Sarasota International Trade Center
172 Sarasota Center Boulevard
Sarasota, FL 34240
800-628-6373, 941-917-0670
888-386-4478, 941-917-0671 Fax
info@horticulturalalliance.com
http://www.horticulturalalliance.com

DIEHARD™ HUMATE SP

A New, High Performance Proprietary Potassium Humate

As both an acid and alkaline soluble potassium humate, DIEHARD™ Humate SP is truly unique.

Unlike any other available humate, DIEHARD™ Humate SP completely dissolves when added directly to fertilizer, micronutrient, or biostimulant formulations of any pH. It allows the user to apply this humate in direct tank mix, fertigation, and drip irrigation or acid soil applications unacceptable for conventional products.

DIEHARD™ SP Humate Advantages Over Conventional Humates:

Full Water Solubility Over a Broad pH Range
- Both acid & alkaline soluble - pH <0.5 to pH 14.0
- Solutions will not precipitate in phosphoric acid

Versatile Product Form
- Available as a completely soluble powder.

High Rio-available Humic Acid Assay
- Proprietary extraction and modification process maximizes humate content
- Made from the highest quality North American leonardite.
- High % humate content provides superior performance on a pound per pound basis.
- Low solution viscosity at high humic acid concentrations provides for easy mixing and pumping

Superior Redissolving Properties
- High solubility prevents build up of insoluble sludges that normally clog lines under low flow
- Rapidly redissolves and wets out without leaving insoluble clumps
- Dissolved powder performs equivalently to liquid product

Excellent Salt Tolerance
- Superior compatibility in all types of fertilizer and pesticide formulations
- Does not precipitate out of solution like conventional humates
- Effective component in a wide-range of NPK, nutrient or combination fertilizer formulations

High Ion Exchange Capacity
- Better stability under varying soil pH conditions
- Better at complexing metals
- Makes micronutrients more readily available to plants

Complexes Micronutrients
- Solution complexes to form 10% Zn, 7% Mn, 5% Cu, 5% Fe, 5% Ca, and 4% Mg nutrient solutions.

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Highly Effective Biological Properties:

The solubility and high ion exchange capacity of DIEHARD™ Humate SP results from the increased number of functional sites available for complexation to metals and cations in the soil. Three independent growth studies demonstrate these superior qualities. The first study[1], conducted on corn, demonstrated DIEHARD™ SP's effectiveness as a humic acid product.

The second study[2], conducted on tomatoes in hydroponic media, surpassed expectations - Tomato transplants remained vigorous while transplants in the control initially wilted. After 4 days growth, DIEHARD™ Humate SP treated plants exhibited greater than six times the root system growth than found in the control. When used at 2/3 the application rate of the competitive conventional humate, DIEHARD™ Humate SP performance was equivalent to the conventional humate. The third study[3], conducted on bentgrass, demonstrated that not only does DIEHARD™ Humate SP perform as well as the competitive conventional humate, but it also increased the health of the sod under stress conditions relative to conventional humates.

Results demonstrating DIEHARD™ Humate SP's ability to maintain sod health.

The following results are from a growth study on mature Penncross creeping bentgrass at the Virginia Tech Turfgrass Research Center. The properties of bentgrass sod were measured in October after the stress period of summer growth (July - September when heat and drought are highest). Sod health was ascertained by the percent increase in the measured property of the treated plot over that of an untreated control plot.

Bentgrass Sod Properties (% Improvement in Sod health parameters vs. no humate treatment)

Humate Treatment	DIEHARD™ Humate SP		Competitive Humate	
Fertility Treatment*	Hi	Low	Hi	Low
Parameter Measured	% Increase		% Increase	
Clipping Yield	0.00	42.00	0.00	30.00
Color Rating	7.00	26.00	5.00	12.00
Photosynthetic Activity[1]	1.00	1.00	-4.00	1.00
Chlorophyll Capacity[2]	-2.00	21.00	-4.00	9.00
Antioxidant Activity[1,2]	345.00	27.00	210.00	-18.00

* High fertilizer treatment: 5OOg N, 163g P_20_5, 260g K_2O /1000 ft^2/ month
Low fertilizer treatment: 200g N, 65g P_20_5, 130g K_20 /1000 ft^2/ month

References:

1. Study conducted in 1996 by Agrobiology Research, Inc.

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2. Study conducted ii' 1996 by North Carolina State University, Department of Horticultural Science, by D. Sanders and P. Nelson.
3. a) Bjorkman, 0., Demming, B., "Photon Yield of O_2 Evolution and Chlorophyll Fluorescence Characteristics at 77K Among Vascular Plants of Diverse Origins.", *Planta*, 1987, 170, 489-504.
b) G. Papageorgiou, "Chlorophyll Fluorescence: An Intrinsic Probe of Photosyn- thesis." in Govindyee, *Bioenergetics of Photosynthesis*, Academic Press, NY, 1975, 320-66.

