

PRODUCT INFORMATION BULLETIN

NuHumic^{WDG} is a highly concentrated humic acid supplement that combines humic acids with VERGETM, a leading edge dispersing granule. Its novel granule complex introduces a new dimension to humic acid products – providing a reliable source of unparalleled levels of soluble humic acid to the plant rootzone without having to rely on inconsistent geochemical or microbial reactions to breakdown parent materials (such as Leonardite fines) used in many other humic acid granule products.

Humic substances (HS) are a source of concentrated organic matter. They are known to be among the most biochemically active molecules found in soil. They are recognized for both their beneficial effects in soils and substrates (particularly those deficient in organic matter) and their influence on the growth and cultivation of plants. They impart a significant influence on the overall yield, flowering, bud development and resistance to stress.

Humic substances are long-lasting critical components of natural soil systems. They can remain in soil systems for centuries or even millennia. However, it is estimated they can also be destroyed in less than 50 years by some agricultural practices. Or they may exist in very limited amounts in “constructed” or “soilless” substrates such as found in today’s horticultural production media.

Humic substances (HSs) are a series of relatively high-molecular-weight, light-brown- to black-colored, complex and heterogeneous organic polymers formed by secondary synthesis reactions (Stevenson 1982).

These substances are partitioned into three main fractions based on their solubilities in alkaline and acidic extraction solutions. These are *humic acids* (HAs), which comprise the alkali-soluble but acid-insoluble fraction; *fulvic acids*

(FAs), the fraction soluble in both alkali and acid; and the *humins* fraction, which cannot be extracted by either dilute base or acid (Stevenson 1982; Schnitzer 1982).

The term, “Humic acid,” is often used commercially as a general term for humic substances (HS) that contain humic and fulvic acid fractions. Humic substances are formed in what can be described as a complex “open” system where an infinite number of plant materials are available and where an equally infinite number of chemical functional groups can be formed. The variables are so extensive that no two humic acids are the same.

Nature’s Chameleon



Humic substances have been described as being constructed with chameleon-like molecules, that will adopt conformational changes in order to facilitate their adsorption to the soil particle interface or even as surrounding conditions change.

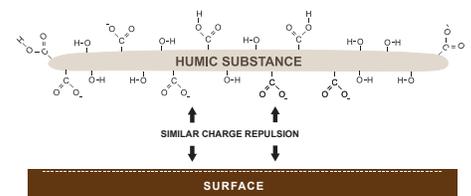
Any change in solution pH, concentration or the presence of metal ions — especially calcium ions — will cause huge changes in the physical makeup of the humic molecules. Even slight changes can cause the molecules to change in orders of magnitude.

Conformational Changes

Humic substances are usually present as negatively charged polymers (due to the presence of weak acid functional groups such as carboxylic acid, –COOH). In water, both non-polar and anionic (negative charge) forms exist in an equilibrium.



Theoretically humic substances should be repelled from the substrate particle surfaces which also have negative charges.



However, humic substances will undergo changes to their molecular configuration to overcome this similar charge repulsion at the substrate interface.

Rootzones with adequate humic acid content also demonstrate improved water infiltration, air : water ratios and uniform water distribution.

Toxic substances. Degradation or inactivation of toxic substances is mediated by humic substances. Humic substances have charged sites on their surfaces which function to attract and inactivate pesticides and other toxic substances. Soil humic substances are capable of either stabilizing or assisting in the degradation of toxic substances.

Features

A small fraction of lower molecular weight components in humic substances can be taken up by plants. The stimulatory effects of humic substances has been correlated with enhanced uptake of macronutrients. Studies of the effects of humic substances on plant growth show positive effects on plant biomass.

There appears to be a close correlation of humic acids and fulvic acids with increases in the permeability and facilitation of mineral elements movement through the cell membranes.

Humic substances also have a very pronounced influence on the growth of plant roots. Root growth is generally more apparent than stimulation of shoot growth.

Humic Acids – A Strong Value Proposition for Sustainable Horticulture Management

Humic substances not only impact the physical, chemical and biological properties of substrates, they also have a direct influence on plants. Their use continues to escalate as they continue to demonstrate economical and ecologically friendly solutions for sustainable horticulture management practices - especially in media with depleted levels of organic matter.

While a number of sources can be considered as raw material for the manufacture of HA-based media conditioners, Leonardite (an oxidized lignite coal containing up to 85% humic acids) is generally preferred (particularly for soil applications).

In order to be soluble, humates in raw form such as lignite or leonardite must go through an alkaline extraction process. Potassium hydroxide-based

extraction is usually favored as it removes more soluble humic acid substances from the raw Leonardite material. Once they have been extracted and concentrated they become soluble in water. By comparison, raw humates can take much longer to break down and become plant available.

Problem Area - Source of HA

The source material for humic acids is quite important. Yet the marketplace presents superintendents with numerous products containing a variety of HA source materials.

The vagaries of selecting soil conditioners containing humic acids continues since source materials are one thing, but the amount of soluble humic substances released from carriers into the soil profile is yet another.

For example, two manufacturers may source the same high quality raw Leonardite material containing 85% humic acids. But each product manufacturer may (and often do) choose to extract the soluble fractions (humic and fulvic acid) using proprietary methods that result in different percentages of soluble extracted humic acids. Still others may choose to use a combination of raw material with extracts.

It should be noted that unless HAs are soluble, they are inactive in soils and unavailable to plants. **So regardless of the stated source material and humic acid content, the key consideration is the percent of soluble humic acids released from the soil conditioner in the soil.**

Now consider that each manufacturer is using their own granular material -- each of which is capable of loading a different amount of active ingredient on the carrier and each has its own release characteristics.

