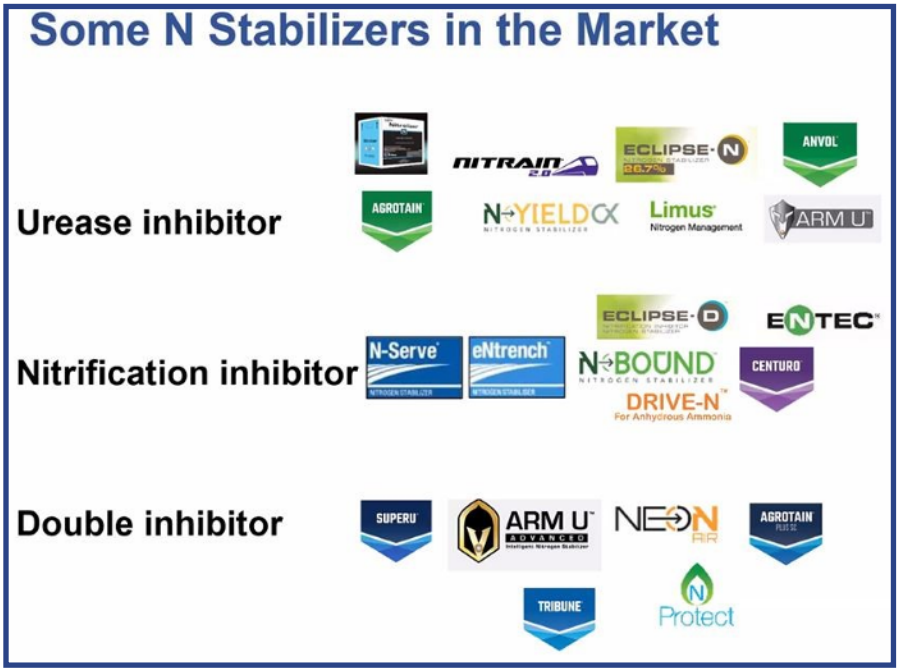
Agronomy Update
February 2024

Nitrogen Inhibitors - A refresher

With an industry mandate to reduce N2O emissions associated with fertilizer application by 30% below 2020 levels by 2030, there is a lot of emphasis on nitrogen stabilizers in the marketplace right now. And the number of products hitting the market is mind boggling – in fact I was unable to come up with a comprehensive list. Here are some of the major ones, as compiled by Dr. Mario Tenuta from the University of Manitoba. I'm sure this list is incomplete, but this gives you an idea of how many options are available to you.



I'm not here to do a comparison of the brands or weigh in on who has the best offering. I don't have the required expertise in this area and that's the suppliers' job anyway. What I want to do is focus on what the different classes of Nitrogen inhibitors are and how they work.

UREASE INHIBITORS

These products delay the breakdown of the urea molecule (CO(NH2)2) into the ammonia form (NH3) by inhibiting activity of the urease enzyme. It is this free ammonia form that is vulnerable to volatilization loss from surface applications or causes burn when seed-placed.

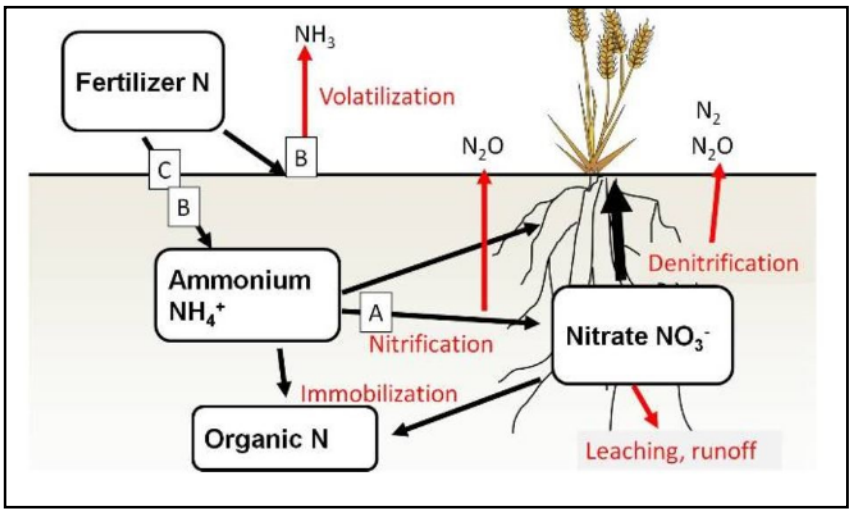
NITRIFICATION INHIBITORS

These delay the conversion of ammonia-form nitrogen (anhydrous ammonia, urea and the urea portion of UAN solution) to the nitrate form which is vulnerable to leaching and denitrification. The NH4+ form has a positive charge and is held on the cation exchange complex which prevents any leaching.

DUAL INHIBITOR

As the name implies, a dual or double inhibitor is a combination of a urease inhibitor and a nitrification inhibitor. Those of you applying nitrogen stabilizers as part of the Canola Councils "Canola 4R Advantage" Program are required to use a dual inhibitor or ESN, a controlled release product.

CONTROLLED RELEASE



In addition to using inhibitors to stabilize nitrogen, the urea form of nitrogen can also be bound to molecules that are degraded slowly, or it can be enclosed within coatings. The most common is ESN urea (44-0-0), enclosed within a polymer coating that allows urea to diffuse out.

Regardless of the type of nitrogen stabilizer, the ultimate goal is the same; to increase the amount of nitrogen ending up in the crop and decreasing the amount ending up in the environment, by holding N in more stable forms for a longer time than the nitrogen cycle generally allows.

So which of these products are the most effective? Well that's a simple question with a complicated answer. Generally speaking, a urease inhibitor is best when you are facing high risk of volatilization; broadcasting or shallow banding of N. In certain soils, N losses can be in excess of 30% if the nitrogen is banded less than 1" deep. Nitrification inhibitors are most effective when there is an extended period between banding and seeding, or if soils are heavy textured and tend to remain wet. Fall applied nitrogen or N placed in downslope positions benefit the most from this type of inhibitor.

Nitrogen stabilizers sound great in theory, but keep in mind that they are not the answer for every situation. If you band down to 3 inches at seeding time, there seems to be questionable benefits to applying a stabilizer in most soils. Dr. Tenuta's research indicates that the breakeven on stabilizers can be anywhere from 3 to 6 bushels/acre of canola and the yield response is generally somewhere between 1 to 3%, so I recommend doing on farm trials to see how well these products work in your fields.

To me, one of the most interesting possibilities of this technology is that we may be able to maintain yields while reducing N rates. If the stabilizers can increase nitrogen use efficiency in the crop as advertised, should we not be able to do the same job with less product? The delayed conversion of the nitrogen should allow more N to be available to the crop through its high demand periods. This is certainly an idea worth looking into. Theoretically, there should also be a benefit to using variable rate technology to apply stabilizers in downslope positions, although the logistics of that are daunting at the present time.

To sum up, nitrogen stabilizers are creating a lot of buzz right now and there are certainly reasons to use them in the right circumstances. I encourage you to ask your suppliers and advisors lots of questions to find out where they might fit into your operation and how they can benefit your bottom line.