

Utrisha™ N

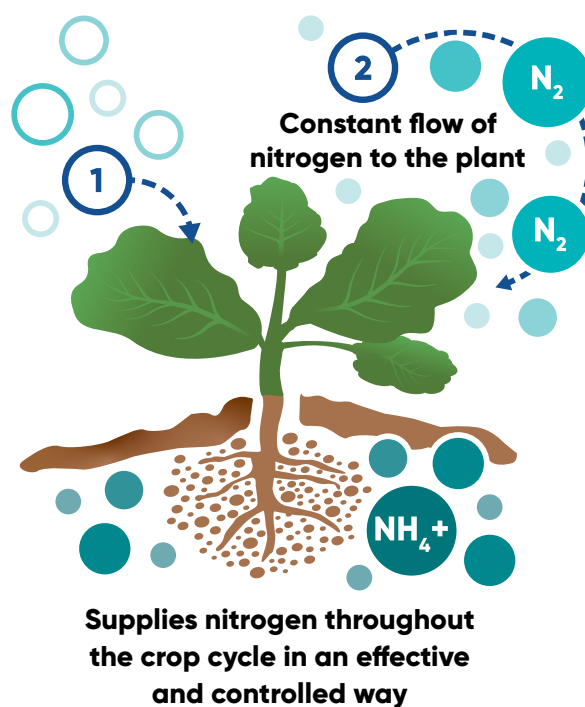
**NUTRIENT EFFICIENCY
BIOSTIMULANT**





Utrisha™ N Key Features

- Utrisha N is a nutrient efficiency biostimulant. The natural bacteria fixes nitrogen from the air and converts it into a usable form for the plant.
- Foliar crop treatment provides supplemental nitrogen to plants and reduces dependency on late-season nitrogen application.
- Colonizes the entire plant by entering through young leaves and quickly translocating to surrounding leaves, stems, and roots.
- Proven utility on a wide variety of crops including canola, wheat, corn and soybeans.
- Aggressive and efficient colonization allows for low use rates relative to similar products.
- Broad application window and tank mix compatibility allows for flexible treatment schedule.
- Innovative dry formulation provides shelf-life stability for more than 1 year.
- Maximizes crop potential through improved nitrogen management, offering proven, predictable performance.





Utrisha™ N

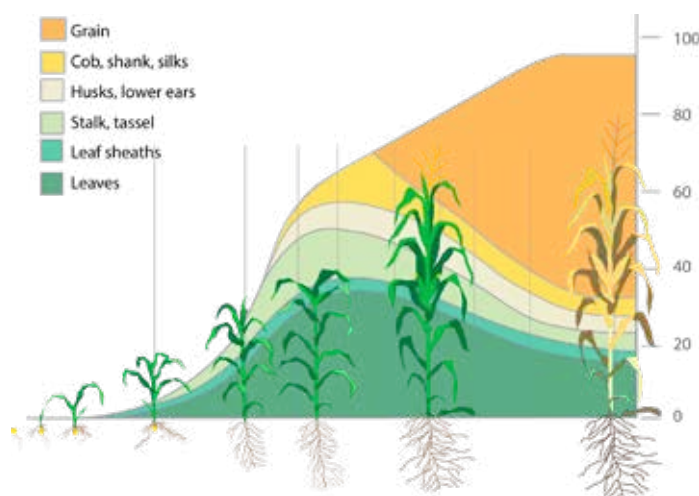
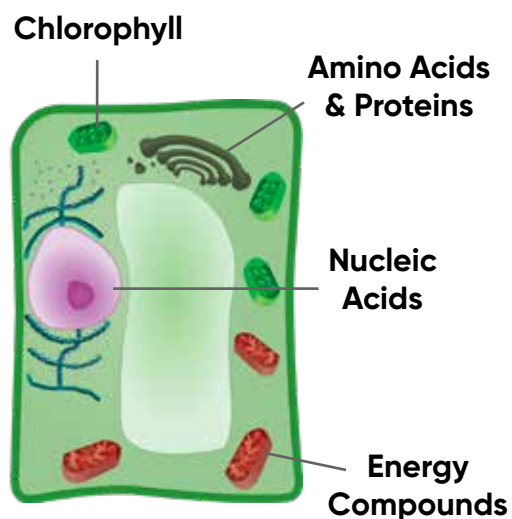
**NUTRIENT EFFICIENCY
BIOSTIMULANT**

