

SYMTRXTM

TECHNICAL BULLETIN



SYMTRX™

THE INNOVATIVE WAY TO CULTIVATE STRONG, HEALTHY CROPS IN A UNIQUELY NATURAL WAY.

SymTRX™: Nutrition Innovation

Growers know the key to bountiful crops is providing essential plant nutrients in a timely manner. Anuvia™ Plant Nutrients is proud to introduce SymTRX: a plant nutrition product engineered to reduce nutrient losses to the environment while increasing nutrient availability for the plant. By using our Organic MaTRX™ to slowly release nutrients for uptake, it also regulates the conversion of nutrients that may be more susceptible to volatilization and leaching.

The Organic MaTRX: A New Mechanism to Deliver Slow Release of Nutrients

SymTRX utilizes the unique, natural binding mechanism of our Organic MaTRX to create a homogeneous slow-release product without using polymers or synthetic coating technologies. After application, microbial activity slowly breaks down the Organic MaTRX — releasing nutrients that continuously feed plants, and reducing the loss of nutrients into the environment from volatilization to the atmosphere or leaching into ground water. This process represents the first real innovation in the Enhanced Efficiency Fertilizer (EEF) segment in many years.

The system uses mechanisms that nature has already perfected and puts them to work for growers to create a more effective and efficient plant nutrient delivery process.

4R Nutrient Stewardship

The fertilizer industry and Anuvia endorse a best management practice system that promotes the 4R Nutrient Stewardship: using the **Right fertilizer source**, at the **Right rate**, at the **Right time**, with the **Right placement**. This science-based approach enhances environmental protection, expands production, increases profitability, and improves sustainability.

A Novel Approach to Nutrition

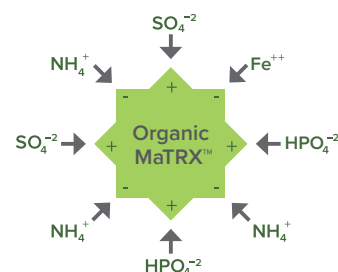
The Organic MaTRX is the foundation of our product. It delivers nutrients to the soil and plants in an intuitive, natural way and represents a novel approach to building a highly effective plant nutrient program.

Organic matter (OM) is an important component of soils, providing holding capacity for plant nutrients and important structural components, which affect soil tilth and water holding capacity. Soil OM is a primary reserve of nitrogen (N), sulphur (S) and other nutrients required by plants. We have taken the natural characteristics of OM and applied those principles to the design of our product.

Our Organic MaTRX possesses both positive and negative charges, providing docking sites for nutrient cations and anions. Positive and negative nutrient ions (ammonium NH_4^+ , ortho-phosphate HPO_4^- and sulphate SO_4^-) react with opposite charges, binding to the Organic MaTRX of our product just as they would with natural OM in the soil.

The binding of nutrients to the Organic MaTRX slows the usual reactions of the nutrients with the soil environment. Then, when these organic matrices are adopted by the soil ecosystem, soil microbes begin to break them down. In turn, the chemical bonds in the Organic MaTRX are broken and nutrients are gradually released for plant uptake. This binding feature also slows conversion of ammonium-N (NH_4^+) to leachable nitrate-N (NO_3^-), known as nitrification, and therefore reduces the loss of N due to leaching or volatilization.

Cation and Anion Absorption (Sequestration)
by Organic Matter (OM)



Homogeneous Formulation

The Organic MaTRX allows Anuvia to create a homogeneous product that provides uniform distribution of nutrients. These nutrients are released in a consistent, timely fashion, which ensures uniform nutrient availability to the plant and minimizes the loss of nutrients to the environment. This added efficiency provides both economic and environmental benefits.

Our 2019 Environmental Resources Management (ERM) assessment shows a number of advantages, including up to a 32% reduction in greenhouse gas emissions (GHG) as measured on the use of numerous crops. In our product development studies on corn, 100% urea showed an 11% higher carbon footprint than the 25% SymTRX:75% urea blend.

