EFFICIENT MICROBES PRO-SOIL
MICROBIAL SOIL MANAGEMENT
INTRODUCTION TO SOILS AND MICROBES

The key element in modern agronomy is soil health and sustainability. In the growth cycle of plants or crops, elements in the soil are taken up through the roots of plants in solution, becoming part of the compounds forming the plant. If plants are allowed to die and decompose, these compounds return to the soil as part of a natural cycle, such as the nitrogen cycle. However, when crops are harvested the cycle is interrupted; the nutrients are not returned to the soil and are used up. Fertilizers have become the modern solution to replacing these elements, increasing the yield of crops and enabling the soil to be farmed year after year. Many artificial fertilizers, however, contain acids, such as sulphuric acid and hydrochloric acid, which tend to increase the acidity of the soil, reduce the soil’s beneficial organism population and interfere with plant growth in the long term.

Generally, healthy soil contains enough nitrogen-fixing bacteria to fix sufficient atmospheric nitrogen to supply the needs of growing plants. However, continued use of chemical fertilizer may destroy these nitrogen-fixing bacteria. Furthermore, chemical fertilizers may affect plant health. For example, citrus trees tend to yield fruits that are lower in vitamin C when treated with high nitrogen fertilizer. Fungus and bacterial disease resulting from the lack of trace elements in soil regularly dosed with chemical fertilizers is not uncommon. This lack of vital micronutrients can generally be attributed to the use of chemical fertilizers.

MICROBES AND SOILS

Microbes are the oldest form of life on earth. These single cell organisms date back more than 3.5 billion years to a time when the Earth was covered with oceans. Without microbes, no life can survive. Microbes play many roles in the earth’s environment from recycling dead plant and animal matter through the soil, removing carbon dioxide from the atmosphere by photosynthesis in the oceans and fixing nitrogen from the atmosphere to form nitrogenous fertilizer for plants. They play an important role in nutrient recycling, nutrient
management, organic matter decomposition and fermentation and in food industry.

"Without soil and their biodiversity, there is no human life."

Most of the chemical reactions that take place in soils have active contribution of microbes. The nitrogen-fixing bacteria, blue green algae, and phosphate solubilizing bacteria are already well known to enhance availability of major nutritional elements to plants whereas the decomposer bacteria are instrumental in recycling, thereby increasing the availability of carbon and several micronutrients from plant residues to soil. Some other microorganisms similarly contribute towards improved plant health and higher crop yield through the production of growth stimulators such as plant hormones and vitamins.

Until recently, microbial handling of soils, crops or even animal and human health have been looked upon as a “nicety” – a solution which could be used in organic farming. The chief reasons for this have been efficacy and cost. The truth is, however, that correct utilization of microbes results in better yields at less cost than one would get through using only fertilizers.

With Efficient Microbes technology based products, that point has been reached. Efficient Microbes technology is an affordable and effective microbial technology that is highly beneficial in enhancing soils and growth. Because of the diverse combination of microbes in Efficient Microbes, the application in agriculture, turfs and plants can be on multiple levels and cover many different applications. Efficient Microbes works by enhancing every aspect of the soil ecology to assist in the growth and health of crops.
Efficient Microbes Pro-Soil is a naturally fermented live (non-freeze-dried) microbial soil formula. Efficient Microbes Pro-Soil is unique in that the formula is comprised of both anaerobic and aerobic microbes; each class processing the foods necessary for the other to survive (species list at the end of this page). Pro-Soil promotes plant, grass and crop growth, increased photosynthesis, resistance to diseases, increased efficacy of fertilizers and suppression of soil-borne diseases and pests.

The key functions of Pro-Soil are:

1. Increased nutrient uptake by plants, grasses and crops, leading to a healthier, faster growing and more disease resistant organism. This means lower input costs and/or increased efficacy from existing inputs.

2. Repopulation of soils with a consortia of robust microbes which motivate the existing microbes in the soil in a regenerative direction. Pro-Soil is extremely effective in the rehabilitation of dead soils, and through correct continued use eliminates the need to let fields lie fallow.

3. Natural balancing of N, P and K levels in the soil.

Pro-Soil has enhanced levels of phototrophic bacteria also known as purple non-sulfur bacteria (PNSB). These microbes have powerful detoxifying, anti-oxidative and anti-entropic properties and are active in re-establishing a wide range of beneficial microbes in polluted or unbalanced environments, such as poor soil conditions.