Corteva Agriscience is proud to introduce Utrisha™ N, an innovative new biological product that provides supplemental nitrogen to key crops throughout the growing cycle. This nutrient efficiency biostimulant has been scientifically evaluated and formulated to provide a natural source of crop-available nitrogen without the risk of loss to the environment as with traditional nitrogen fertilizers. Utrisha N is novel solution that provides flexibility and reliability to sustainable nitrogen management plans that support healthy crop growth.

Nitrogen: The most important nutrient

Nitrogen is essential for plant survival and a key element for optimal crop health. Nitrogen is not only a primary component of nucleic acids, but also an integral building block for proteins and bioactive compounds such as chlorophyll. Nitrogen is found in many different forms with the overwhelming majority in a form unavailable to most crop plants. Over 78% of the earth's atmosphere is composed of nitrogen (elemental nitrogen; N_2) and nitrogen found in the soil is commonly in the form of organic nitrogen ($R-NH_2$) derived from the decomposition of living organisms. Most plants require both of these common nitrogen forms to be processed prior to uptake for optimal plant growth. Current farming practices often rely on addition of supplemental nitrogen throughout the growing cycle for optimal yield.

Many crops, including corn, require nitrogen at all developmental stages. A large increase in nitrogen demand occurs in late spring/early summer as corn matures. Seasonal weather conditions can lead to a loss of nitrogen from the soil, which can be minimized with soil nitrogen stabilizers such as those using Optinyte™ technology. Utrisha N is a biological product that not only *adds* supplemental nitrogen directly to crops at the time of greatest demand, but provides additional nitrogen for the remainder of the season.





A Need for New & Innovative Nitrogen Inputs

Many crops require additional sources of nitrogen and the application of fertilizer or manure has become essential for optimal production. Excessive nitrogen application has the potential to harm plants ("nitrogen burn") and can lead to the direct contamination of drinking water with toxic nitrates, as well as, runoff that can result in a number of devastating problems in freshwater ecosystems and coastal watersheds. In addition, many applications result in release of potent greenhouse gases, such as nitrous oxide, a major cause of global warming. This significant environmental effect has elevated nitrogen use efficiency and fertilizer management as key priorities to combat the deleterious effects of agricultural nitrogen application. Sustainable farming practices are designed to maximize the use of all necessary nitrogen inputs while minimizing nitrogen loss to not only produce the greatest return on investment, but decrease the environmental impact of agriculture. Nitrogen source, timing and use rates are central tenets to a robust nitrogen management plan. Utrisha™ N nutrient efficiency biostimulant is a unique biological tool supporting nitrogen management in these ways.



Nitrogen is frequently applied to soil in the form of urea granules. In warm growing conditions, as much as 30% off this nitrogen can be lost to volatilization in the absence of stabilizers.



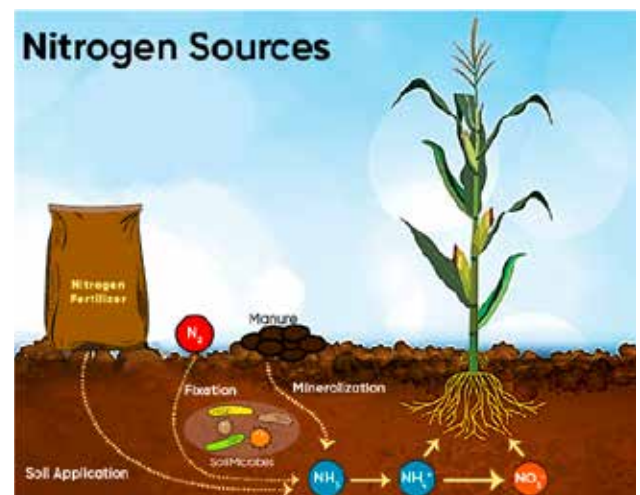
This phytoplankton bloom was visualized by satellite imaging along the coast of New Jersey, Delaware, Maryland, and Virginia (May 2021). Scientists believe the primary contributors of this massive bloom were fertilizer runoff from farms, suburban areas, and water treatments. While many blooms are transient, long-term blooms can block vital sunlight to lower layers killing plants and can deplete water of dissolved oxygen, which has devastating effects on fish and other wildlife.



