



HUMIC SOLUTIONS

FROM THE GROUND UP

Humic DG™ | **Black Gypsum** DG®

THE POWER OF HUMIC ACID

According to Dr. Robert E. Pettit, Emeritus Associate Professor at Texas A&M University, "Humic substances are recognized by most soil scientists and agronomists as the most important component of a healthy, fertile soil."

A HISTORY OF HUMIC SUBSTANCES

Humus, the stable form of organic matter, is the primary source of carbon in the soil. Soils rich in humus contain an abundance of biological activity that allows for the oxidization of crop residues and animal manures. Soils across the United States contain varying levels of humus. Research has shown agricultural practices focused on maximum output can reduce humus and beneficial bacteria in soil, causing the soil to lose some of its natural productivity and fertility.

Just as humus is formed in rich, productive soils, humates are naturally occurring deposits of highly oxidized organic material that are buried deep in the earth's surface. Today's growers are looking for ways to utilize precision production practices to bridge the organic matter gap in the soil. Once mined, humates can provide a concentrated source of available carbon to build organic matter in the soil.

Humates, or humic substances, can be divided into three major humic fractions: fulvic acids, humic acids, and humins. Each of these fractions has some similar and some unique physical and chemical properties that contribute to their effectiveness and complement fertilizer programs.