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Specifications of DIEHARD™ HUMATE SP Soluble

DIEHARD™ HUMATE SP is potassium-sodium humate powder that acts a natural soil and plant growth stimulant. It is a dark brown to black powder with an 85-95% humic acid content. DIEHARD™ HUMATE SP is 88-92% soluble in water. It is easily assimilated by plants and some of its main functions include improving plant immunity, improving plant metabolism, improving plant root development, improving the supply of plant nutritional elements and increasing the formation of ferments. DIEHARD™ HUMATE SP promotes the increased accumulation of chlorophyll, sugar, amino acids and more and improves the efficiency of nitrogen utilization, allowing for reduced fertilizer rates. One of the primary actions of DIEHARD™ HUMATE SP is to increase the plant's ability to withstand the stresses of heat, drought, cold, disease, insect and other types of environmental or cultural pressures. DIEHARD™ HUMATE SP also increases general plant productivity, in terms of yield, as well as plant stem strength. Within the soil, DIEHARD™ HUMATE SP stimulates soil microorganisms, promoting Humus formation.

Differences from other Humate products:

- *The optimal combination of Potassium and Sodium Humic Acid Salts, which allows for the full and effective use of the properties of our DIEHARD™ HUMATE SP in Plant nutrition.*
- *The presence of soluble Silicon (Si) compounds in DIEHARD™ HUMATE SP provides plants with the nutrition for stronger stems, making them more resistant to natural stress situations and insects.*

Application rates: (Please refer to the Horticultural Alliance, Inc. DIEHARD™ HUMATE SP Usage Guide that is most relevant to what you are growing. Horticultural Alliance, Inc. created these guides to empower each user with the knowledge needed to properly utilize our new humate products for the improvement of plants and soils. Although it may require repeated readings, taking the time to study the usage guide you need will provide you with the ability to increase your crop's health and performance and to reduce your overall input costs.)

Continued Next Page

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General Specifications:

Content of soluble humic acids		85% - 90%	
Moisture		11% - 15%	
Insoluble part (on dry basis)		9% - 12 %	
Solubility in water		88% - 92%	
pH in 0.01% solution		8.5 - 9.2	
Organic carbon (active carbon)		53%	
Spectrum Analysis Data:			
Element	**%**	**Element**	**ppm**
Si	2.25	Ni	1
Al	1.25	Co	9
Mg	0.70	V	8
Ca	5.0	Cr	1.5
Fe	2.0	Mo	70
Na	4.0	Zr	8
K	5.0	Nb	4.5
Ti	0.35	Cu	4
P	0.05	Pb	2
B	0.05	Ag	2
Ba	0.02	Ga	9
Sr	0.03	Y	1
Mn	0.012	Zn	70
Other elements including Cd, Hg, and Ar were not found			

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How to Make a Liquid Concentrate From DIEHARD™ Humate SP

One of the most common uses of DIEHARD™ Humate SP is to mix it with water to form a solution that can then be applied to soil or plants through liquid systems. Although it is relatively easy to mix, there are a few important factors to consider when using the DIEHARD™ HUMATE SP in this manner.

On average, the DIEHARD™ HUMATE SP powder is 90% soluble in water, with the remainder being insoluble mineral content that will go into suspension when mixed with liquids. Once any agitation is stopped, the insoluble part will slowly begin to settle to the bottom of the mixing tank. Although the insoluble portion is very fine and will not clog nozzles, careful consideration should be given to the specifics of each application before adding DIEHARD™ HUMATE SP directly into the final spray or irrigation tank. To avoid any possible issues with the sediment, it is recommended that the DIEHARD™ HUMATE SP be mixed in a separate container from the final spray or irrigation tank and allowed to settle before it is placed into the spray or irrigation system.

