



Bio-Sustain

LIQUID SOIL AMENDMENT

- ✓ **SOIL AMENDMENT**
- ✓ **PLANT FOOD**
- ✓ **BIO-FERTILISER**



Benefits

- Improves Soil Fertility
- Increases Microbial Activity
- Improves Soil Health
- Increases Nutrient Availability
- Improves Plant Immune Systems
- Stimulates Root Growth
- Environmentally Safe



A Biological Soil Amendment System:

Bio-Sustain is a liquid microbial bio-fertiliser, plant food and soil amendment in one easy to use product. This complex bio-fertiliser contains a high concentration of beneficial soil microbes that multiply in the soil. These microbes convert nutrients and minerals into a form that plants can easily use supporting healthy growth throughout the plant life cycle. Bio-Sustain is a comprehensive microbial system comprised of beneficial soil bacteria & fungi, essential plant nutrients, trace elements. It builds vital systems in the soil structure making a perfect environment for stronger, healthier, faster growing plants.

Bio-Sustain is processed from organic composted poultry manure, vermicompost, carbon, natural ingredients and beneficial soil microbes. The soil microbes are a complex range of beneficial bacteria and fungi; these “PROBIOTICS FOR THE SOIL” can include; *Bacillus subtilis*, *Bacillus megaterium*, *Pseudomonas fluorescens*, *Frateruria aurentia*, *Azotobacter sp*, *Azospirillum sp*, *Nitrobacter sp*, *Nitrosomonas sp*, *Enterobacter sp*, *Achrombacter sp*, *Aspergillus sp*, *Actinomycetes sp*.

Bio-sustain also contains small amounts of plant available nutrients and trace elements from the compost extraction process including; *Nitrogen*, *Phosphorus*, *Potassium*, *Sulfur*, *Carbon*, *Boron*, *Zinc*, *Manganese*, *Iron*, *Copper*, *Calcium*, *Magnesium*, *Molybdenum*, *Sodium*, *Aluminum*, *Cobalt*

Unsurpassed Technology:

Bio-Sustain is an all-natural certified organic product specifically formulated to increase biological activity in the rhizosphere and restore a productive root system to distressed plants.

Bio-Sustain also increases plant immunity and helps to control plant pathogens, pests & disease.



A Biological Soil Amendment System:

Although microorganisms are microscopic they are universally present in soil, water and air. Besides supporting the growth of various biological systems, soil microbes serve as a medium for plant growth. They convert complex nutrients into simpler forms which are readily absorbed by the plant. Further, they produce variety of substances like IAA (Indole acetic acid), gibberellins, antibiotics etc. which directly or indirectly promote the plant growth.

Nitrogen is an essential element for all forms of life and it is the most vital nutrient for plant growth and productivity. Nitrogen, which is needed for the synthesis of amino acids and proteins, is the most limiting nutrient for plants. Bio-Sustain contains several bacteria which facilitate nitrogen making it readily available for the plants to uptake.

The Need for Nitrogen

Plants lacking sufficient nitrogen become yellow and stunted, with smaller than average flowers and fruits. Nitrogen is found naturally in organic matter, manures and other organic fertilisers. Nitrogen is a key nutrient for plant growth. Four forms of nitrogen are used as fertilizer: *Nitrate, Ammonia, Ammonium & Urea*

- Urea is broken down by microbes in the soil to become ammonia
- Ammonia is broken down into ammonium through mineralization
- Ammonium is broken down into nitrite and then nitrate through nitrification. Nitrate can be used by plants

Nitrogen Fixation: (*Azospirillum, Azotobacter, Pseudomonas, Achromobacter*).

Special bacteria convert the nitrogen gas (N_2) to ammonia (NH_3) which the plants can use.

Nitrification: (*Nitrobacter, Nitrosomonas*).

These special bacteria convert ammonia into nitrite ions which the plants can take in as nutrients.

