A New Innovation in Plant Nutrients

Importance of Plant Nutrients

For farmers, turf managers and homeowners, plant nutrients are key to lush grass and bountiful crops. Anuvia™ Plant Nutrients is proud to introduce a new product that can reduce nutrient losses to the environment while increasing nutrient availability for the plant. It slows the release of nutrients for uptake and regulates the conversion of nutrients that may be more susceptible to volatilization and leaching.

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

Our product utilizes the Organic Matrix™ – a unique, natural binding mechanism – to create a natural slow-release product that is homogenous and requires no artificial polymers or coatings. After the product is applied, the Organic Matrix breaks down over time, releasing nutrients that continuously feed plants and reducing loss of nutrients into the environment via volatilization to the atmosphere or leaching into ground water. It represents the first real innovation in the Enhanced Efficiency Fertilizer (EEF) segment in many years.

In a nutshell, our product puts the mechanisms nature perfected to work to create a more effective and efficient plant nutrient delivery system that can be used by farmers, turf managers and homeowners alike.

4R Nutrient Stewardship

The fertilizer industry and Anuvia Plant Nutrients endorse a best management practice system that promotes the use of the **Right fertilizer source**, at the **Right rate**, at the **Right time**, with the **Right placement.** This innovative, science-based approach enhances environmental protection, expands production, increases profitability and improves sustainability.

A Novel Organic Matrix

16-1-2-17S-3Fe (Contains 16% Organics)

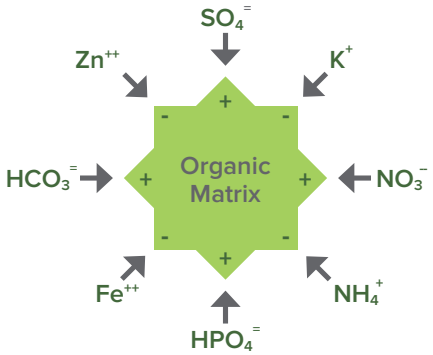
The Organic Matrix is the foundation of our product. It delivers nutrients to the soil and plants in an intuitive, natural way and represents a novel approach to building a highly effective plant nutrient program.

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), sulfur (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 Matrix possesses both positive and negative charges, providing docking sites for nutrient cations and anions. Positive and negative nutrient ions (ammonium NH_4^+, potassium K^+, sulfate $SO_4^=$, ferrous iron Fe^{++}) react with opposite charges, binding to the Organic Matrix of our product just as they would with natural OM in the soil.

The binding of nutrients to the organic matrix 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 Matrix 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 Adsorption (Sequestration) By Organic Matter



Homogenous Formulation

The Organic Matrix allows Anuvia to create a homogenous 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 for farmers, turf managers and homeowners.

Additional Soil & Plant Benefits

Research is ongoing to better measure additional potential benefits in Anuvia products, such as providing amino acids and peptides which may positively impact soil productivity and plant growth.

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Micronutrient Delivery

Micronutrients are a growing need in both specialty and crop production. Numerous companies provide micronutrients to the market in a variety of ways. Anuvia's proprietary product represents an efficient system for delivering desired micronutrients in association with the base nutrient package.

Our product contains trace amounts of secondary micronutrients known to contribute to improved plant performance, such as calcium (Ca), magnesium (Mg), manganese (Mn), copper (Cu) and zinc (Zn). By increasing or adjusting the levels of these important micronutrients to meet the unique needs of different crops, Anuvia can create specialized products for specific crop segments.
Our patented Organic Matrix provides a unique vehicle to uniformly deliver the important micronutrients plants need. Each unit of Anuvia product contains the following trace amounts of micronutrients:

Calcium (Ca)	**.05%**
Copper (Cu)	**.04%**
Magnesium (Mg)	**.2%**
Manganese (Mn)	**.01%**
Zinc (Zn)	**.015%**

Physical Properties

Size guide number (SGN) (3 products):

- Minis 80 SGN
- Intermediates 120 SGN
- Regular 240 SGN

Crush strength (hardness):
6 – 7 lbs

Bulk density (loose pour):
53 – 54 lbs/cu ft or 848-864 kg/m_3

Abrasion resistance (% degradation):
6.5 – 9.9

Critical relative humidity:
70%

Angle of repose:
31%

The Anuvia product can be stored, handled and used in the same way as conventional dry fertilizers. It also has utility in the major specialty and crop production segments.

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Iron 16-1-2-17S-**3Fe**

Iron (Fe) is involved in many biochemical processes in plants, including photosynthesis, respiration (utilization of stored sugars), oxidation-reduction reactions, symbiotic nitrogen fixation by legumes (Rhizobia bacteria) and the formation of chlorophyll. Iron-deficient plants are notoriously chlorotic. Severity of the chlorosis varies with the genetics of the particular plant species. The problem develops as soon as the plants germinate and worsens over time.

