



HOW NITROGEN STABILIZATION AFFECTS CORN YIELD POTENTIAL



Dow AgroSciences

Solutions for the Growing World

Instinct[®] II

NITROGEN STABILIZER

N-Serve[®]

NITROGEN STABILIZER

THE VALUE OF MAKING NITROGEN LAST LONGER

The longer nitrogen is available in the root zone, the greater the chance for corn plants to reach optimum yield potential. One proven way for growers to slow the loss of nitrogen is by using a nitrogen stabilizer to inhibit the process called nitrification (see details inside).

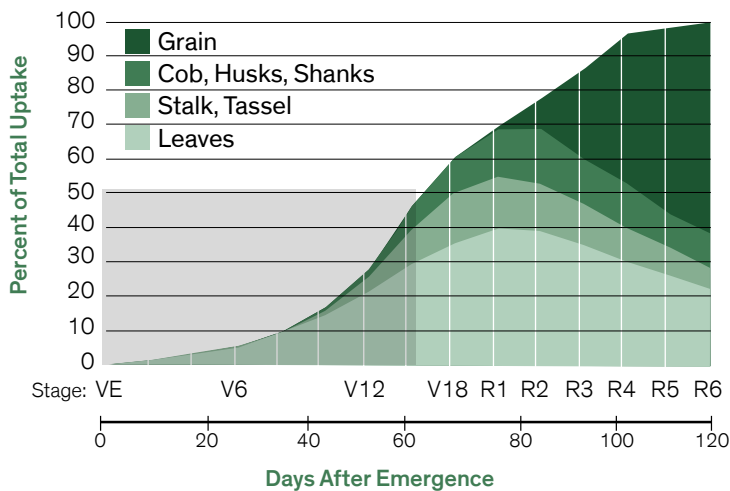
More than 35 years of research with nitrapyrin, the active ingredient in N-Serve® and Instinct® II nitrogen stabilizers, shows that inhibiting nitrification and protecting nitrogen at the root zone can result in yield increases of up to 5.2 percent when applied in the spring and 7 percent when applied in the fall.

Nitrogen Available When Corn Needs It Most

Chart 1 shows that corn plants have the greatest need for nitrogen at the same time it is most rapidly lost in the soil.

- Yield potential is determined in the first 30 to 40 days.
- Corn begins rapid uptake and utilization of nitrogen at about the seven-leaf stage.
- By about three weeks before tasseling to mid silk, corn plants have used approximately half of the season's total nitrogen.
- Approximately 80 percent of the plant's total nitrogen need occurs about 75 days after emergence.

Chart 1. Nitrogen Uptake in Corn



Source: Adapted from How a Corn Plant Develops, Special Report 48 Iowa State University

Research Shows Yield Increases

Spring Applied

Fall Applied

5.2%

7%

Nitrogen Available in its Most Efficiently Used Form

Corn uses nitrogen in two forms:

- The ammonium form (NH_4), which is more efficiently used by plants and more stable in the soil
- The nitrate form (NO_3), which is less efficiently used and more likely to be lost to leaching and denitrification





THE IMPORTANCE OF NITROGEN TO CORN GROWTH AND DEVELOPMENT

For corn to reach optimum yield potential, corn plants need readily available nitrogen (N) during key growth stages. Corn's greatest demand for nitrogen for growth and grain production occurs up to 75 days after emergence (seven- to 10-leaf stage). This is also the time of greatest nitrogen loss in the soil (see Chart 1).

In addition to yield advantages, adequate amounts of nitrogen during early development improve overall plant health. This can increase grain protein, improve standability, reduce stalk rot and enable more natural crop drydown — all factors that can impact a crop's profit potential.

Nitrogen Deficiency is Common — and Costly

As corn plants mature throughout the season, their source of nitrogen can be lost due to leaching and denitrification (see Figure 1). If nitrogen is no longer available for the plant to use, the plant begins to absorb the nitrogen contained within its own leaves and stalk — a process known as cannibalization.

When the plant is absorbing nutrients from itself, it's also making sacrifices — such as reducing the supply of nutrients to lower leaves. These leaves begin to turn yellow, shrivel to a fraction of their normal size and eventually drop, a process referred to as “firing.”

It's normal for lower leaves to die as corn plants mature, but excessive firing is a visual symptom of nitrogen deficiency. Once cannibalization begins, the cornstalks are weakened and more susceptible to stalk rot and yields can be significantly reduced.

