when applied to the soil as fertilizer, are converted by hydrolysis to ammonia and ammonium bicarbonate. The hydrolysis of urea to ammonia is regulated by the action of an enzyme called urease. This reaction results in gaseous ammonia and carbon dioxide (figure 1), which may then be lost to the atmosphere. This process is called volatilization. Some ammonia may react with water to form ammonium (NH_4^+) (see figure 2) which can be taken up by plants, or further converted to nitrate N.

Figure 1: Hydrolysis of urea to ammonia and carbon dioxide.

$$(NH_2)_2CO + 2H_2O \xrightarrow{Urease} 2NH_4HCO_3 \rightarrow 2NH_3 + CO_2$$

Figure 2: Conversion of ammonia to ammonium.

$$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$$

Under normal conditions, ammonium can further be converted to nitrite (NO_2^-) and then to nitrate (NO_3^-). Although nitrate nitrogen is the main form of nitrogen that is taken up by plants, it is also subject to loss by leaching into the groundwater. This process of conversion of ammonium to nitrate is called nitrification, and is regulated by microbes (see figure 3).

Figure 3: Conversion of ammonium to nitrate.

$$NH_4^+ \rightarrow NO_2^- \rightarrow NO_3^-$$

Hydrolysis of urea can be delayed by a urease inhibitor, which slows the production of ammonia and ammonium from urea. N-(n-Butyl) thiophosphoric triamide, commonly known as NBPT, is the most widely-used urease inhibitor. NBPT delays the conversion of urea to ammonia and ammonium, restricting urea hydrolysis for up to 14 days (see figure 4).

Nitrification can be delayed by a nitrification inhibitor, which slows the production of nitrate from ammonium. One of the most common nitrification inhibitors is a molecule called dicycandiamide, or DCD. It can delay nitrification by up to 10 weeks, thereby reducing the amount of nitrogen lost to groundwater leaching (see figure 5).

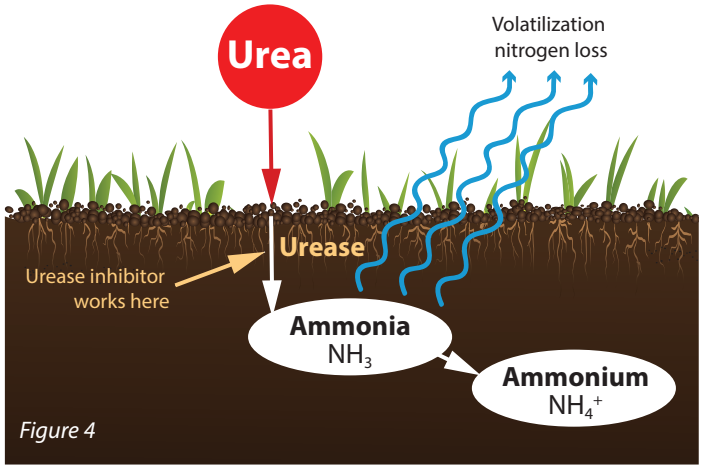

Figure 4

NBPT is more efficient when urea nitrogen is top-dressed, as most berry fertilizer currently is in BC. This practice puts the nitrogen in a vulnerable position, where it is likely to be lost through volatilization as ammonia, following hydrolysis of urea. This is more likely in hot, dry conditions. Not only is this a loss of expensive nitrogen fertilizer, it is arguably a bad environmental practice, as volatilized ammonia represents atmospheric pollution. Up to 30% of the available nitrogen can be lost through volatilization within 72 hours of application. Urease inhibitors, in particular, to a large extent protect against this.

Even when nitrogen has been incorporated, it can be lost from an ecosystem via leaching into groundwater.

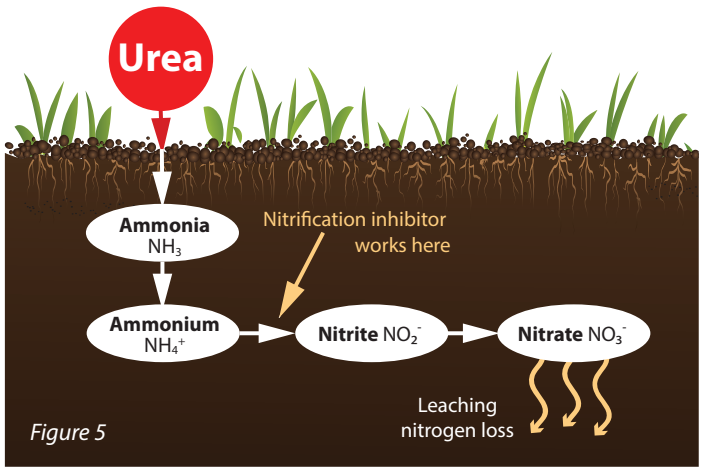

Figure 5

TerraLink can blend both inhibitors into your fertilizer mix, and indeed many of our stock blends contain these inhibitors currently.