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Components Used In DIEHARD™ Mycorrhizal "Cocktails"

- I. **Mycorrhizae** - An estimated 10,000 research studies have been done on mycorrhizae during the past 25 years. Mycorrhizal fungi inoculants have been available to commercial markets only during the past 10 years.
 - A. Endomycorrhizae - A symbiotic relationship of endomycorrhizal fungi with roots of 90% of plant species worldwide.
 1. Inoculant contains multi strains of live spores of *Glomus mosseae*, *Glomus intraradices*, *Glomus fasciculatum*, *Glomus dussii*, *Glomus clarum*, *Glomus deserticola* and *Glomus microaggregatum*.
 2. Available in dry form with a shelf live of 24 months.
 - B. Ectomycorrhizae – A symbiotic relationship of ectomycorrhizal fungi with many tree species i.e. pines, oaks and select hardwoods.
 1. Inoculant contains multi strains of *Pisolithus tinctorius* and a variety of species of *Rhizopogon*, *Scleroderma* and *Laccaria*.
 2. Available in dry or liquid suspensions.
 - C. Ericoidmycorrhizae – A symbiotic relationship ericoidmycorrhizal fungi with azalea, blueberry, beet, carnation, heath, macadamia, orchid, rush, rhododendron, protea and sedge.
 1. Ericoid Mycorrhiza does not exist naturally in our soils and therefore must be introduced for plants to flourish.
 2. Inoculum consists of *Oidiodendron* sp.
 - a. - *Rhizoscyphus ericae* (isolate type 1)
 - b. - *Rhizoscyphus ericae* (isolate type 2)
 3. Infective propagules: 2500 cfu/L
 4. Available in 500 ml bottles that will effectively treat ½ acre (1,000 plants).
- II. **Trichoderma** and other beneficial fungi- *Trichoderma* (6 species, 2 each) *Trichoderma hamatum*, *Trichoderma harzianum*, *Trichoderma reesei*.

Trichoderma is a recognized beneficial fungus that is used to compete with the food source and space of negative causing fungi in the soil. Spores of the fungus, when mixed with soils, germinate and grow around plant roots depriving negative fungi the living space and food source thereby causing death to them, therefore pre-



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venting fungal diseases.

III. Stimulants

A. Humic Acid

1. Physically modifies the soil.

- i. Improves soil structure
- ii. Increases aeration of soil
- iii. Increases water and nutrient holding capacity.
- iv. Improves soil workability.
- v. Helps resist drought.
- vi. Improves seedbed productivity.
- vii. Makes soil more friable or crumbly.
- viii. Reduces soil erosion.

2. Chemically change the fixation properties of the soil.

- i. Retains water soluble inorganic fertilizers in the root zones and releases them to plants when needed.
- ii. Promotes the conversion of a number of elements into forms available to plants.
- iii. Possesses extremely high ion-exchange capacities.
- iv. Participates in the decomposition of rocks and minerals.
- v. Increases buffering properties of soil.
- vi. Chelates metal ions under alkaline conditions.
- vii. Rich in both organic and mineral substances essential to plant growth.
- viii. Increases percentage of total nitrogen in the soil.
- ix. Provides the carbon necessary for humus building.
- x. Provides the organic chemicals for chelation of both major and minor mineral nutrients.

3. Biological benefits:

- i. Stimulates plant growth by accelerating cell division.
- ii. Increases the rate of development in root systems.
- iii. Increases vitamin content of plants.
- iv. Increases the permeability of plant membranes; promoting the uptake of nutrients.
- v. Stimulates root growth, especially lengthwise.
- vi. Enables improved nutrient uptake and root respiration and formation.



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- vii. Stimulates growth and proliferation of desirable soil microorganisms as well as algae and yeasts.
- viii. Aids in photosynthesis.
- ix. Stimulates plant enzymes.
- x. Acts as an organic catalyst.