THE THREE HUMIC FRACTIONS

NATURALLY DERIVED BIO-ORGANIC CARBON SOURCES



Foliar Uptake

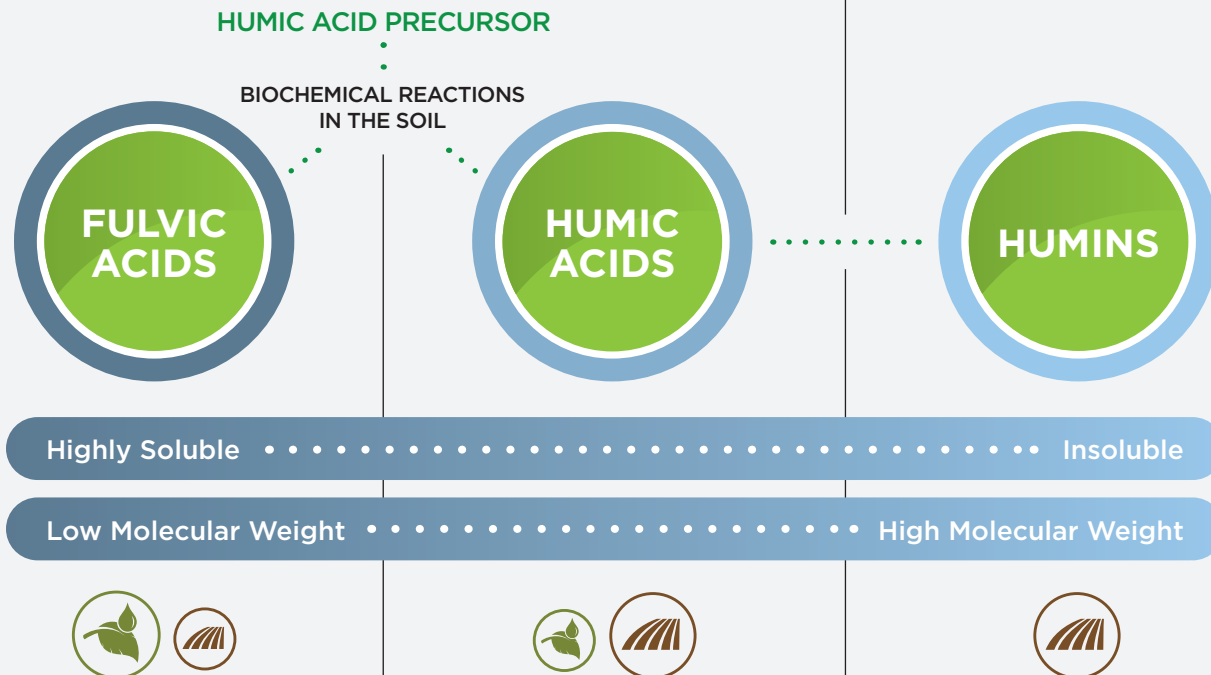


Soil Uptake

FULVIC ACIDS are lowest in molecular weight and are the most soluble of the three fractions. They can be readily absorbed by leaves and roots, making them well suited for foliar application. Fulvic acids enhance the absorption of nutrients and the efficiency of plant metabolic reactions. Since fulvic acids last up to thirty days in the soil (depending on weather conditions), they are also an ideal enhancement for an in-furrow row starter.

HUMIC ACIDS are higher in molecular weight than fulvic acids, but lower than humins, and are moderately soluble. They have a high cation exchange capacity (CEC) and are typically more efficient as a soil application. Humic acid molecules chelate many essential nutrients and help stimulate soil microbiology. Humic acids have limited benefit as a foliar application.

HUMINS are highest in molecular weight and are the least soluble of the three fractions. This allows them to persist in the soil over time. They contain high levels of carbon and have large nutrient holding capacity. Humins are best used through soil application.



In addition to the three humic fractions, humic products utilizing The Andersons Dispersing Granule (DG) technology contains a unique and powerful ingredient we call humic acid precursor. **HUMIC ACID PRECURSOR** contains a soluble form of organic carbon that releases into the soil as DG granules disperse. Through biochemical reactions, it is transformed into humic and fulvic acids, enhancing nutrient uptake and improving soil health.

WHAT IS HUMIC ACID?

When you think of humic acid, think carbon. Carbon is one of 17 essential elements required by plants for optimal growth. Oxidized lignite, also known as Leonardite, is the carbon source in The Andersons humic solutions. Similar to carbon's functions in the soil, humic acid is a natural soil conditioner that acts as a chelator and microbial stimulator. Its unique carbon matrix of carboxyl and hydroxyl groups includes a high concentration of organic acids and trace minerals.

SOIL ANALYSIS: NUMBERS DON'T LIE

The application of humic substances has the potential to impact soil qualities including organic matter, soil texture, and cation exchange capacity (CEC). Because many soils' organic matter levels have degraded in recent years, resulting in lower CEC, regular soil testing is a vital tool for indicating the need to build organic matter and available carbon. Carbon-based product application is becoming an increasingly accepted and economical farm management strategy. The Andersons humic solutions can be a powerful tool in this effort.

INCREASED CARBON = INCREASED MICROBES = INCREASED NUTRIENT CYCLING AND NUTRIENT EFFICIENCY

Humic acid provides the carbon food source which stimulates soil microbiology, leading to a positive impact on soil pH. Carbon is an essential plant nutrient that provides soil microbes with a food source and habitat.

Microbes support soil and overall plant health by making nutrients available to plants in the inorganic form. Humic acid is the primary food source to grow populations of beneficial soil fungi, including mycorrhizal fungi. When compared with soil bacteria, soil fungi do more of the heavy lifting in building humus, improving soil structure, and fighting predatory fungi. This is especially true in the root zone, where fungi work to increase root size and vigor, while reducing susceptibility to plant pests and stress.

Humic acid also activates key soil chemistry to react with nutrients through chelation and complexation. The larger molecules of humic acids physically modify soil structure by binding soil particles together (clay-organic matter complexes). This increases soil aggregate stability and improves water infiltration, nutrient holding capacity, aeration, soil tilth, and workability. This also increases the availability of key micronutrients to the plant.



INCREASE CROP QUANTITY AND QUALITY¹

Over a six year study, USDA researchers found the application of humates yielded average increases of 5-15 bushels per acre for corn and 2-7 bushels per acre for soybeans. Other impressive findings included increases in corn stover proportional to those of grain and an increase in root growth by 15-25%. Research conducted in a variety of conditions and soils has shown that a positive return on investment can be expected when using humic products from the right source, at the right rate, at the right time, and in the right place.