Pro-Soil can also help reduce composting turning costs by 70-80% and prevent anaerobic, odor-causing decay. It facilitates healthy decomposition and increased production of stable organic matter particles (humus). Anaerobic pockets become aerated and the overall quality of the product is improved while reducing management time and cost.
All living systems, including soil, plants, and trees have a microbial ecology that can be managed and improved by the constant delivery of Pro-Soil. Regenerating good bacteria produces a microbial ecology where beneficial bacteria dominate harmful bacteria, creating a healthier, more vibrant environment.

**BENEFITS FROM USE OF PRO-SOIL**

- Accelerates natural decomposition of residues after harvest.
- Promotes the formation of soil aggregates and increases resistance to soil compaction.
- Stimulates root growth thereby improving absorption capacity of water and nutrients by the plant.
- Increases the viability and availability of nutrients in the soil.
- Improves production quality.
- Enhances the structure and porosity of the soil.
- Maximizes the conversion of organic matter into humus.
- Increases the population of beneficial microorganisms that help in suppressing disease-causing microorganisms consequently reducing the use of pesticides.
- Helps reduce the incidents of nematodes and diseases.
- Lowers cost through the ability to reduce fertiliser use.

**PRO-SOIL INGREDIENTS:**

Purified and Structured Water, Natural Sugar Cane Molasses, Mineral Powder, Sea Salt, 100% Natural Juice Concentrates, Propietary Blend of EM Cultures.
APPLICATION GUIDE

Note: The following application rates are guidelines only, and some customers may require application protocols more tailored to their operation. Efficient Microbes technical support is available free of charge to all customers.

COMMERCIAL AGRICULTURE

SOIL TREATMENT:
Add Pro-Soil to irrigation water at a rate of 30-40 Litres of Pro-Soil per hectare. This can be done 2-4 times a growth cycle, depending on climate. Dry or cold climates require more frequent treatments. If you do not irrigate, Pro-Soil can be drilled into soil at a 8-15cm depth and a rate of 50 litres per hectare.

TRANSPLANTING:
Water-in new transplants with a 1:750 Pro-Soil /water solution. Pro-Soil can be used with other products such as organic fertilizers, mineral supplements and compost teas.

FOLIAR TREATMENT:
Apply Pro-Soil with a sprayer at a 1:500 Pro-Soil / water dilution rate. Application frequency should be every 2-6 weeks depending on conditions and objectives. Approximately 10 Litres / hectare of Pro-Soil should be applied during a foliar treatment. If total spray rate is less than 1 000 Litres / hectare and more Pro-Soil is needed for desired results a lower dilution rate, 1:250, may be necessary.

SEED SOAKING (for increased germination):
Dilute Pro-Soil with water at a rate of 1:1000 (1 teaspoon per 5L water). Soak small to medium seeds: 10 minutes; Soak medium to large seeds: 20 minutes. Continue to spray weekly with Pro-Soil/water dilution once seeds have been planted.

GREENHOUSE APPLICATIONS

SOIL PREPARATION:
Fill trays with standard growing medium. Once filled, each square meter must be treated with 20ml Pro-Soil diluted in 1 litre of water and allowed to stand out of direct sunlight for 96 -120 hours before planting takes place. Application can be by either backpack sprayer or watering can.

PLANT APPLICATION:
After planting, each square meter to be treated with 10ml Pro Soil diluted in 1 Litre of water twice weekly. Apply either by backpack sprayer or watering can.
COMMERCIAL COMPOSTING

1. Apply Pro-SOIL as soon as the material is consolidated (or windrowed) and preferably before the material has become thermophilic (temperatures above 48 degrees C).
2. These recommended rates of Pro-SOIL application are guidelines and may need to be adjusted for site-specific conditions and unique feedstocks:

<table>
<thead>
<tr>
<th>FEEDSTOCK</th>
<th>PRO-SOIL APPLICATION RATE PER TON</th>
<th>APPLICATION TIMING</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Green Waste</td>
<td>2-3 liters Pro-SOIL</td>
<td>Day 1</td>
</tr>
<tr>
<td>50% Green Waste / 50% food or other waste (e.g. manure)</td>
<td>4 liters Pro-SOIL</td>
<td>Day 1 (2L) and day 14 (2L)</td>
</tr>
</tbody>
</table>