Ammonification: (*Bacillus, Pseudomonas*).

Decomposing bacteria convert the nitrogen-rich waste compounds into simpler forms for plant uptake.

Denitrification: (*Achromobacter, Pseudomonas*).

Denitrification is the final step in which other bacteria convert the simple nitrogen compounds back into nitrogen gas (N_2), which is then released back into the atmosphere to begin the cycle again.

Summary

Nitrogen in organic materials must first be decomposed by microorganisms before it can be used by plants. Mineralization is the process by which microbes break down organic matter and release ammonium nitrogen. Ammonium nitrogen, which can be used by plants, does not leach because it has a positive charge so it “sticks” to negatively charged soil particles. If not taken up by plants, ammonium nitrogen will be further degraded by organisms to produce nitrate nitrogen, also available to plants, through the process called nitrification. Nitrate molecules are negatively charged. They will be repelled by negatively charged soil particles, and if not taken up by plants, will move easily with water through soil, potentially resulting in nitrates reaching groundwater.



A Biological Soil Amendment System:

Phosphate Solubilising Bacteria: (*Pseudomonas, Bacillus megaterium, Achromobacter, Aspergillus*).

Phosphorus is the most important key element in the nutrition of plants, next to nitrogen (N). It plays an important role in virtually all major metabolic processes in plant including photosynthesis, energy transfer, signal transduction, macromolecular biosynthesis and respiration. Due to immobilisation of phosphate by mineral ions such as Fe, Al and Ca and organic acids, the rate of available phosphate in soil is well below plant needs. PSB converts insoluble phosphate compounds into plant available forms. PSB can cause a large amount of soluble phosphate to be released and in excess of 50 Kg/ ha of P₂O₅. Phosphorus solubilising activity is determined by the ability of microbes to release metabolites such as organic acid.

Potassium solubilising Bacteria (KSB): (*Pseudomonas, Frateuria aurentia, Bacillus, Aspergillus*).

Potassium (K) is the third major essential macronutrient for plant growth. The concentrations of soluble potassium in the soil are usually very low and more than 90% of potassium in the soil exists as insoluble minerals. Potassium Solubilising Bacteria (KSB) are able to solubilise potassium through production and secretion of organic acids making them available to the plants.

Soil microbes and cycling of elements:

The biogeochemical process through which organic compounds are broken down to inorganic compounds or their constituent elements is known as mineralisation. Soil microbes plays an important role in the biochemical cycling of elements in the biosphere where the essential elements (C, P, S, N & Fe etc.) undergo chemical transformations. Through the process of mineralisation organic carbon, nitrogen, phosphorus, sulfur, Iron etc. are made available for reuse by plants.

Plant Growth Promoting Rhizobacteria (PGPR):

(*Pseudomonas, Bacillus, Achromobacter, Enterobacter, Aspergillus*).

The group of bacteria that colonise roots or rhizosphere soil are referred to as plant growth promoting rhizobacteria (PGPR). Micro-organisms found in the rhizosphere are able to produce substances that regulate plant growth and development. These microbes have direct mechanisms that facilitate nutrient uptake or increase nutrient availability by nitrogen fixation, solubilisation of mineral nutrients, mineralise organic compounds and production of phytohormones. The mechanisms of PGPR include regulating hormonal and nutritional balance, inducing resistance against plant pathogens, and solubilising nutrients for easy uptake by plants.



A Biological Soil Amendment System:

Chelation in soil increases nutrient availability to plants. The word chelate translated from the Greek word “chel” means crab’s claw. It refers to the claw like manner in which a metal (usually iron) is loosely bound in a chelated molecule. Elements are more easily absorbed by plant roots in chelated form than elements that are not chelated. Chelates are organic molecules that can retain or release specific metal ions. These ions would include plant nutrients such as calcium, magnesium, cobalt, copper, zinc, iron and manganese. Upon entering plant cells cationic nutrients will form chelates with organic and amino acids. Chelation enables the nutrients to move freely inside the plants. The chelation process increases the mobility and therefor availability of nutrients to plants.