Iron in Soil

Plants can only use ferrous iron (Fe^{++}). Most of the Fe in the soil is in the unavailable ferric (Fe^{3+}) form. When Fe is added to the soil in an inorganic form such as ferrous sulfate ($FeSO_4$), normal soil reactions quickly convert it to the ineffective ferric form. High soil pH and low organic matter content contribute to Fe availability and uptake problems. Conditions in the region around plant roots have tremendous effects on Fe availability and uptake.

Iron in Fertilizer

Over the years, many types of Fe fertilizers have been developed, but few have been both effective and economical. Soil applications have been particularly ineffective. Chelated forms of Fe have proven to be the most effective, but the high cost of these solutions have been a limiting factor. Foliar sprays, or frequent applications of very acidic Fe fertilizers, diminish the chlorosis but must be repeated several times during the growing season. By doing this, conditions remain, and the problems reoccur.

The Anuvia Difference: Iron

The bound ferrous Fe in Anuvia's product is less subject to undesirable soil oxidation reactions that would convert it to the unavailable ferric form. Anuvia's Organic Matrix provides an excellent vehicle to effectively deliver Fe in the form that is usable by plants. Iron present in the ferrous form, as both ferrous and ferrous ammonium sulfate, contributes to the available nutrient pool, improves ion exchange and the micro-ecology in the root zone, and increases plant resistance to heat and drought stress.

Nitrogen **16**-1-2-17S-3Fe (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 percent 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 percent N, primarily in the ammonium form. Depending on the situation where the product is applied, this amount will provide sufficient N. The product can also be supplemented by blending with additional N sources.

The Anuvia product releases approximately 65 percent 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 Matrix is freed from attached inorganics and eventually broken down by bacteria in the soil. This process, which has already been perfected by nature, releases N from the Organic Matrix slowly, so plants receive nutrients continuously for a period of time.

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 Matrix 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.

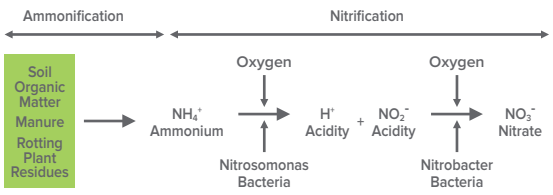
In addition, ammonium can help plants store more of the sugars formed by photosynthesis as starch, resulting in increased yield and better plant health. It has been estimated that utilizing ammonium-N can save 10 to 17 percent of a plant's photosynthetic energy.

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 leached or lost to the environment, allowing farmers, turf managers and homeowners to experience a better return on investment and a have a positive impact on their environment. Eventually, however, ammonium-N released from the organic matrix, if left unused, will 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

Phosphorus 16-**1**-2-17S-3Fe

The Anuvia product contains one percent phosphorus (P), reported as available (P_2O_5). The P that is present comes from the breakdown of microorganisms in organic feedstock. When required, additional P can be provided by blended materials. For some crops, P applications are restricted due to the potential for surface runoff that would carry P into sensitive water bodies, causing algal blooms. The Anuvia product is well suited for these situations due to its low percentage of P.

Potassium 16-1-**2**-17S-3Fe

Plants require potassium (K) in amounts second only to N. It helps plants produce protein and is a critical element of carbohydrate and starch synthesis, making adequate K critical for high-carbohydrate crops such as potatoes, sugar cane, sugar beets and grapes. Plus, K is an enzyme activator; it helps plants withstand moisture stress and helps perennial crops such as alfalfa avoid winter kill by ensuring the plants have enough stored starch in their roots to get through the winter.

And while potassium can be plentiful, the problem is availability – up to 98 percent of K in the soil is unavailable to plants in its existing form. Potassium in soil and fertilizers, referred to as potash, is listed in fertilizer analyses as K_2O. However, plants take up and utilize only the K^+ ion.

The Anuvia Difference: Potassium

The Anuvia product contains a small amount of this essential element in the K cation form (K^+). This serves to supplement the crop's K needs, which will be met by other blended K fertilizers.

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Sulfur 16-1-2-**17S**-3Fe

The Role of Sulfur

Sulfur 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 and 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. Sulfur 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. Sulfur has become more important in crop production in recent years. Anuvia delivers S in the sulfate form.

Sulfur 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: Sulfur

The plant-essential sulfate in the Anuvia product is both immediately and slowly 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. Sulfur binding to the Organic Matrix in the Anuvia product is less leachable under excessive rainfall conditions. Our homogenous product delivers a release of S to plants, which optimizes yield and ensures maximum efficiency.

ANUVIA™ PLANT NUTRIENTS

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