The standard particle sizing of DIEHARD™ HUMATE SP ranges between 50 and 150 microns, with a small portion of ultra-fine particles that are smaller than 50 microns. The smaller the particles, the longer it takes for them to settle out of suspension to the bottom of the tank. Although a majority of the insoluble material will settle within hours, the complete settlement process could take up to 30 days, depending on the concentration of powder being mixed into solution. The higher the concentration that is mixed, the thicker the solution will become, and the longer it will take for the ultra-fine particles to settle to the bottom of the tank.

For simplicity, all of the rates in the mixing chart at the bottom are based on the addition of powder to full gallons of water. For example, if you wanted to make 50 gallons of 6% concentrate, you would fill the tank to 50 gallons and then add 0.710 pounds of DIEHARD™ HUMATE SP per gallon (35.5 pounds total) into the tank. The addition of DIEHARD™ HUMATE SP will cause the total volume in the tank to increase slightly beyond 50 gallons, but the concentration will be correct. If using a non-closed mixing system, be sure to leave at least ¼ of the mixing tank's full capacity for the addition of the powder and the ability to mix it without splashing.

When mixing, any type of container will work but some type of agitation must be used. The better the agitation, the more rapid the powder will mix into solution. We suggest using room temperature water, as the DIEHARD™ HUMATE SP will dissolve more slowly in very cold water. Always add the desired amount of water to the tank first and begin full agitation before adding any DIEHARD™ HUMATE SP.

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If you will be manually adding the powder into a mixing tank, **slowly** add the DIEHARD™ HUMATE SP into the tank, ensuring it is being pulled into solution as quickly as you are pouring it into the tank. Do not dump the powder into the tank all at once or clumps could form that will require manually breaking them up to get them to dissolve! If the powder begins to settle on top, pause adding more powder until the top of the tank is all liquid again. Once all of the powder is added, continue agitation until the solution appears uniform. The exact time required will vary greatly based on the type and strength of agitation as well as the concentration being made. The higher the concentration, the longer it will take to fully dissolve the powder.

The **most effective** method for making a liquid from DIEHARD™ HUMATE SP is to use a Venturi system in conjunction with a recirculating transfer pump (pacer pump). To do this, simply connect the transfer pump (usually rated at 50 to 200 gallons per minute) to the outlet port of any holding tank and connect the output hosing from the pump to an inlet port on the same holding tank (usually near the top). If the holding tank does not have an inlet port, it is safer to create one rather than to try and hold the out put hose inside the top lid of the tank. Take a Venturi (available in most farm or irrigation supply stores) and connect it to the suction side of the transfer pump. A Venturi has a port opening that creates a pressure differential and as the liquid is pulled through the Venturi by the transfer pump, the pressure differential will pull any material added through the port and forcefully mix the material with the liquid from the holding tank. It may be necessary to add some sort of hopper or funnel that connects into the Venturi port opening so that a large enough volume of powder can be added at one time. We recommend a one cubic foot size hopper, which will hold approximately one 55-pound box of DIEHARD™ HUMATE SP at a time. One the pump begins to circulate the liquid in the holding tank, the pressure will begin to suck the powder into solution and within minutes a complete 55-pound box of DIEHARD™ HUMATE SP can be fully incorporated into solution.

When mixing the DIEHARD™ HUMATE SP with any method, it is important to minimize the introduction of air into the system, or excessive foaming could occur. If using a form of paddle agitation, make sure the paddle(s) are turning as low in the tank as possible and that the water level is well above the top of the paddle blades. If using pump agitation, remove any inline filters and be sure that both the suction and return lines are fully submerged at all times or foaming may occur. It is best to have the suction line located on the bottom of the tank or as low on the side of the tank as possible. Use an appropriate pump for the size tank you are using. Generally, a pump that will circulate the entire tank every 2-5 minutes will work well. Do not attempt to use an air pump to bubble circulate the tank or excessive foaming will occur!