¹ Dobberstein, John. Humics Emerging as a Tool to Increase Root Growth, Yields. No-Till Farmer. May 2016.

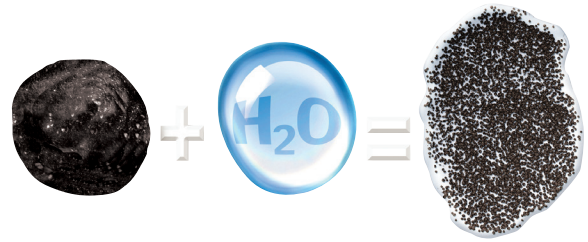
Product	Form	Application Method	% Humic Acid	Fulvic Acid	Humic Acid	Humin	Humic Acid Precursor
Humic DG™	Dispersing Granule	Dry Applied	62%	X	X	X	X
Black Gypsum DG®	Dispersing Granule	Dry Applied	21%	X	X	X	X

DISPERSIBLE GRANULES

HUMIC DG™ | BLACK GYPSUM DG®

DISPERSIBLE

The Andersons Dispersing Granule (DG) technology creates spherical, dust free, and ultra dry particles. These granules rapidly disperse upon contact with soil moisture, creating tens of thousands of microparticles, which greatly increases surface area and allows for faster breakdown and availability of the humic substances.



SPREADABLE

DG technology creates uniform, spherical granules that are clean, dust free, and easy to handle (left). DG granules can be spread evenly and consistently through all types of application equipment. Competitor's dry humic acid product is dusty, non uniform and contains up to 20% moisture, making it hard to handle and difficult to spread (right).



BLENDABLE

DG granules are designed to be ultra dry, which allows for successful blending with all types of dry fertilizers, including urea.



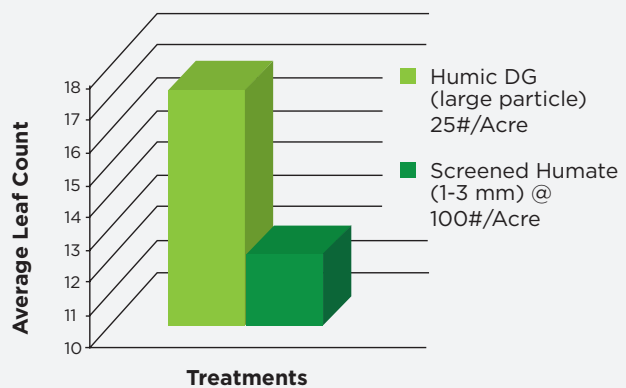
4X AS EFFECTIVE!

Humic DG granules provide better performance than screened humate, at one fourth the typical rate.

DG TECHNOLOGY IMPROVES EFFICACY

HUMIC DG™ VS. SCREENED HUMATE

Wheat Leaf Count at 62 Days After Treatment
(grown in sand medium)



Greater leaf count in wheat treated with 25 #/A Humic DG compared to those treated with 100 #/A screened humate.

Humic¹²DG™

- ✓ Fulvic Acid
- ✓ Humic Acid
- ✓ Humin
- ✓ Humic Acid Precursor

Humic DG granules contain 62% humic acid and 10% humic acid precursor. DG technology creates a dust free, spherical, ultra dry particle that rapidly disperses into thousands of microparticles upon contact with moisture. Humic DG granules' increased surface area, when compared to screened humate, creates greater availability to the plant. It performs in a wide range of conditions and soil types, independent of application method and feature dual carbon sources that are unique to The Andersons granular humic products. Humic DG contains the full spectrum of humic substances: fulvic acid, humic acid, and humin, as well as humic acid precursor.