The Careful Balance of Nitrogen

Plants acquire nitrogen through the root system

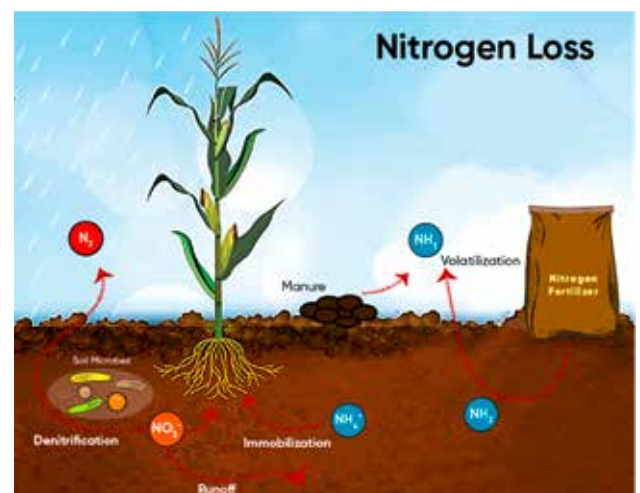
Soil microbes perform key processes to convert nitrogen into forms that can be readily absorbed through the roots and utilized by plants. The primary processes are *fixation*, *mineralization*, and *nitrification*. *Fixation* is the production of ammonia (NH_3) directly from atmospheric nitrogen gas (N_2). This can be done naturally by bacteria such as those found in the roots of legumes or synthetically as with the production of fertilizers. *Mineralization* is the conversion of organic nitrogen found in manure and decomposing organisms to ammonia and ammonium (NH_4^+) by soil microbes. Lastly, *nitrification* is the microbial process that rapidly converts ammonium to nitrate (NO_3^-) in warm temperatures, which plants convert back to ammonium prior to use. Thus, all three forms of nitrogen, including ammonia, ammonium, and nitrate can be absorbed through roots and utilized by plants to support growth and development. The innovative technology behind Utrisha™ N nutrient efficiency optimizer allows above ground plant tissues to provide additional nitrogen to the system*.



Nitrogen is lost from soil

There are several ways in which plant available nitrogen is depleted from soil. In the best scenario, nitrogen is incorporated into living organisms such as plants, which is referred to as *immobilization*. Nitrogen found in the form of nitrate (NO_3^-) is susceptible to removal from soil by two mechanisms. First, soil bacteria that require oxygen for survival utilize oxygen found in nitrate when atmospheric oxygen is unavailable (as with saturated soil) via a process known as *denitrification*. This produces nitrogen gases, including nitrous oxide (N_2O) and N_2 byproducts. In addition, excessive rainwater can readily remove nitrate in a process known as *leaching*. Lastly, ammonium from soil applied fertilizers and manures can be lost through *volatilization* as it is converted to ammonia gas in hot and windy conditions.

All means of nitrogen loss reduce productivity, lower return on investment, and come at a significant environmental cost ranging from groundwater contamination to increased greenhouse gases. Nitrogen stabilizers such as Optinyte™ technologies protect fertilizer losses from the soil, while Utrisha™ N produces supplemental nitrogen directly within crops without a risk of loss to the environment*.