Once the solution is mixed, stop the agitation and allow the product to settle (if desired). If you do not intend to allow the insoluble part to settle, we recommend that you completely use all of the finished solution you intend to spray or irrigate with so that there is nothing left in the final spray or irrigation tank to settle out. If the liquid mixing

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tank is left to settle, allow sufficient time for the insoluble portion to fall to the bottom of the tank (at least overnight). Then pump the liquid out from the top of the mixing tank to prevent sucking the sediment up from the bottom of the mixing tank. Once the liquid is removed down to the sediment level, clean and wash the mixing tank before making a new batch of liquid. The sediment material is excellent for mixing with composts or potting mixes and should not be considered waste!

Desired humic acid concentration	Amount of DIEHARD™ HUMATE SP to add to each full gallon of water	Approximate time required for COMPLETE settlement
0.005%	**0.25 grams**	Almost no sediment by volume. Can often be mixed directly in spray or irrigation tank.
0.01%	**0.50 grams**	
0.1%	**5.00 grams**	
1%	**0.112 pounds**	Allow to settle overnight. For completely clean solution allow to settle for 1 to 2 days.
2%	**0.226 pounds**	
3%	**0.343 pounds**	
4%	**0.462 pounds**	Allow to settle overnight. For completely clean solution allow to settle for 3-7 days.
5%	**0.585 pounds**	
6%	**0.710 pounds**	
7%	**0.839 pounds**	Allow to settle for 2 days. For completely clean solution, allow to settle for 2 weeks.
8%	**0.971 pounds**	
9%	**1.107 pounds**	
10%	**1.246 pounds**	Allow to settle for 3 to 7 days. For completely clean solution, allow to settle for 30 days.
11%	**1.388 pounds**	
12%	**1.535 pounds**	

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DIEHARD™ Humate SP
(Acid Soluble Potassium Humate)

Description:
DIEHARD™ Humate SP is a modified potassium humate derived from leonardite. Made by a patented process the product has superior solubility in low pH systems.

Typical Analysis:

9.0	pH
16%	Soluble potash (K_2O)
8%	Sulfur
35%	Carbon
33%	Oxygen
3%	Hydrogen
70%	Organic acids ($BaCL_2$ Method)

- 50% derived from Humic acids
- 20% derived from Fulvic acids

Benefits:

- Improves soil structure
- Increases nutrient exchange and retention
- Stimulates microbial growth
- Improves nutrient absorption
- Stabilizes pH
- Increases stress tolerance
- Increases root development
- Improves seed germination

DIEHARD™ SP Humic vs. Conventional Humates:

Property	DIEHARD™ SP Humate	Conventional Humate
Alkali soluble	Yes	Yes
Acid soluble	Yes	No
Water solubility	Complete	Varies
Fertilizer Compatible	Yes	Maybe

Versatility:
The unique nature of DIEHARD™ Humate SP makes it one of the most versatile potassium humates available today. The product can be mixed and applied with most types of fertilizers (including acidic fertilizers), pesticides, seed treatments and micronutrients.

Recommended Dosages:
Garden Vegetables and Strawberries - 1 lb. per acre per treatment; three treatments per year in irrigation water
Fruits – 1 lb. per acre per treatment; minimum of three treatments per year in irrigation water
Citrus – 1 lb. per acre per treatment; minimum of three treatments per year in irrigation water
Banana – 10 lbs. per acre per treatment; minimum of five treatments per year in irrigation water at equal intervals
Vineyard Grape – ½ lb. per acre per treatment; minimum of three treatments per year in irrigation water
Corn – 1- 2 ½ lbs. per acre per treatment; minimum of two treatments per year in irrigation water
Olive – ½ lb. per acre per treatment; minimum of two treatments per year in irrigation water
Sorghum – 1- 2 ½ lbs. per acre per treatment; minimum of two treatments per year in irrigation water
Turf – 1.5 pounds per acre, 3-4 times per year
Ornamentals – 3 lbs. per acre per treatment; weekly treatments in irrigation water
Drip irrigation – 3 lbs. per acre per treatment; weekly treatments
Soil fertilizers – 1 lb. per acre per treatment to promote adsorption
Leaf fertilizers – ½ lb. per acre per treatment to promote adsorption

Physical Properties:
Powder

% Solubility in water	98 min.
% Moisture	10 max.
Color:	Black

Liquid

Density:	9.3 lbs/gallon

Powder to Liquid Application Ratio: 1 lb. powder equals 1 gallon liquid at 8% concentration.

Packaging:
Powder – 50 lb. net weight multi-wall kraft bags or non-returnable bulk bags