NON-PLANT FOOD INGREDIENTS

Soil Amending Ingredient
 Humic Acid* 62.0%
 Total Other Ingredients** 38.0%

*Derived from Leonardite
 **Inactive components of Leonardite, proprietary binding agent, water

PHYSICAL PROPERTIES

pH.....3.2-3.9
 Density.....43.0 lbs/ft³
 Carbon Content..... 45-47%
 Color..... Black

APPLICATION

	Application	Use Rate (per acre)	Timing
Row crops, specialty crops, legumes	Soil	4-10 pounds in furrow; 40 pounds maintenance or corrective	Post harvest up through planting

PRODUCT USAGE INFORMATION

- ✓ **Broadcast**
- ✓ **Air Drill/Strip Till**
- ✓ **In-Furrow**
- ✓ **2x2**

FEATURES & BENEFITS

- Flexible application allows for use as a stand alone product or in blends with granular fertilizers
- 4X more efficient than screened humate
- Enhances nitrogen and phosphorus efficiency
- Promotes good soil structure and increases water holding capacity
- Enhances root system development
- Easy to handle and spread through all types of application equipment
- Economical application cost per acre compared to liquid and screened humates

FREQUENTLY ASKED QUESTIONS

- Q: How does the humic acid content of Humic DG granules compare to other liquid and dry humic acid products?**
A: As a granular soil amendment with 62% humic acid, Humic DG granules compare favorably to dry, granular, and powdered humic acid products. The humic acid is more effective in the soil than most of the competitive products due to the self-incorporating microparticles that provide greater surface area for soil activity and contain all three humic fractions.
- Q: How does humic acid affect nitrogen volatilization?**
A: The high reactivity of humic acid retains the nitrogen in the ammonium form, preventing it from volatilizing to ammonia and not being utilized by the plant.
- Q: Do humic acids influence phosphorus activity in the soil?**
A: Yes, increased phosphorus availability has been observed in academic studies. Humic acid impacts both short-term and long-term phosphorus availability.



Left: Untreated
 Right: Humic DG (15 lb/A broadcast)

Black Gypsum DG[®]

- ✓ Fulvic Acid
- ✓ Humic Acid
- ✓ Humin
- ✓ Humic Acid Precursor

Black Gypsum DG granules are homogenous and combine natural gypsum and humic substances to form a unique bio-amendment. DG technology creates a dust-free, spherical, ultra-dry granule that rapidly disperses into thousands of microparticles upon contact with moisture. These microparticles deliver calcium, sulfur, and carbon directly into the soil. The DG technology allows for reduced application rates, as compared to other agricultural-grade gypsum products, which makes this a very economical soil amendment.



GUARANTEED ANALYSIS

Calcium Sulfate Dihydrate (CaSO ₄ • 2H ₂ O).....	48.0%
Calcium (Ca)	12.0%
Sulfur (S)	8.9%
8.9%...Combined Sulfur	

Plant nutrients derived from calcium sulfate and mined gypsum

NON-PLANT FOOD INGREDIENTS

21% humic acid derived from leonardite

PHYSICAL PROPERTIES

Density.....59.2 lbs/ft³

APPLICATION

Application	Rate per acre
Row crops, specialty crops, horticulture crops	150-300 lbs.*
Soil Detoxification	600-800 lbs.

Supplies 15-30 pounds of humic acid per acre

PRODUCT USAGE INFORMATION

- ✓ **Broadcast**
- ✓ **Air Drill/Strip Till**
- ✓ **In-Furrow**
- ✓ **2x2**

FEATURES & BENEFITS

- Contains 48.0% calcium sulfate dihydrate (CaSO₄•2H₂O)
 - » Water soluble
 - » Increases calcium and sulfur without changing soil pH
- 21% humic acid from oxidized lignite (leonardite)
- Improves root development, plant nutrient uptake, and phosphorus stability
- Provides secondary nutrients (calcium and sulfur)
- Enhances soil health by stimulating soil microbial populations and relieving compaction and salinity
- Blends with fertilizer or can be used alone