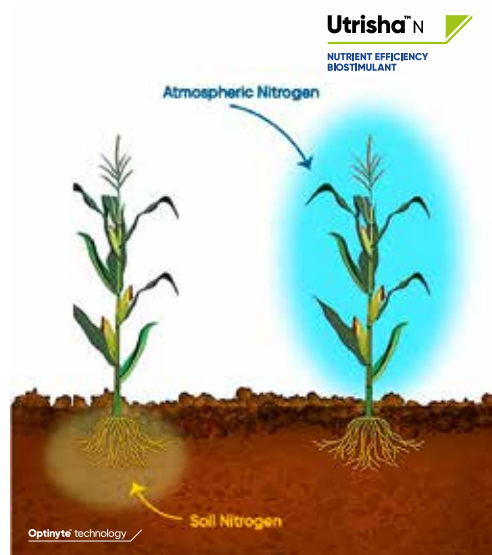
* *Methylobacterium symbioticum* strain identified and the subject of a European patent application by Symborg Inc. (EP Application No. EP3747267A1)

Utrisha™ N Description

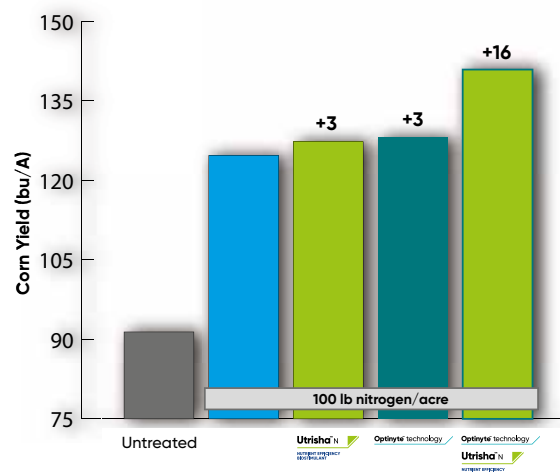
Utrisha™ N nutrient efficiency biostimulant is a biological solution that addresses the main challenges of effective nitrogen management; application timing, use rate, and location.

The active component of Utrisha N is a strain of *Methylobacterium symbioticum* selected for optimal agricultural use and has not been genetically modified in any way.

Utrisha N enables above-ground vegetative plant tissues to become a source for a constant supply of nitrogen. *M. symbioticum* enters the plant through green leaves and rapidly colonizes the entire plant to convert atmospheric nitrogen to a plant-available form (ammonium)*. This allows Utrisha N to deliver nitrogen directly to actively growing plant parts, without risk of poor application timing or negative environmental effects. Available as a shelf-stable powder, Utrisha N is an innovative tool that can be applied as a foliar application to enable aerial portions of the plant to serve as a nitrogen source *in addition* to those sources absorbed by the root system.







Illustrated benefit from both protection of soil applied nitrogen and adding Utrisha N, which adds supplemental N from the atmosphere.



Corn field trial results comparing treatment of V5 stage corn with Utrisha N in the presence of traditional nitrogen treatment (blue bar) with or without Instinct nitrogen stabilizer (N = 6, University of Missouri 2020).

* *Methylobacterium symbioticum* strain identified and the subject of a European patent application by Symborg Inc. (EP Application No. EP3747267A1)

The 4Rs of Nitrogen Stewardship

Right Source 	Selecting the correct formulation and chemical form of nitrogen fertilizer is essential to minimize loss of nutrients and preserve return on fertilizer investment. Utrisha™ N nutrient efficiency biostimulant converts atmospheric nitrogen to ammonium to provide nitrogen directly to the crop.
Right Rate 	Application of the minimal amount of nitrogen required for good crop yield reduces risk of profit loss and environmental pollution. Utrisha N works through a mechanism that is self-regulated to provide nitrogen to the plant without risk of overproduction.
Right Time 	Seasonal variation in weather has enormous impact on fertilizer lost via leaching and volatilization, making application timing critical. Utrisha N works by colonizing young plants and serves as a direct source of supplemental nitrogen for the remainder of the season without risk of leaching or volatilization.
Right Place 	Choosing the optimal placement (i.e. soil depth) for traditional fertilizers is key to avoid nitrogen loss to the environment. Utrisha N provides supplemental nitrogen directly to the leaves of the plant, effectively mitigating nitrogen loss to the environment.



Utrisha™ N Benefits

Consistency in yield: Utrisha™ N is an effective way to enhance nitrogen use efficiency. Bacteria in Utrisha N constantly supply nitrogen in conditions where soil sources of nitrogen are limited or inconsistent.