Soil, Plant and Microbiome Benefits

As shown by ongoing research, SymTRX works in concert with soil to increase microbial activity, promote the soil's ability to regenerate, and create healthier soils for better water holding capacity and nutrient retention. A 2018 study confirmed that SymTRX feeds the soil microbiome to contribute to improved soil health.

The commonly accepted measurement of soil health is the carbon efflux test, which measures CO_2 given off by soil microbes. Higher levels signify more microbial activity, which can lead to better soil health. The University of GA conducted a carbon efflux study comparing SymTRX 20S (16-1-0-20S) to ammonium sulphate and found that CO_2 levels increased by 246.8%. This suggests that SymTRX is less harmful to microflora and contributes to increased microbial colonization, resulting in greater microbial activity and improved soil health.

SymTRX Products

Different use patterns, crops and growing conditions require different nutrients. That's why we created a choice of products with a formula for every field.

SYMTRX™

10S

14-24-0-10S

20S

16-1-0-20S

Nitrogen (16% Nitrogen–Ammonium Form NH_4^+)

Nitrogen: Essential to Protein

Of the primary nutrients, N is considered most important because of the large amount plants require. Nitrogen is essential to all living things and is present in protein, which makes up much of the tissue in all cells, as well as in amino acids, enzymes, RNA, DNA, chlorophyll and a host of other materials. Earth's atmosphere is about 78% N by volume, but atmospheric N is not usable by plants and animals until converted into the chemical equivalent of ammonium-N by natural processes that occur within symbiotic bacteria, specific types of algae, lightning and certain manufacturing processes.

Normally when plants are fertilized, they have a high demand for N to drive rapid growth and development. The Anuvia plant nutrient product contains 16% N in the ammonium form. Depending on the nitrogen requirements of a crop, the product may provide sufficient N or can be blended with another N source to supply higher N needs.

The Anuvia product releases approximately 65% of its N in the first two weeks in the form of NH_4^+ , which is readily available and usable by plants. NH_4^+ can be utilized by plants even before they develop a nitrate-N reduction system, and is energy efficient as well. Nitrogen uptake as ammonium negates the possibility of N losses, which can be sizeable, by leaching and denitrification by soil bacteria.

The balance of N in our product becomes available as the Organic MaTRX releases the attached nutrient ions as the bonds are broken down by microbes in the soil. This process, which has already been perfected by nature, releases N from the Organic MaTRX slowly, so plants receive nutrients continuously for a period of time.

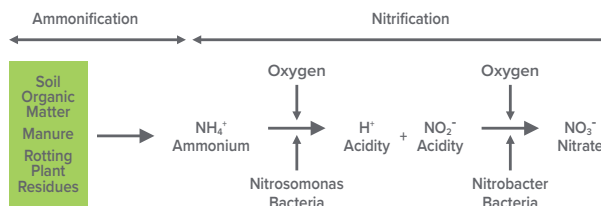
Slow-Release Nutrients

The N in our product is released over a six- to eight-week period under temperate conditions, but can be affected by soil temperature, soil moisture, soil aeration, and the microorganism content of the soil.

Higher temperatures speed up this process, lower temperatures slow the reactions. The slow-release N in our product is not easily lost to leaching, allowing growers to experience a better return on investment and have a positive impact on their environment. If left unused, ammonium-N released from the Organic MaTRX, will eventually be converted to nitrate-N by soil bacteria (nitrification).

Ammonification (N Mineralization) and Nitrification

Conversion of nitrogen into plant-available forms through the microbial process of ammonification and nitrification.



Source: Dr. Dale Leikam, Leikam AgroMax

The Anuvia Difference: Ammonium-N

Though plants can use both ammonium-N (NH_4^+) and nitrate-N, ammonium-N is less leachable and requires less of the plants' stored metabolic energy for incorporation into plant components. Positively charged ammonium naturally bonds to the Organic MaTRX of our product, and is slowly released by naturally occurring bacterial hydrolytic action (ammonification). It is then held (adsorbed) by the soil clay and organic matter, which results in a resistance to leaching by water moving through the soil.