Chelates and Cation Exchange Capacity (CEC).

Chelates end effect is much like a cation exchange in the sense that they hold elements until they are needed and then releases them for plant use, but the chemistry for doing this is different. Chelates work outside and inside of the plant. Outside the plant cell, in the soil, a chelated element is kept in reserve and can not form a compound with another element and participate out of the water medium. Once inside a plant cell some metals are prohibited from moving freely. But when they are in chelated form the needed metal is able to move readily inside the cell and and from cell to cell.

Humic and Fulvic Acids

In the soil, humic and fulvic acids are important chelators, combining minerals into organic compounds that are more available to plants. They also tie up toxins, making them less available to plants.

Humic substances are complex macromolecules derived from the microbial degradation of plant, animal, and microbial residues. The formation of humic acid is inseparable from soil microbes. The survival and reproduction of soil microbes cannot be separated from humic acid. The two are interdependent and promote the formation and development of soil, fertility evolution, material circulation and energy conversion.

Microbes use plants as carbon sources and energy sources to synthesise polymer humic substances in cells, which are released into the soil, then degraded into humic and fulvic acids outside the cells. The process accelerates the rates of microbiological decomposition of the organic matter, increases microbial populations, and alters the physical and chemical properties of the material, leading to accelerated humification, during which the unstable organic matter is fully oxidized and stabilized



How does Bio-Sustain work:

The process begins with specifically selected bacteria that have been isolated from highly fertile soils and exhibit optimum abilities to produce enzymes and other organic nutrients.

The bacteria are selected for maximum adaptability so that they are effective in many different soil conditions, and provide unique abilities to fix both natural (atmospheric) nitrogen and synthetic (chemical) nitrogen delivered by fertilisers. When Bio-Sustain is applied to soil, bacteria multiply and grow very rapidly.

As the biological health of the soil improves, minerals become more available to plants and nutrient uptake can be increased by 200 - 300%, with nitrogen utilisation increasing by 50 - 75%. Nitrogen dissipation (gaseous escape) is greatly reduced, and leaching (run off and seepage into the water table) is almost eliminated.

Increasing the biological content of a soils' ecosystem makes the soil more permeable, increases Cation Exchange Capacity (CEC), allowing the soil to absorb more water and healthy populations of microorganisms metabolise fertilisers and nutrients that have lain unused in the fields for years, making these nutrients available to plants growing today.

When bacteria digest and metabolise fertilisers in the field, fertiliser is kept out of our water resources and is delivered where it belongs, to the plant. Less residual chemical fertiliser in the soil means fewer toxins reaching our water resources.

Making the soil ecosystem healthy relieves stress on plants of all types, and allows them to utilise their own immune systems to ward off predatory herbs (weeds) and pests (insects), resulting in reduced herbicide and pesticide input requirements and costs.

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Why use Bio-Sustain ?

Unfortunately today many soils are grossly out of balance and are devoid of beneficial microbial populations. This is primarily due to an over reliance on pesticides and inorganic fertilisers as both adversely affect the delicate microbial balance found in healthy soil profiles. Bio-Sustain was specifically formulated to re-establish these beneficial microbial populations and provide the soil with the necessary components to promote vigorous plant growth.

Why we recommend repeated treatment?

At certain times of the year the soil supporting plants requires greater biological activity in order to grow healthy plants. This includes the establishment phase, flowering phase, post harvest, plant stress and when environmental conditions favour disease (warmth, dampness, high humidity). It is always advisable to increase biological activity with an extra shot of beneficial organisms.

What are the benefits of Bio-Sustain?