THE FATE OF APPLIED NITROGEN

Just applying nitrogen doesn't guarantee it will still be there—in the most usable form—when corn needs it. Since applied nitrogen can be a corn grower's largest input cost, it's important to know what happens to the various forms of nitrogen in the root zone.

Remember that corn can use nitrogen in two forms: the ammonium form (NH_4), which is used efficiently by the corn plant; and the nitrate form (NO_3), which the plant uses less efficiently (see next page). The ammonium form is instantly available when UAN is applied, while nitrogen sources such as anhydrous ammonia and urea rapidly convert to NH_4 after application.

Notice in Figure 1 that ammonium carries a positive charge, which allows it to be held in place by negatively charged soil and organic matter. However, a conversion process begins when temperature-sensitive Nitrosomonas soil bacteria convert NH_4 to the nitrite form (NO_2). Other bacteria, Nitrobacter, then convert nitrite (NO_2) to the nitrate form (NO_3). Nitrates and nitrites both are negatively charged, so they are more susceptible to loss through leaching and denitrification (see sidebar).

The speed of the conversion process depends on several factors, including temperature, moisture, aeration pH and time. The microbes that convert ammonium to nitrate become more active when soil temperatures reach 50° F, and the entire conversion process can take as little as two to four weeks during warmer conditions.

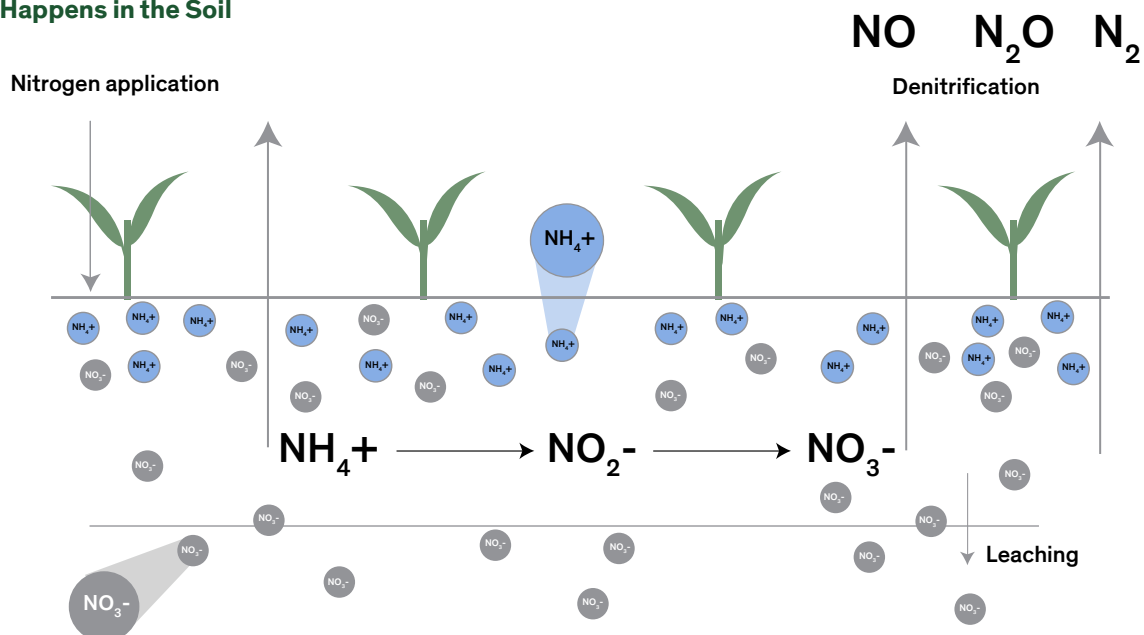


What are Leaching and Denitrification?

Leaching is the loss of nitrates from the soil below the root zone due to rain and irrigation. Since soil and organic matter also are negatively charged, the nitrates are repelled and can be easily washed away, especially in coarse, sandy soils.

Denitrification refers to the loss of nitrogen when soil microbes convert nitrates to gaseous forms that can escape into the atmosphere as a greenhouse gas. Denitrification affects only nitrates, not ammonium.