Flexibility in application: Utrisha N effectively and quickly colonizes the entire plant by entering through open stomata of vegetative tissues. This allows Utrisha N to be applied to crops, such as corn, as early as V4 or later vegetative stages.

Robust fit with integrated farming systems: Utrisha N is compatible with select herbicide treatments. Refer to detailed compatibility list for product-specific information or talk to your local Corteva Territory Manager or Agronomist.

Ease of use: Innovative formulation as a shelf-stable wettable powder is stable for over 1 year to provide consistent product reliability. In addition, powdered formulation is lightweight relative to other biological liquid crop treatments.

Excellent fit for nitrogen management programs: Flexibility in application and timing allows Utrisha N to be an excellent supplemental nitrogen source that is highly compatible with nitrogen stabilizers, such as those utilizing Optinyte™ technology. Utrisha N is a single foliar application that increases nitrogen provided to the plant and complements nitrogen stabilizer technologies, which protect soil nitrogen.

Sustainability: Utrisha N provides supplemental nitrogen to crops without the risk of leaching into water tables or introducing additional greenhouse gases into the atmosphere.



Utrisha™ N Mode of Action

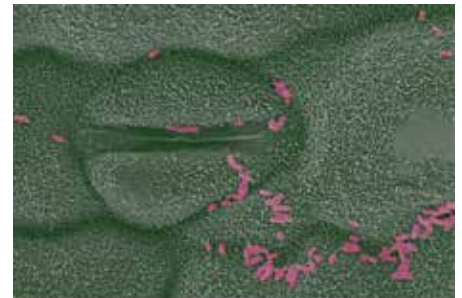
Nitrogen fixation

Utrisha™ N nutrient efficiency biostimulant contains a pink-pigmented *Methylobacterium* that can convert atmospheric nitrogen (N_2) into ammonium (NH_4^+) using an enzymatic pathway that is not found in most plants*. The ammonium produced by the intracellular bacteria is then used by plant enzymes to produce glutamine for incorporation into essential plant proteins. Importantly, as the plant's metabolic needs for glutamine are met, unused glutamine inhibits the bacterial pathway to stop the production of ammonium. Thus, the bacteria fix only enough nitrogen for the plant to utilize in growing conditions and do not overproduce ammonium.



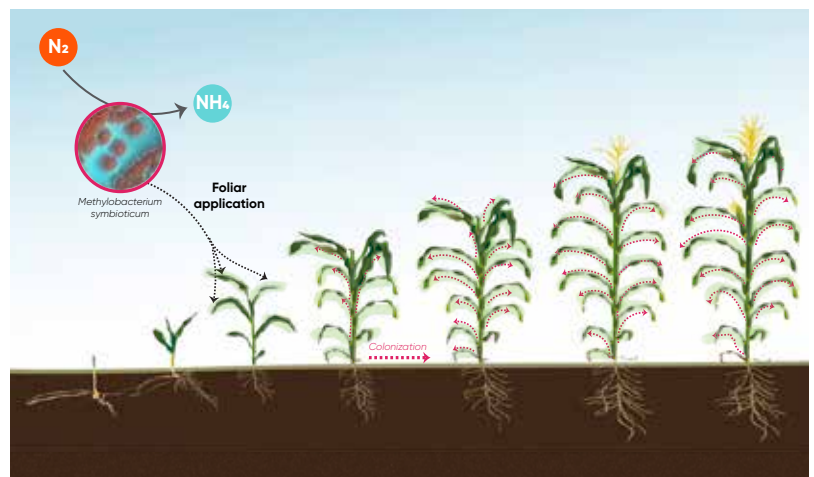
Translocation

Methylobacteria are a genus of bacteria that survive and multiply by scavenging methanol, which is a byproduct of normal vegetative plant growth. Once applied to the leaf, bacteria sense methanol released from the stomata of growing plants and subsequently move towards these plant openings as a point of entry. This ability to translocate allows Utrisha N to be utilized as a straightforward foliar application for supplemental nitrogen supply without the risk of crop or environmental damage seen with broadcast or injection of nitrogen fertilizers.