- Stimulates root growth development
- Enhances nutrient absorption
- Enhances soil fertility
- Rapidly increases beneficial soil microbes
- Helps release bound nutrients and minerals in the soil
- Increases yield
- Minimises nutrient leaching
- Increases a natural resistance to pests and diseases
- Reduces stress caused by environmental changes
- Improves the utilisation rate of fertilisers.



Dairy, Sheep, Beef & Commercial crops

Bio-Sustain builds vital systems in the soil structure making for a healthier growing environment. This advanced solution, containing biological compounds and activators, promotes bio-stimulation for plant growth, while regenerating soil fertility, increasing microbial activity, plant and soil immunity as well as nutrient availability and uptake for long term sustainability. The concentrated liquid solution is suitable for use in dairy, sheep, beef, commercial crops, forestry and grassland farming.

Benefits:

- Ensures a healthy deep root system
 - Rapidly increases the diversity and longevity of soil microbes
 - Speeds up dry matter breakdown turning it into usable nutrients
 - Pasture sweetness improves with a higher nutritional value
 - Increases a natural resistance to pests and diseases
 - Helps release and dispel bound up chemicals and other nutrients in soil
 - Improves animal health and fertility through enriched nutrient content of pasture
 - Reduced recovery time after forage/hay cutting
 - Environmentally safe to use around waterways without fear of leaching or nutrient runoff
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- ✓ Increases plant available Nitrogen - nitrate (NO_3^-) and ammonium (NH_4^+)
 - ✓ Increases Phosphate availability through Phosphate solubilising bacteria (PSB)
 - ✓ Increases Potassium availability through Potassium solubilising bacteria (KSB)
 - ✓ Increases mineral availability through microbial mineralisation
 - ✓ Increase utilisation of atmospheric nitrogen
 - ✓ Mobilises left over potash (K) in the soil
 - ✓ Improves physical capabilities of the soil (Cation Exchange Capacity)
 - ✓ Accelerates dry matter breakdown creating a valuable carbon source



Bio-Sustain can be applied to the foliar or directly to the soil

MIXING INSTRUCTIONS:

Mix using non-chlorinated water only.

Apply to cover at least 70% of the plant surface (including undersides of leaves).

NOTES:

Apply early morning or late afternoon and out of direct sunlight.

Store in a cool dark place and out of direct sunlight.

Soil Applications:

By applying Bio-Sustain directly to the soil you will start to restore soil health and vitality. Adding products that contain organic matter to the soil together with Bio-Sustain you can quickly build soil structure increase CEC, improve soil health and fertility. A mineral balanced soil determines the efficiency of the five billion micro-organisms, which inhabit every teaspoon of healthy soil. Disease protection, nutrient uptake, available nitrogen supply and mineral stability are all functions of an efficient microbial workforce. Every management decision will have an impact on this precious soil-life.

Foliar Applications:

Applying Bio-Sustain to the leaves as a foliar spray you envelop the plant with a nutrient-rich solution containing vast colonies of beneficial bacteria. Some of the micro-organisms are absorbed through the leaves and they improve the plant's immune system. Some micro-organisms stay on the leaves and protect the plant from attack by bacteria and fungi. Plants can absorb nutrients 10 times more efficiently through their leaf surfaces than through their roots. As a result, spraying the foliage can produce remarkable results. Spray plants during their critical growth stages such as transplanting time, bud development, flowering, fruit set and post harvest.