Figure 1. What Happens in the Soil



The Fate Inside the Corn Plant

Corn uses the two forms of nitrogen differently. When taken up by the roots, the ammonium form (NH_4) is directly converted into amino acids. Nitrates (NO_3) must be transported to the leaves before being transformed into amino acids, requiring sugar, produced by photosynthesis, to be transported from the leaves to the roots. Both processes yield the same product, but ammonium lets the plant more efficiently capture energy from sunlight to make sugar for plant and grain production.

The Value of Inhibiting Nitrification

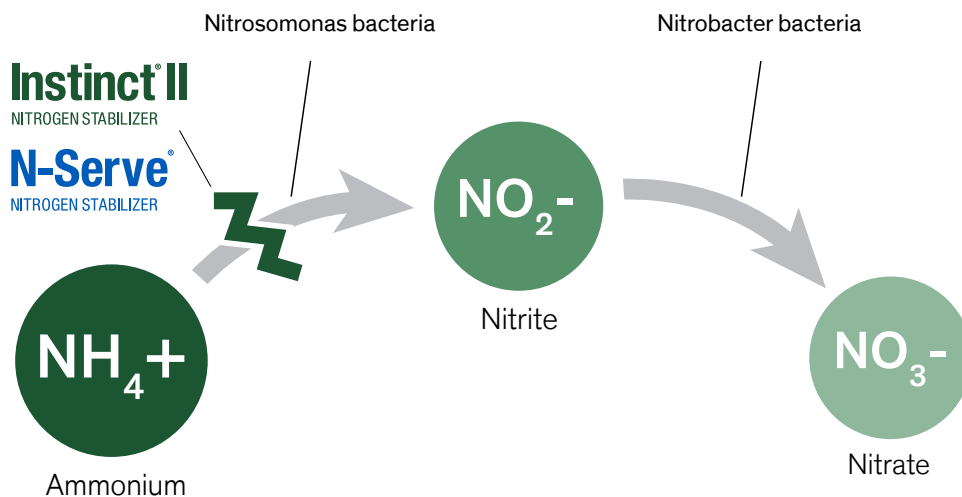
In the past, growers would apply additional nitrogen to make up for the expected losses from leaching or denitrification. Researchers now recommend applying only the amount of nitrogen the corn plant requires to fulfill its yield potential — then inhibiting the loss of that nitrogen by using a nitrogen stabilizer.

By inhibiting nitrification, N-Serve® and Instinct® II make the most efficiently used form of nitrogen available longer for plant uptake. This helps make the best use of a grower's fertilizer investment, while reducing nitrate leaching and greenhouse gas emissions.

For more information about nitrogen stabilization, visit www.NitrogenStabilizers.com



Figure 2. How Nitrogen Stabilizers Inhibit Nitrification





TRUST THE LEADER IN NITROGEN STABILIZATION

For nearly four decades, Dow AgroSciences has been the leader in nitrogen stabilization. Today, we offer world-class expertise about a wide range of nitrogen fertilizers, application timing and cultural practices. We also offer two management solutions to help improve overall return on nitrogen investment:

Instinct® II

NITROGEN STABILIZER

for use with UAN, Urea
and Liquid Manure

N-Serve®

NITROGEN STABILIZER

for use with
Anhydrous Ammonia

Both products are accepted for registration by the U.S. Environmental Protection Agency — and both support our commitment to responsible stewardship of the environment by reducing leaching of nitrates into groundwater or loss of nitrogen into the atmosphere as a greenhouse gas.

4R Nutrient Stewardship Program

Dow AgroSciences is proud to partner with the 4R Nutrient Stewardship Program to achieve cropping system goals.

The 4R framework takes an innovative, science-based approach that provides stakeholders with educational tools, advocacy support and implementation recommendations for crop nutrient stewardship. The program advocates management practices to increase production, boost farmer profitability, enhance environmental protection and improve sustainability.

The concept is to use the right fertilizer source, at the right rate, at the right time, with the right placement.

For more information about N-Serve® or Instinct® II, contact your local Dow AgroSciences sales representative or visit www.NitrogenStabilizers.com

NitrogenStabilizers.com 1-800-258-3033.



Dow AgroSciences

Solutions for the Growing World



*Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow
Instinct II is not registered for sale or use in all states. Contact your state pesticide regulatory agency to determine if a product is registered for sale or use in your state.
Do not fall-apply anhydrous ammonia south of Highway 16 in the state of Illinois. Always read and follow label directions. M01-137-165 (08/13) DAS 010-41879