3. Add Pro-SOIL to the water used to hydrate the feedstock. The material should then be turned for an even application. Dilution of Pro-SOIL will vary depending on total water volume needed to attain proper moisture. Ideal moisture content should be 35-45%. Adjust as needed with sawdust, wheat bran or other green waste, such as leaves, grass etc.
4. Turn (aerate) the compost as needed. NOTE: The rate of the composting using Pro-SOIL should be monitored as turning will be needed far less frequently. In ideal conditions, the compost need only be turned twice throughout the cycle.
5. Pro-SOIL can be applied at a lower rate (2 liter/ton) when compost is mature to further increase microbial density and compost quality.

HOUSEHOLD GARDENS AND FLOWERS

LAWNS AND FLOWERBEDS:
Apply Pro-SOIL at a rate of 100ml mixed with water per 100m² of garden per week. Product can be applied by means of sprayer or watering can.

INDOOR PLANTS:
Apply Pro-SOIL at a rate of 15ml (1 tbsp.) per 2L of water. Apply once a week.

YARD COMPOSTING:
Add Pro-SOIL to compost at a dosage of 1-2L/cubic meter. Spray the compost pile on the first and last week of month or every 2 weeks as needed. Moisture should not exceed 35%. Turn as needed.
SOIL TREATMENT
This component of the program is important to help improve soil structure and
strengthen the beneficial micro-ecology of soil.

Apply Pro-Soil into irrigation water at a rate of 15L per hectare once fortnightly during the growing season, depending on soil health. If high pest pressure, or very compact soils, apply up to 30 litres per hectare as long as problems persist.

Note: If foliar treatment is also being done (as below), the soil application can be reduced to 10L/ha per application.

FOLIAR TREATMENT
Foliar treatment is not essential but is recommended in order to maximise the benefits of Pro-Soil, and particularly in conditions that are conducive to disease (e.g. mildew or rot), or to assist in combatting disease.

Recommended Dilution Rates:
Apply Pro-Soil as a foliar application at a rate of 6 – 12 litres per hectare using a dilution ratio of 1:125 with water i.e. 750L – 1500L of the mixed solution (Pro-Soil plus water) per hectare. If there are no acute disease problems, 6 litres per hectare is sufficient.

Recommended Frequency:
Winter:
EM Pro-Soil should be applied once a month as a foliar treatment to trees (or vines) as well as tree residue (litter) from the previous year. Many diseases from the previous year are harboured in the leaf and fruit litter. It is important to inoculate, remove, and compost this residue to help break the disease cycle.

Spring:
When bud swell begins increase Pro-Soil application frequency to once per week. If it is a wet spring and the temperatures become conducive for disease, particularly mildews and rots, apply Pro-Soil up to 2 times per week. Spray blossoms at a dilution rate of 1:250.

Summer:
Apply Pro-Soil every week as fruit is maturing. With more frequent treatments the fruit may develop improved colour, size, and overall quality.

Autumn/Post Harvest Treatment:
Spray Pro-Soil on the trees within 48 hours before harvest to maximize post-harvest fruit quality and storage. Resume winter schedule after harvest.

Grape Vineyard Recommendation:
If biweekly sulphur application occurs throughout the growing season, Pro-Soil applications (1:125 dilution ratio) can be alternated every other week to reduce sulphur application by 50%
APPLICATION TIPS

- During the 1st year of treatment it is critical to apply Pro-Soil on a consistent basis to ensure establishment of effective microorganisms.

- Foliar:
  - Apply Pro-Soil in the mornings or evenings when the solar index is lowest (mornings are best).
  - When increasing the Pro-Soil concentration for foliar applications it is recommended to treat a smaller test plot and monitor the 24 to 48-hour tree or vine response before treating the entire orchard or vineyard.