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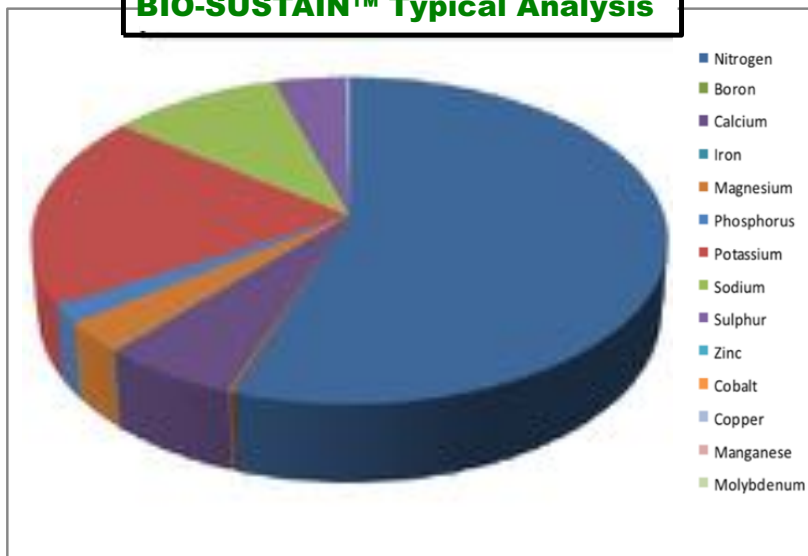
Micro-Organisms in Bio-Sustain:

Description:	Liquid Bio-fertilizer
Process:	Fermentation
Produced From:	Pure Cultures
Methods of Analysis:	Total plated count of micro-organisms by pour-plate and spread-plate
Total plate count:	1 x 10 ⁶ CFU/ml (minimum amount)

Micro-organism Cultures in Bio-Sustain:

Bacillus Subtilis, Bacillus megaterium, Pseudomonas Fluorensceus, frateuria aurentia, Nitrobacter sp, Nitrosomonas sp, Enterobacter sp, Achrombacter sp Azotobacter sp, Azospirillum sp, Aspergillus sp, Actinomycetes sp.

BIO-SUSTAIN™ Typical Analysis



Nitrogen	mg/L	3200
Phosphorus	mg/L	400
Potassium	mg/L	1300
Calcium	mg/L	385
Sulphur	mg/L	354
Copper	mg/L	5.2
Iron	mg/L	19
Magnesium	mg/L	81
Manganese	mg/L	2.2
Molybdenum	mg/L	2.5
Cobalt	mg/L	1.44
Boron	mg/L	142
Sodium	mg/L	320
Zinc	mg/L	5.88
Carbon	mg/L	1200



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Application Directions

Soil Preparation

2-4L concentrate per ha: Mix with 200-500L water approx.

Pre-planting apply Bio-Sustain to promote and accelerate microbial activity in the soil.

This rate can be increased as the product benefits accumulate with every use.

During Life of Crop

For best results, apply 2 to 4 times during the crop cycle.

Apply during their critical growth stages such as transplant/sowing stage, bud development, flowering, post harvest etc.

Apply at the first sign of insect attack or disease. Can be applied any time of year.

Seedlings initial rate

1 – 2L per ha: 10 – 20ml per litre of water.

Short maturing crops (ie. leafy and vine vegetables)

1 – 2L per ha: 1-2L of Bio-Sustain concentrate per 200L of water (approx.)

Mid maturing crops (ie. cereals)

2 – 3L per ha: 2-3L of Bio-Sustain concentrate per 200L of water (approx.)

Long maturing crops (ie. cotton, maize, sugar cane)

2 – 4L per ha: 2-4L of Bio-Sustain concentrate per 200L of water (approx.)

After Harvest Application

5 -10L concentrate per ha: Applied in the same manner as a foliar spray.

Bio-Sustain can be sprayed on stubble/trash to accelerate the breakdown of solid matter into an added nutrient form. This increases the carbon content of the soil and provides an added food source for microbial activity during the spelling period prior to next planting.

Pasture Farming

4 – 6 Litres concentrate per ha: Mix with 200-500L of water approx.

Apply 2/3 times per year to increase and accelerate microbial activity in the soil. This rate can be increased as the product benefits accumulate with every application.

Horticulture/Permaculture/Green House Application

2 – 4 Litres concentrate per ha: Mix with 200-500L of water approx.

Easy to apply through any irrigation/fertigation or sprinkler system in accordance with watering program.



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