Colonization

The active component in Utrisha N is a strain of *Methylobacterium symbioticum*, which is an endophytic bacteria. Endophytic bacteria can live and reproduce in plants without causing damage. After the nitrogen-fixing bacteria found in Utrisha N translocate into the plant, they continue to multiply and scavenge methanol produced in the active growth regions. Through this mechanism, the plant is colonized by *Methylobacterium* as the plant grows. In corn, complete colonization can be achieved after 3–5 days and continues throughout the vegetative growth process and provides supplemental nitrogen to the plant.



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Utrisha™ N Formulation

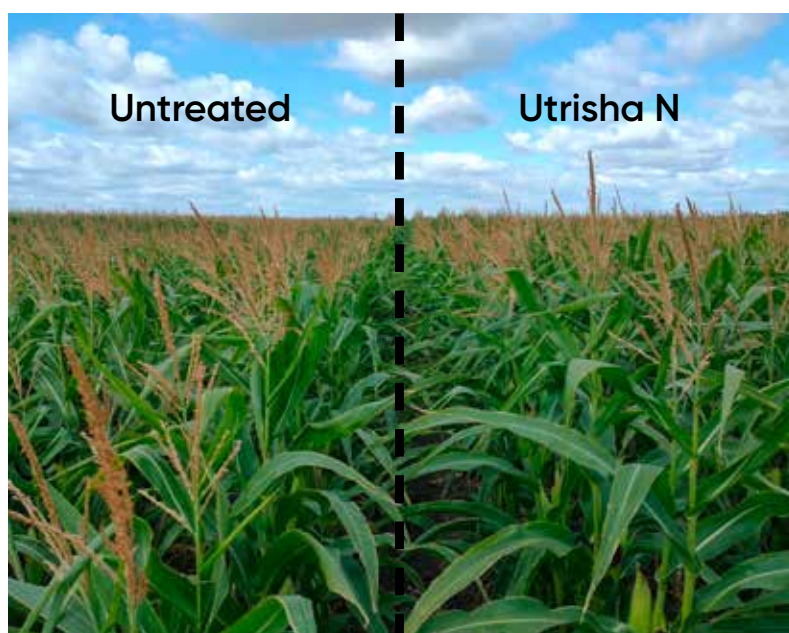
- Supplied as a powdered light-weight package to facilitate ease of use with tank mix and side-dress applications
- Expertly formulated and validated for optimal cell viability after rehydration
- Compatible with certain tank mix components (see product label)
- Demonstrated stability for >1 year when stored as directed on packaging
- Consistent delivery of supplemental nitrogen after each application
- Excellent compatibility with standard crop application equipment



Crop Specific Information

APPLICATION INFORMATION	
PACKAGING	1 case = 2 x 5.39 kg bags
RATE	135 g/ac (40 ac/bag)
WATER VOLUME	10-25 gpa
RAINFEST	1 hour
RECOMMENDATIONS	<ul style="list-style-type: none"> • Apply in healthy crops unaffected by poor nutrition or other biotic/abiotic stresses • Apply with sufficient plant biomass, when the crop presents good soil coverage • Use water with a total chlorine content <2 ppm • Use water with a pH between 5 and 8

APPLICATION INFORMATION	
CANOLA	4 leaf-bolting (before stem elongation)
CEREALS	4 leaf-jointing (avoid winter dormancy in winter wheat)
CORN	V4-V8
SOYBEANS	V4-V8



2021 Field Trial – Lenore, MB

Disclaimers

The Utrisha™ N nutrient efficiency biostimulant Technical Bulletin is provided for reference purposes only and is not a substitute for or an addition to a product label or Material Safety Data Sheet (MSDS). Always read and follow label directions for the country of use for registered pesticides. The information and any recommendations in this bulletin ("information") are presented in good faith; however, Corteva Agriscience makes no representations as to the completeness or accuracy of the information. The information is supplied upon the conditions that the persons receiving it will make their own determinations as to its suitability for their purposes prior to use and consult with their advisors to ensure compliance with all federal, state, and local regulations. In no event will Corteva Agriscience be responsible for damages of any nature whatsoever resulting from the use of or reliance upon the information.

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