TAKE AWAY: Maximum plant performance cannot be achieved with chemical fertilizers alone. Maximum performance must include organic biological activity.

B. Yucca Plant Extract

1. Increases cell wall permeability allowing the roots to take up water and nutrients faster and easier.
2. Increases microbiological activity.
3. Inhibit ammonia production and nitrate accumulation.
4. Is an effective wetting agent and promotes growth.
5. Increases proliferation of organisms during high pH, copper poison and oxygen starvation stresses.
6. Helps control nematodes - is toxic to a wide number of insects.
7. Has been widely used for years as a soil conditioner.

C. Carbohydrates

1. Simple sugars and starches provide an immediate surge of energy for the beneficial microorganisms during initial organic matter degradation.

IV. Plant Growth Enhancers

A. Microorganisms

1. Main components in soil health and soil productivity, not only responsible for the degradation of organic matter, but necessary for making nutrients available for plant use.

2. Contains a microbial blend of many species of *Bacillus*, *Flavobacterium*, *Saccharomyces*, *Penicillium* and a host of other beneficial microorganisms.

3. Boosting these microbe populations in the soil.

B. Sea kelp

1. Contains more than 60 macro and trace elements. Sea Kelp contains concentrated quantities of plant anixins, growth regulators and stimulants, such as indole-3-acetic acid, gibberellic acid and cytokinins.



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C. Amino Acids

1. L-Alanine, L-Argine, L-Aspartic Acid, L-Cystine, L-Glutamic Acid, L-Glycine, L-Histidine, L-Isoleucine, L-Leucine, L-Lysine, L-Methionine, L-Phenylalanine, L-Proline, L-Threonine, L-



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Serine, L-Tryptophan, L-Tyrosine, L-Valine. (proprietary concentrations)

2. Enhances health and improves the overall nutrient efficiency by buffering heavy metals and sodium in the soil.
3. Improve the availability and exchange of plant nutrients on the root surface, and microbial activity in the soil.

D. Humus

1. Composed of a complex mixture of colloidal substances containing of lignin, protein, and polyuronides and carbon that improves the exchange capacity of the soil and enhances uptake of phosphates and other essential micro nutrients.
2. Increases plant vigor, helps keep fertilizer from leaching through the soil, and buffers plants against extreme concentrations of salts.

E. Langbeinite

1. Originating from evaporated seawater; it contains Sulfur, Potash, Magnesium and many other important trace elements.

F. Vitamins & Enzymes

2. B, B2, B3, B5, B6, B7, B9, B12, C, K, Biotin

B VITAMINS

- * Stimulate the metabolism of the root cells
- * Activate plant's defense mechanisms against environmental stress
- * In particular B1 activates priming mechanism in SAR
- * In particular B2 and B3 stimulate cellular metabolism
- * B6 is a powerful antioxidant
- * B12 has been shown to positively affect plant growth, especially important since plants cannot synthesize B12
- * Together, they provide a synergistic effect.



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VITAMIN C

- * Enhances photosynthetic capacity
- * Provides antioxidant properties to combat smog, ozone, drought & UV radiation

VITAMIN K

- * required for transport chain of electrons across the plasma membrane
- * required for enzyme regulation

BIOTIN

- * Included in formula to enhance microbial growth

3. Riboflavin, biotin, choline, thiamine, pantothenic acid, folic acid, and niacin.
4. Enhance the properties of fertilizer and are essential for the basic metabolic processes of the plant such as chlorophyll production, cell division, transpiration and respiration.

H. Sulfate of Potash

1. A natural mined mineral high in soluble potash.

I. Glomalin (Forms in conjunction with VA mycorrhizae)

1. Protects hyphae from leaching
2. USDA estimates equals one third of carbon capture in soils
3. Dramatically increases soil stabilization of aggregates

V. Beneficial Bacteria

A. Effect on soil

1. Converts soil elements, such as nitrogen and phosphorous, into plant available form.
2. Increases conversion of soil elements, including phosphorous, into plant available forms.