- Driplines:
  - Applying Pro-Soil via drip lines can initially produce clogging of the nozzles as a result of microbial activity releasing built-up deposits in the lines. It is not the Pro-Soil that causes the clogging, it is the scale and mineral deposits that the Pro-Soil is removing. This only occurs when first applying Pro-Soil through the system and once the lines are clean, it ceases to be a problem.
MATERIAL SAFETY DATA SHEET

MATERIAL: Efficient Microbes Pro-Soil
CODE: PS001
Updated: 5.11.2012

PRODUCT NAME: EM Pro-Soil
PRODUCT REG. #: B 4336 Act 36 of 1947. Group 2
DISTRIBUTED BY: Efficient Microbes cc
COMPANY REG #: 2006/184281/23

SPECIES IN PRO-SoIL:
Bacillus subtilis, Bifidobacterium animalis, Bi. bifidum, Bi. longum, Lactobacillus acidophilus, L. buchneri, L. bulgaricus, L. casei, L. delbrueckii, L. fermentum, L. plantarum, Lactococcus diacetylactis, Lactococcus lactis, Rhodopseudomonas palustris, R. sphaeroides, Saccharomyces cerevisiae, and streptococcus thermophilus.

SECTION I - PRODUCT IDENTIFICATION
GENERAL/GENERIC NAME: Liquid Microbial Inoculants
HAZARD RATING: HEALTH: 0 Normal Material
FIRE: 0 Will not burn
REACTIVITY: 0 Stable

SECTION II - HAZARDOUS INGREDIENTS
No hazardous ingredients present; not hazardous to humans, animals or plants.

SECTION III - PHYSICAL DATA
BOILING POINT: >100 °C
SPECIFIC GRAVITY: 1.2 (25°C)
VAPOR PRESSURE: N/D
SOLUBILITY IN WATER: Complete
VAPOR DENSITY: Air = 1
MELTING POINT: N/A
% VOLATILE BY VOLUME: 0
EVAPORATION RATE: Equal to water
APPERANCE AND ODOR: Dark brown liquid; sweet, fermented smell.
pH OF SOLUTION: < 3.50+0.20

SECTION IV - FIRE AND EXPLOSION INFORMATION
FLASH POINT: N/A
HAZARDOUS DECOMPOSITION BYPRODUCTS: None
EXPLOSION LIMIT: 0
FIRE FIGHTING PROCEDURES: N/A
EXTINGUISHING: N/A
SPECIAL FIRE & EXPLOSION HAZARDS: None
SECTION V - HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE
LEVEL: None; see Section II
HEALTH HAZARDS: None
CARCINOGENICITY: Non-carcinogenic
EFFECTS OF CHRONIC OVEREXPOSURE: None
PRIMARY ROUTES OF ENTRY: Skin contact, Eye contact, Ingestion, Inhalation

SIGNS AND SYMPTOMS OF EXPOSURE:
SKIN: None
EYES: May cause eye irritation
INHALATION: None
INGESTION: May cause gas

FIRST AID:
IF ON SKIN: None
IF ON EYES: Flush with fresh water
IF INHALED: None
IF INGESTED: Drink water

SECTION VI - REACTIVITY DATA

HAZARDOUS POLYMERIZATION: Will not occur
STABILITY: Stable with no toxic fumes.
INCOMPATIBILITY: None
HAZARDOUS DECOMPOSITION OR BYPRODUCTS: None; biodegradable

SECTION VII - SPILL OR LEAK PROCEDURES

IN CASE OF LEAK OR SPILL: Mop up with fresh water, sewer disposal
WASTE DISPOSAL METHOD: Sewer disposal
HANDLING AND STORING PRECAUTIONS:
STORE AT ROOM TEMPERATURE: Store at room temperature
HAZARDOUS WASTE: No

SECTION VIII – HANDLING AND STORAGE

MINIMUM/MAXIMUM STORAGE TEMPERATURE: 2°C to 49°C
HANDLING: Keep containers closed when not being used. This product presents a weak off-gassing of organic volatiles. Avoid direct or prolonged breathing off-gas.
STORAGE: Store in closed containers. Store in an area that is clean, dry, isolated from all toxic and harmful substances.
ABOUT EFFICIENT MICROBES

Started in 2006, Efficient Microbes is a privately registered company dedicated to the use of beneficial microbes for the improvement of human health, livestock and pet health, agriculture and soil health and environmental sustainability. The company is based in Durban, South Africa.

Efficient Microbes is committed to the consumer and to the environment, and offers the most effective and environmentally friendly solutions to a large number of problems that are normally solved with medicines or harsh chemicals.

For more information visit our website, or contact us for assistance in any area.