Science behind our main ingredient SumaGrow

SumaGreen is a synergistic consortium of native microbes selected for their abilities to increase plant health and growth through soil fertility.

Soil health is fundamental to profitable and sustainable agriculture. Vital organic matter and soil nutrients are often destroyed and mined out because of fertilizer overuse, soil erosion and nutrient run-off, and unsustainable farming practices.

SumaGreen's microbial formulation improves and restores soil health and fertility. These microbes are complementary, multifunctional and work in five important ways:

I. **Biological Nitrogen fixation** - Ninety five to ninety nine percent of nitrogen in the soil is in an organic form that is not available for uptake by plants. And although 78% of the earth's atmosphere is nitrogen, it also is mostly unavailable for plant use. However, Mother Nature has a solution - microbes. Microbes play an important part in the nitrogen cycle. SumaGreen's microbial formulation unlocks bound soil nitrogen and absorbs nitrogen from the air for optimum plant growth and development.

II. **Phosphate Solubilization** - Often, phosphate is present in a bound form unavailable to plants. SumaGreen's microbial formulation solubilizes the bound phosphate and makes it available to the plant in a useable form. Phosphate is involved in photosynthesis, respiration, energy storage and transfer, cell division, and enlargement. Phosphate:

- Promotes early root formation and growth
- Improves quality (BRIX value) of fruits, vegetables, and grains
- Vital to seed formation
- Helps plants survive harsh winter conditions
- Increases water-use efficiency

III. **Mobilization and Mineralization of Available Plant Nutrients** - It is not enough that a soil contains an element. What matters is its availability to plants. Mobilizing and

mineralizing soil nutrients, such as bound Phosphate, Magnesium, and Calcium into a form that is available for plant uptake is a vital role of the microorganisms contained in products containing SumaGrow inside.

- Other Nitrogen-fixing bacteria that live in the soil continue the conversion into ammonium (NH_4^+, a form plants can use
- Nitrifying bacteria convert ammonium into NO_2 then to NO_3^-. NO_3^- is also a form that plants can uptake
- Various decomposers (including bacteria and fungi) breakdown organic forms of nitrogen into ammonium, where then the nitrifying bacteria can continue that conversion into NO_3^-.

IV. **Phytohormone Production** - Phytohormones are plant growth regulators and makes the appropriate nutrients available during different growth stages. For example, at the time of flowering a plant will have increased nitrogen needs. SumaGreen's formulation of microbes are vital in providing the plant with the necessary means of absorbing the appropriate amounts of nutrients it needs at the stage it needs them. This gives crops treated with products containing SumaGrow inside the opportunity to reach optimum growth and yield.

V. **Act as Biological Control Agents** - The SumaGreen formulations inhibits plant pathogens and enhances the plant's natural defense mechanisms. This bio-control function is comprised predominately of Trichoderma strains. They generally grow on the root surface and are effective against root disease in particular, but can also be effective against foliar diseases. SumaGreen also increases the plant's resistance against pests. Pests recognize the higher sugar content of SumaGreen treated plants and forages and because most pests lack a liver and cannot digest high concentrations of amino acids, this makes the plants an unattractive nutrient source.

Additionally, products containing SumaGrow inside have a saprophytic competence in the soil. Saprophytic competency of microbes in the formulation is one of the major challenges to the practical utilization of improved commercial inoculants' competitiveness and persistence in the soil against less efficient native strains. Test results show that SumaGrow inside products are a highly competent one in soil. It captures additional water and available nutrients from naturally occurring organic matter in the soil for the plant's use. This enables plants to better sustain adverse environmental conditions such as variations in soil pH and moisture issues.

SumaGreen also promotes a healthy soil pH. Soil pH has strong effects on the availability of most nutrients. This is because pH affects both the chemical forms and solubility of nutrient elements. The ideal soil pH for many crops is slightly acid, between about 5.8 and 7.0, because in that range there is well-balanced availability for all nutrients. This pH range also promotes an active and diverse soil microbial population and is a healthy range for earthworms and other soil organisms. It has been shown that acid tolerant bacterial strains can more readily generate a pH

gradient when grown in acid conditions and can subsequently maintain a more constant internal pH.

SumaGreen's microbial formulation is suspended in a 12% humic acid carrier, stabilized at a balance pH of 7.0, which allows it to effectively work in varied climates and soil conditions. These humates act as a carbon food source for the microbial formulation, are high in organic matter and contain micronutrients, such as calcium, magnesium, zinc and manganese.

Products containing SumaGrow inside have been extensively tested in university greenhouses, field trials, replicated crop trials and specialized testing facilities. We do not know of a single product currently on the market that has a consortium of microbes with verified functional properties that give marked growth enhancement of such a truly broad spectrum of crops including row crops, vegetable crops, forage grasses, fruit and citrus crops and bio-fuel crops such as switch grass and miscanthus.

The sustainability of products containing SumaGrow inside creates a healthy, nutrient rich plant. For organic production, several products containing SumaGrow inside are OMRI Listed. Products containing SumaGrow inside can increase crop yields, improve stress and drought resistance, reduce fertilizer dependence, and increase the nutritional values of food and forage crops.