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3. Adds in the decomposition of soil organics thereby making them available to the plant.
4. Increases soil buffering properties.
5. Chelates metal ions in alkaline conditions, increasing plant availability
6. Enhances soil biology by inoculating the soil with beneficial microbes, and providing a food source to maintain them in a soil.

B. Effects on plants

1. Contains nitrogen fixing *Bacillus* species that converts atmospheric nitrogen to available nitrogen for plants, a phosphate-solubilizing bacillus that converts insoluble phosphorus to soluble, and a growth hormone promoting bacillus that stimulates root growth.
2. Stimulates plant growth by naturally accelerating cell division.
3. Stimulates root formation and growth.
4. Increases plant cell membrane permeability allowing for more efficient uptake of water, nutrients and oxygen.
5. Reduces transplant shock.
6. Increases plant membrane permeability for more efficient nutrient uptake.
7. Stimulates root growth, respiration and formation, the presence of soil microorganisms and plant enzymes.

Our KEY MICROBIAL COMPONENTS include:

BACILLUS: Promote plant growth by providing nitrogen, solubilizing phosphates and produce phytohormones which lead to improved growth and development of plants.

Bacillus megaterium (decomposition, nutrient cycling)

Bacillus subtilla (fungal root disease biocontrol)

Bacillus amyloliquefaciens (biocontrol of plant pathogens)

Bacillus azotoformans (nitrogen fixation, plant growth hormones)

Bacillus licheniformis

(*Bacillus pumulus*)

Bacillus Firmus

Bacillus coagulans

Geobacillus stearothermophilus

Paenibacillus polymyxa.(fixes nitrogen)

PSEUDOMONAS: (3 SPECIES)

Pseudomonas putida (protects roots from disease from other organisms)



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Pseudomonas fluorescense (plant growth properties and biocontrol agent)

Pseudomonas aureofaceans (biological control agent inhibits a variety of pathogenic microorganisms)

STREPTOMYCES: (3 SPECIES)

Streptomyces lydicus (2 strains): anti-fungal

Streptomyces griseus: anti-fungal

Streptomyces coelicolor

TRICHODERMA (6 SPECIES)

Trichoderma harzianum (2 strains): anti-fungal, plant growth hormones

Trichoderma viride (2 strains): anti-fungal, plant growth hormones

Gliocladium virens (2 strains): anti-fungal

VI. Minor Element Package

A. Boron (B)

1. Helps in the use of nutrients and regulates other nutrients.
2. Aids production of sugar and carbohydrates.
3. Essential for seed and fruit development.
4. Sources of boron are organic matter and borax

B. Copper (Cu)

1. Important for reproductive growth.
2. Aids in root metabolism and helps in the utilization of proteins.

C. Chloride (Cl)

1. Aids plant metabolism.
2. Chloride is found in the soil.

D. Iron (Fe)

1. Essential for formation of chlorophyll.
2. Sources of iron are the soil, iron sulfate, and chelated iron.

E. Manganese (Mn)

1. Functions with enzyme systems involved in breakdown of carbohydrates, and nitrogen metabolism.
2. Soil is a source of manganese.

F. Molybdenum (Mo)



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1. Helps in the use of nitrogen

G. Zinc (Zn)

1. Essential for the transformation of carbohydrates.
2. Regulates consumption of carbohydrates
3. Part of the enzyme systems that regulate plant growth.

VII. Water Management Gel

A. Effects in soil

1. Holds soluble fertilizers in the root zone slowly releasing the soluble thereby reducing leaching
2. Increases soil water holding capacity and availability
3. Increases water infiltration, soil aeration, soil friability, and soil permeability.
4. Reduces compaction
5. Improves micro flora and bacterial content of soil

B. Effects on plant

1. Reduces iron chlorosis in plants
2. Improves nutrient soil/moisture osmotic plant uptake
3. Reduced transplant stress
4. Increased yields, survival, and shelf life