Since specific standards for products containing humic substances are not yet universally established for registration purposes, growers should feel free to investigate and ask questions regarding any product's source materials and percent of humic acids released in the media before making a decision.

Problem Area - Granular Formulations

Many formulations are dusty and are composed of granules with uneven

size, making them almost impossible to handle. Variable granule sizes also adversely affect the physical distribution of the dry materials, resulting in applications with non-uniform disbursement of the humic acid active ingredients within the rootzone.

There are also reported problems with the uncertainty associated with products that must rely on microbial activity to convert the raw parent material to soluble humic fractions. There is always a degree of uncertainty associated with biological release of active ingredients.

Today dispersible dry granular humic soil conditioner formulations have come a long way towards addressing dust issues non-uniform granule size. Issues dealing with both the uniformity of active ingredient dispersion and the actual levels of soluble humic acid following application remain with some formulations.



With the introduction of NuHumic^{WDG}, innovative concepts and leading edge technologies are moved to reality. More importantly, the use of NuHumic^{WDG} allows the horticulture manager to profit from a product that redefines humic acid performance.

NuHumic^{WDG} humic acid fractions improve the media structure and enrich the properties of substrates by increasing the exchange capacity and buffering qualities, increasing the retention of applied fertilizers in the soil profile, promoting the chelation of many elements and improving their plant uptake.

Source of HA

Only Leonardite containing high percentages of humic acid is used in the production of NuHumic^{WDG}.

NuHumic^{WDG} does not rely on the uncertainties associated with the need for precursors, biochemical reactions and enhanced microbial populations to solubilize its humic acids.

Granular Formulations

NuHumic^{WDG} granules are a novel source of soluble bioactive components of high quality humates.

The NuHumic^{WDG} granules incorporate a patented clay and leonardite complex within the proprietary Verge dispersing granule's composition.

verge™

Verge is the product of advanced processing techniques and a natural raw material that are combined to create innovative granules with unsurpassed function, uniformity and appearance.

Improved handling and reduced dust exposure

Verge has a durable outer core and spherical shape that prevents tiny fragments from breaking off, unlike traditional, irregular-shaped granules that rub together during handling, transportation, and formulation.

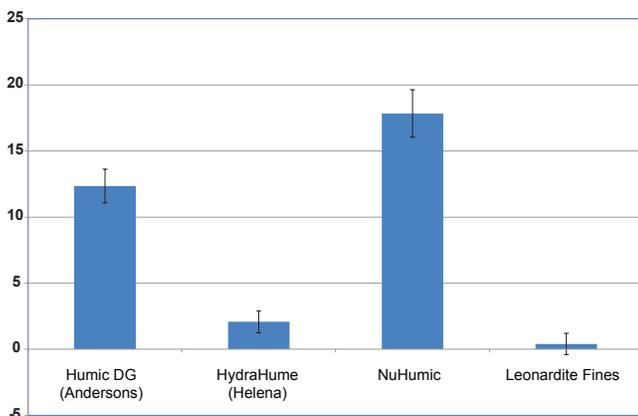
Growers using NuHumic WDG with Verge technology should experience a formulated product with improved handling and reduced dust exposure.

Uniform distribution of granules and active ingredient

Application tests using a rotary spreader show that Verge granules are more evenly distributed across the swath width regardless of distance from the spreader.

This results in a uniform distribution of granules and active ingredient across the treatment area.

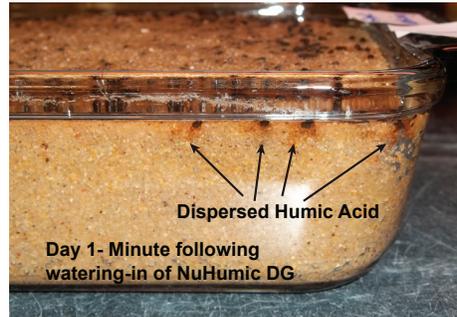
Percent Humic Acid Released in Water



Results of water extraction test. Results determined using modified version of the California Method for Determining Humic Acid.

Rapid Release HA Delivery System

The NuHumic^{WDG} Verge granule has been engineered to rapidly release its high humic acid content following a watering-in cycle.



Levels of humic acids sufficient to initiate reactions needed to improve the soil structure, enrich the properties of soil and provide benefits to plants are quickly established with the use of NuHumic^{WDG}.



Darker brown color of NuHumic^{WDG} sample indicates a higher percentage of soluble humic acids in water extract.

NuHumic^{WDG}

using **verge** dispersible granular technology

and fertilizers

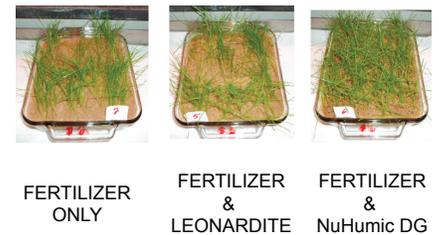
NuHumic^{WDG} is well suited for use with dry fertilizers. When moistened, the NuHumic^{WDG} granules quickly dissolve to release their soluble humic acids. The dispersed humic acids surround the fertilizer particles.

Microbes are attracted to the HA carbon source "coating" and the fertilizer is digested by these microbial colonies.

This biochemical process promotes the retention of the fertilizer in the root zone so that leaching is minimized.

Humic acid chelation of fertilizer and trace elements also markedly increases plant uptake thereby providing more nutrients to the plant and a better yield.

Test Results
Rye Grass
Study #1
21 Days Following Application



NuHumic^{WDG}

using **verge** dispersible granular technology

Redefining Humic Acid Performance

Additional information and suggested usage charts are available at www.hurricanehydroponics.com.



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