BIO - ZONE

Nutrient Solubilization

* Most soils contain an abundance of inorganic P and K, the problem is its usually in an insoluble form and cannot be assimilated by the plant.
* Select beneficial soil bacteria have the capacity to convert insoluble phosphatic and potassium-based compounds into plant available forms.
* Beneficial soil bacteria produce copious amounts of organic acids in the soil profile
* This secondary metabolite is responsible for the conversion of insoluble, inorganic, mineral-based phosphorus, and potassium into plant available forms.
* In acidic soils P tends to bind with Aluminum (Al) and Iron (Fe) to form insoluble aluminum phosphate & iron phosphate.
* In alkaline soils P tends to bind with Calcium (Ca) & Magnesium (Mg) to form insoluble calcium phosphate & magnesium phosphate.
* Inorganic phosphate-based minerals such as calcium phosphate and iron phosphate are then solubilized by these low molecular weight organic acids into plant available P
* Inorganic potassium-based minerals such as feldspar, muscovite, orthoclase, biotite, mica is solubilized by organic acids into plant available K
* The hydroxyl and carboxyl groups associated with organic acids chelate the cations bound to the P & K which in turn converts them into soluble P & K.
* Organic Acids include but are not limited to gluconic acid, 2-ketogluconic acid, lactic acid valeric, succinic, isovaleric acid & acetic acid.

*** The solubilization process results in increased P, K, Ca, Mg, S, Fe, Mn & Zn availability to the plant.**

Nutrient Mineralization

* Most soils contain an abundance of organic P, the problem is its usually in an insoluble form and cannot be assimilated by the plant.
* Select beneficial soil bacteria and fungi have the capacity to convert insoluble phosphatic based compounds into plant available forms.
* Beneficial soil bacteria & soil fungi produce secondary metabolites which includes enzymes.
* This secondary metabolite is responsible for the conversion of insoluble, organic based phosphorus into plant available forms.
* Most soils contain an abundance of phytic acid an indigestible, organic form of phosphorus
* Organic phosphates such as phytic acid are mineralized by enzymes released by the soil bacteria and fungi.
* Phosphate Mineralizing Enzymes include but are not limited to phytase, acid phosphatase, alkaline phosphatase & D-glycerophosphates
* Release of phosphatases enzymes hydrolyzes the organic P and splits it from their organic residues, which makes it plant available

*** The mineralization process results in increased P, Ca, Mg, S, Fe, Mn & Zn availability to the plant.**

Contains Plant Growth Promoting Rhizo-Bacteria

* Stimulating plant growth was once entirely attributed to supplemental applications of N, P, K fertilizers
* Recently the emphasis for stimulating plant growth has shifted to the use of microbial based phytohormones
* Plant Growth Hormones (phytohormones) are secondary metabolites produced by beneficial soil bacteria
* Collectively these organisms are referred to as Plant Growth Promoting Rhizo-Bacteria or PGPR
* Plant Growth Promoting Rhizo-Bacteria produce plant growth hormones (phytohormones) such as auxins, cytokinins & gibberellins
* Auxins stimulate flowering, root architecture, issue differentiation, lateral root initiation, polar root hair positioning & root gravitropism
* Gibberillins control cell elongation, cell division, cell differentiation & stress reduction
* Cytokinins stimulate flowering, control cell division in roots & shoots, increased resistance to drought, enhances chloro-phyll synthesis

*** Phytohormones produced by bacteria increase yields independent of supplemental fertilizer applications**

Reduction In Nitrogen Loss / Leaching

* Beneficial soil bacteria significantly reduce the incidence of nitrogen leaching in the soil profile
* Nitrogen (particularly nitrate) is very mobile in the soil profile, and it often leaches past the root system before the plant has a chance to sequester it
* Soil bacteria temporarily incorporate free nitrogen into their bodies utilizing it to satiate their metabolic functions.
* This storehouse of nitrogen is then given back to the plant through a process known as nutrient mineralization.
* Nutrient mineralization occurs when protozoa (another soil dwelling organism) consumes soil bacteria to satiate their own carbon & nitrogen requirements.
* Soil bacteria contain more N than the protozoa require, therefore the protozoa essentially keep the carbon and spit this excess nitrogen back into the rhizosphere (soil influenced by roots) where it is then absorbed by the plant roots.
* Much of this nitrogen would have leached past the roots if it had not been temporarily stored and redeposited in the root zone by microbial means
* **Reduction of N leaching improves efficiency of soil applied nitrogenous based fertilizers**

Siderophores & Iron Sequestration

* Siderophores are low molecular weight secondary metabolites produced by Plant Growth Promoting Rhizobacteria (PGPR) they have a strong affinity for chelating ferric ions from the soil environment
* All microorganisms (beneficial & pathogen) require iron in varying quantities, its used in the electron transport chain to produce ATP
* When iron levels are low in the soil these secondary metabolites scavenge iron from the soil profile making it available to **BOTH** the microorganism itself and the plant
* This is also a mechanism used by beneficial soil organisms to outcompete soil borne pathogens. They use siderophores to outcompete the pathogens for iron
* **Summarily siderophores support the growth of plants by increasing the availability of Fe^{3+} to the plants**

