INNOVAR AG™

InnoSolve™ 45N

1. REDUCING VOLATILIZATION

On the soil surface, specific InnoSolve components protect urea.

2. PREVENTING LOSS FROM IMMOBILIZATION

Once safely in the soil, urea converts into ammonium (NH_4^+).

3. CONTROLLING NITROGEN CONVERSION

In the soil profile, specific InnoSolve components help protect against losses by delaying nitrification

Nitrification

NH_4^+	→	NO_2^-	→	NO_3^-
ammonium		nitrite		nitrate

4. REDUCING LEACHING

Specific InnoSolve components help reduce leaching loss, as nitrogen remains in the form of positively-charged ammonium (NH_4^+).

Denitrification

NO_3^-	→	NO_2^-	→	NO	→	N_2O	→	N_2
nitrate		nitrite		nitric oxide		nitrous oxide		dinitrogen gas

5. REDUCING DENITRIFICATION

With more nitrogen in the form of ammonium (NH_4^+) longer, losses from denitrification are greatly reduced.

6. CREATING SITES TO HOLD AMMMONIUM N, P, K, SECONDARY, AND MICRONUTRIENTS

InnoSolve polymer provides sites to hold ammonium and other positively-charged nutrients.

7. BUILDING MICROORGANISM POPULATIONS

InnoSolve components include a long-term and short-term food source that increase the available carbon level in the soil.

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1. Reducing volatilization: On the soil surface, specific InnoSolve components protect urea.

On the surface, microorganisms produce urease, a nickel-based enzyme that catalyzes the breakdown of urea into ammonia (NH_3) and carbon dioxide (CO_2). Without any protection, urea is subject to this volatilization before it even enters the soil. With the infusion and encapsulation of InnoSolve components, the urea is protected, and the urease enzymes are ineffective at volatilizing the urea. This allows the stabilized urea to enter into solution over time, and to begin its journey into the soil.

2. Preventing loss from immobilization: Once safely in the soil, urea converts into ammonium (NH_4^+).

As it moves through the organic layer of the soil, and into the actual soil profile, the threat shifts from volatilization to nitrification. At this stage, the urea moves away from the relatively insoluble InnoSolve components, and converts to ammonium (NH_4^+).

3. Controlling nitrogen conversion: In the soil profile, specific InnoSolve components help protect against losses by delaying nitrification.

Once the urea converts to ammonium (NH_4^+), specific InnoSolve components guard against nitrification, the process by which microorganisms convert ammonium to nitrate to obtain energy.

Nitrification

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

ammonium → nitrite → nitrate

4. Reducing nitrification and leaching: Specific InnoSolve components help defend against nitrification, and keep nitrogen in the form of ammonium.

Due its cationic (positively-charged) nature, ammonium (NH_4^+) is caught by negatively charged soil colloids and mineral complexes in the soil. On the other hand, nitrate (NO_3^-), due its anionic (negatively-charged) nature, is highly susceptible to losses from leaching. Therefore, keeping nitrogen in the form of ammonium will allow more nitrogen to be available to the plant. In addition to this, compared to ammonium, plants must use three (3) to four (4) times more energy to make nitrate usable.

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5. Reducing denitrification: With more nitrogen in the form of ammonium (NH_4^+) longer, losses from denitrification are greatly reduced.

In the case where ammonium is not protected, microorganisms rapidly go through the process of nitrification, creating nitrate. This creates an opportunity to increase the loss of nitrogen through denitrification. Denitrification occurs when nitrogen is lost through the conversion of nitrate to gaseous forms of nitrogen. This occurs when the soil is saturated and the bacteria use nitrate as an oxygen source.

Denitrification

NO_3^-	→	NO_2^-	→	NO	→	N_2O	→	N_2
nitrate		nitrite		nitric oxide		nitrous oxide		dinitrogen gas

By holding nitrogen in the ammonium form longer, denitrification is greatly reduced as the nitrate starting material isn't present in very high amounts.

6. Creating sites to hold ammonium N, P, K, Secondary, and Micronutrients.

With nitrification (and denitrification) reduced, the ammonium levels greatly increase. Ammonium attaches to anionic parts of the soil, primarily soil colloids and minerals. Localized levels of soluble ammonium can outnumber the available anionic sites, causing either the displacement of other cations from the anionic sites on the soil and minerals (especially potassium), or by leaching farther down through the soil profile away from the roots of the plants.

Because the InnoSolve polymer is anionic, it will have attached itself to a cation that is either attached to a soil colloid or a mineral. This anionic polymer remains in the soil, and catches the ammonium and other cationic ions that become temporarily soluble in the soil during the nature cycling of minerals. This directly increases not only the nitrogen uptake in plants, but also the uptake of other cationic elements, such as potassium, calcium, magnesium, copper, iron, manganese, nickel, and zinc. And by holding the cationic elements in solution, it decreases the chances of them interacting with anionic elements (phosphorus, sulfur, boron, and molybdenum), which increases their uptake into the plant as well.

7. Building microorganism populations: InnoSolve components include a long-term and short-term food source that increase the available carbon level in the soil.

Because of its molar mass (approximately 5000 g/mol) the InnoSolve polymer serves as a long-term food source of biology. In the short term, a smaller molecular-weight InnoSolve sugar source, now squarely in the soil profile with the roots, acts as a short-term food source. This increases the microbial population in and around the roots, creating a healthier environment for the roots, and positively contributing to the short-term carbon level that is immediately available for microorganisms.