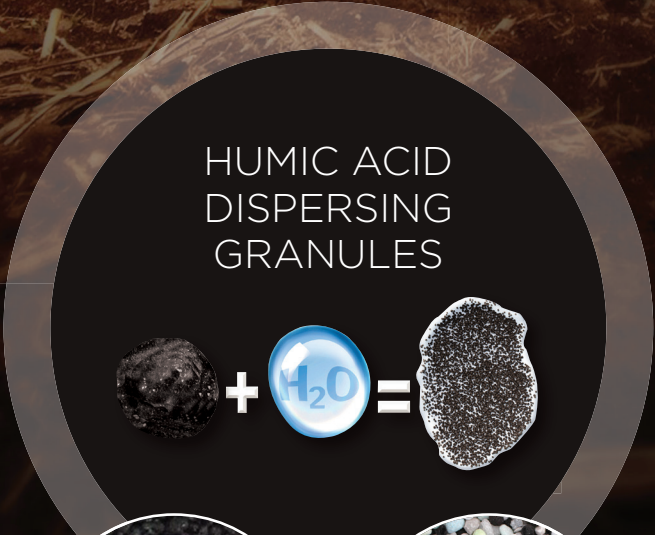
FREQUENTLY ASKED QUESTIONS

- Q: What advantages do Black Gypsum DG granules have over other types of standard gypsum?**
- A: Our gypsum source is calcium sulfate dihydrate (CaSO₄•2H₂O), which, with two extra water molecules, is more water soluble than the anhydrite form (CaSO₄). These extra molecules make calcium and sulfur more readily available to the plant as soon as Black Gypsum DG granules enter the soil solution. While a plant receiving the anhydrite form of calcium would be forced to wait days or weeks to take advantage of the applied nutrients, a plant receiving an application of Black Gypsum DG granules begins to utilize the nutrients in hours. Black Gypsum DG granules deliver 21% humic acid in every application. This humate is quick acting, and provides further chelation of applied and existing nutrients, increasing their availability to the plant.
- Q: How does the application of carbon enhance soil health?**
- A: Humic substances contain carbon, which will provide soil microbes with a food source and habitat, allowing them to flourish. As a result, essential macro and micronutrients held in the soil will become more available, and additional fertility will be utilized more efficiently. Humic acids also have a high cation exchange capacity, which enhances the soil's ability to hold nutrients.

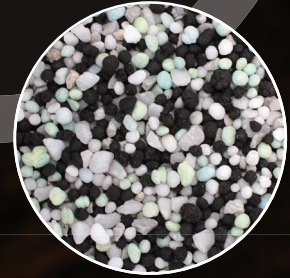


AIR DRILL READY

Humic DG and Black Gypsum DG are unique soil conditioners. Patented dispersing granules are the perfect match for an air drill seeder. The uniform particles provide precise placement of humic acid into the seed bed. Humic DG and Black Gypsum DG can also be blended with fertilizer.



DG GRANULES



DG GRANULES BLENDED
WITH UREA FERTILIZER

Diversification, Growth, **And** *Beyond*

Publicly traded since 1996 (NASDAQ: ANDE), The Andersons is a diversified company conducting business across North America in the grain, ethanol, plant nutrient and logistics sectors.

The Andersons is taking the same dedication and deep market knowledge that filled our elevators with grain almost 70 years ago to create fresh ways to serve our customers. We're building a cutting edge network of transportation and logistics facilities that maximize our reach. We're expanding into new markets using patented technology to take our businesses further, faster. We're developing a line of products that make the grass greener and the yield bigger. We're repurposing today's resources into useful solutions for tomorrow and joining the quest for a world run on renewable energy. We're finding a way to compete on a global level and still feel like a small business, and never losing sight of our simple goal of serving God by serving others.

We'll be fair and honest, tried and true, because those are the things that got us here. The Andersons story has as much to do with ingenuity as it does with legacy. A story about enduring relationships. A story about a team that is going beyond the ordinary; beyond the status quo; and beyond expectations.



Our Mission:

We firmly believe that our Company is a powerful vehicle through which we channel our time, talent, and energy in pursuit of the fundamental goal of serving God by serving others. Through our collective action, we greatly magnify the impact of our individual efforts to:

- Provide extraordinary service to our customers
- Help each other improve
- Support our communities
- Increase the value of our Company



www.AndersonsHumates.com

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