Microbial Synergists

* Contains full spectrum of targeted microbial synergists and growth factors to promote microbial growth & proliferation
* Provides them with energy during critical lag phase of development when metabolic requirements drastically increase
* Contains organic protein source to satiate nitrogen requirements of beneficial bacteria & fungi
* Contains multiple carbon sources (simple sugars) which serves as food source for beneficial bacteria & fungi
* Each organism in formula has a preferred carbon source, by targeting carbon source to organism you optimize microbial growth
* **Inoculants absent microbial synergists exhibit limited growth potential in soil microclimates**

CONTAINS NON-PLANT FOOD INGREDIENTS

Active Ingredients

Bacillus subtilis 300,000,000 CFU per gram, Bacillus licheniformis 300,000,000 CFU per gram, Bacillus pumilus 300,000,000 CFU per gram, Bacillus amyloliquefaciens 300,000,000 CFU per gram, Streptomyces lydicus 150,000,000 CFU per gram, Streptomyces griseus 150,000,000 CFU per gram, Streptomyces coelicolor 150,000,000 CFU per gram, Trichoderma viride 100,000,000 CFU per gram, Trichoderma harzianum 100,000,000 CFU per gram

Inert Ingredients

53.00 % Dextrose (Microbial Nutrient), 26.00 % Sucrose (Microbial Nutrient), 12.00 % Non-Calcined Diatomaceous Earth (Microbial Carrier), 4.00 % Hydrolyzed Soy Protein (Microbial Nutrient), 3.00 % Hydrated Sodium Calcium Aluminosilicate (Drying Agent), 2.00 % Brewer's Yeast Extract (Microbial Nutrient)

87 % Water Soluble By Weight

APPLICATION RATES

SOIL DRENCH: Apply at the rate of 1.0 - 2.0 oz per 1,000 sq ft utilizing a sufficient volume of potable water to achieve desired coverage. Agitate the tank while adding product. Apply every 3 – 4 weeks to maintain biological activity in the rhizosphere.

FOLIAR SPRAY: Thoroughly dissolve 0.5 – 1.0 oz of product per gallon of potable water while agitating tank. Apply liberally to foliage (front & back) avoiding runoff. To enhance surface coverage and adhesion tank mix with a non-ionic spreader sticker at manufactures recommended rates. Apply every 14 – 28 days to improve biological activity in the phyllosphere (surface of leaf). Avoid spraying on windy days to minimize drift. Do not spray immediately prior to rainfall or irrigation.

DEEP ROOT FEEDING: Apply as required throughout the growing season to improve biological activity in the rhizosphere. Thoroughly dissolve product at the rate of 1 lb per 100 gal of potable water. Mix required volume and inject using a grid system by spacing holes on 2.0 to 3.0 foot centers, in a grid pattern, extending at least to the drip line of the plant. Inject prepared solution into the soil to a depth of **at least** 4" for shrubs and 8" for trees. Utilize a total volume of 1 gal of finished solution per 2 ½ - 5 feet of plant height injecting equal amounts of product mixture into each hole.

GREENHOUSE: Prepare a stock solution by dissolving 1 lb in 8 gallons / 0.45 kg in 30 liters of clean potable water. Run stock solution through injector system @ 1 : 100 dilution & apply as a Sprench at the rate of 10 – 30 gal per 1000 sq ft of table space. Water volume may be adjusted based on plant type, canopy and growing media.

* 1st application: drench plug tray just prior to planting / transplanting.
* 2nd application: drench 2 weeks after planting / transplanting.
* 3rd application: drench 4 weeks after second application.
* If the growth cycle extends beyond 8 weeks, continue drench every 2-4 weeks throughout balance of growth cycle

HYDROPONICS: Add product directly to reservoir (do not predilute) each time you change out nutrient solution. Maintain reservoir pH levels between 5.5 and 6.5 for optimum results. Aerate for optimum results.

PHASE	U.S.	METRIC
Cuttings & Transplants	1 teaspoon per 5 gal water	5 grams per 19 liters water
Early Vegetative Phase	1 1/2 teaspoon per 5 gal water	7.5 grams per 19 liters water
Vegetative Growth Phase	2 teaspoons per 5 gal water	10 grams per 19 liters water
Transition To Bloom Phase	1 teaspoon per 5 gal water	5 grams per 19 liters water
Bloom / Ripening Phase	1 teaspoon per 5 gal water	5 grams per 19 liters water

GENERAL INFORMATION

* May be tank mixed with fertilizers, biostimulants and microbial foods (sugars, humic acids, kelp)
* It is advisable not to co-apply microbial inoculants with pesticides (fungicides, herbicides, insecticides, nematicides, fumigants) as they can compromise integrity of or kill the beneficial organisms herein contained.
* If co-application of inoculant and pesticide is required tank mix and apply same day (minimize time in tank)
* When applied in rotation with pesticides its advisable to allow 5 - 7 days between application of pesticide and inoculant.
* Never tank mix with pesticides that contain imazilil, propiconazole, tebuconazole and triflumizole.
* Do not mix product and store, apply all tank mixes same day
* Agitate tank while adding product and during entire application process
* Always perform jar test when mixing product with other inputs to test for physical compatibility
* To facilitate mixing process you may create slurry (1 lb in 2 gal / 0.45 kg in 7.6 liters of water) and add slurry while agitating
* Optimal results achieved if product is applied early morning, evening or on an overcast day.

PLANT SAFETY

* Product has been tested on numerous plant species with no apparent phytotoxic response
* However the product has not been tested on every plant variety in combination with all possible tank mixes, under every conceivable environmental condition. We always recommend testing product on a small number of plants to check for adverse plant response PRIOR to full scale field application