In addition, ammonium can help plants store more of the sugars formed by photosynthesis as starch, resulting in increased yield and better plant health. It has been estimated that utilizing ammonium-N can save 10% to 17% of a plant's photosynthetic energy.

SymTRX was shown to have a beneficial reduction in nitrogen loss via leaching, a 50% reduction compared to urea, and a 39.9% reduction compared to ammonium sulfate.

Phosphorus

Phosphorus: Life Energizer

Plant and animal life would not exist without phosphorus. Phosphorus is often called the “energizer” because it plays an essential role in respiration, photosynthesis, energy storage and transfer, cell division and reproduction in plants. Phosphorus is part of ATP, the energy fuel in plants. ATP drives virtually every chemical reaction within the plant. An adequate supply of phosphorus is essential for proper cell growth and transfer of genetic code from one cell to another.

Phosphorus is also important for seed formation, development and maturation. Lack of sufficient phosphorus can cause stunting of plants, poor coloration and delayed maturity. In addition to slower plant growth, root development is also slower and can lead to increased moisture stress and poorer yields. Phosphorus is available to plants in organic and inorganic forms.

Organic phosphorus comes from organic matter and represents a small percentage of total phosphorus for the plants, especially on sandy soils with little or no organic matter. Inorganic phosphorus is usually applied as synthetic fertilizer in the form of either a polyphosphate or an orthophosphate. Polyphosphates must be broken down in the soil to become available to the plants. The time it takes for the phosphorus to become available depends on soil temperature moisture. Orthophosphates are readily available to the plants but can be tied up chemically in the soil by cations.

The Anuvia Difference: Orthophosphates

Phosphorus enters the plant through its roots as an orthophosphate ion. Once inside the plant, it becomes incorporated into organic compounds such as sugar phosphates, enzymes, DNA and RNA. The phosphorus in SymTRX is in an orthophosphate form so it is in the plant-available form immediately.



Sulphur

The Role of Sulphur

Sulphur is an essential nutrient in crop production that serves many functions. It is essential in the formation of amino acids, proteins and oils. It is necessary for chlorophyll formation, promotes nodulation in legumes, is essential for atmospheric nitrogen (N_2) fixation, helps develop and activate certain enzymes (nitrate reductase), and is a structural component of two of the 21 amino acids that form protein. Sulphur also provides plant health benefits in crop production. It has been classified as a secondary element, along with magnesium (Mg) and calcium (Ca), but now is more commonly considered “the fourth major nutrient.” Some crops can take up as much S as P. Sulphur has become more important in crop production in recent years. Anuvia delivers S in the sulfate form.

Sulphur and Nitrogen

A crop's need for S is closely associated with N. The relationship between S and N is not surprising since both are components of protein and are involved in chlorophyll formation. They are also linked by the role of S in the conversion of nitrate to amino acids. Crops having a high N need will usually also have relatively high S needs.

The Anuvia Difference: Sulphur

The plant-essential sulphate in the Anuvia product is available to plants, and always in a usable form. This is in contrast to other S-containing products that may contain elemental S, which must be oxidized by soil bacteria in order for plants to utilize it. Our homogeneous product delivers a release of S to plants, which optimizes yield and ensures maximum efficiency.



Physical Properties

Category	SymTRX 20S avg.	SymTRX 10S* avg.
Moisture content:	Less than 3%	Less than 2%
Crush strength (hardness):	6 - 7 lb	7 - 9 lb
Post humidity (75%RH; 86F) hardness:	5 - 6 lb	6 - 8 lb
Bulk density (loose pour):	53 - 54 lb/cu ft or 848 - 864 kg/m ³	54 - 55 lb/cu ft or 864 - 880 kg/m ³
Abrasion resistance (% degradation):	< 1%	< 1%
Critical relative humidity:	~70%	~72%
Angle of repose:	31 degrees	34 degrees



*Pending Registration

SymTRX can be stored, handled and used in the same way as conventional dry fertilizers.



SYMTRX™



Exclusive Sales Agent for SymTRX

For more information on how to purchase SymTRX visit
www.ATPnutrition.ca or call **(877) 538-5511**



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