# Bactivate Liquid

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**It is unequivocal that science supports the use of micro-organisms as Plant Growth Promoting Micro- organisms in soil-plant systems. These organisms can provide many benefits including combating the effects of plant disease, organic matter turnover, nutrient fixing and mobilisation, and they also produce plant growth promoting compounds.**

It is well documented that soil ecology plays an important role in regulating many soil processes and properties, including but not limited to:

- Soil biota are the engine for OM turnover and nutrient release, key for soil fertility
- Soil biota produce compounds that build structural stability
- Soil biota fix free nitrogen from the atmosphere
- Soil biota form mutual relationships with plants (symbiosis)
    - increasing soil exploitation for nutrient uptake
    - nitrogen fixation, legume nodulation
    - mycorrhizal fungi to absorb phosphorus and other nutrients from soil. Soil biota decontaminate and lock-up toxic compounds
- Soil biota
    - improved soil structure
    - improves biota environment and population
    - macro fauna creates bio-pores improving soil atmosphere and soil drainage
- Soil biota combat the effects of pathogens or soil disease
    - pathogenic biota cause disease when there is a lack of biodiversity in soil (often when the system is disrupted by agriculture)
    - combat plant disease

There is an enormous body of research internationally and here in Australia that demonstrate the benefits that can be gained by managing soil microbial populations. This research has led to the development of the biological and nutritional products that are the basis of the Bactivate range of soil ameliorants. These products contain a range of soil based biological bacteria and fungi that are known in the scientific research community as Plant Growth Promoting Rhizo-bacteria (PGPR) or Plant Growth Promoting Micro-organisms (PGPM).

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## Overview

When soil is not correctly balanced in its structure, organic factors, chemical components and in its microbial life cycles often these instabilities lead to lack of performance of the plant it is attempting to mature. This is very common in farming practices in general as we often till soil, grow monoculture crops and apply chemical pesticides, fungicide and herbicides, quite a lot of these products affect the soil biological life throwing these balances in soils out. An effect from this can be unwanted soil pests, lack of nutrient solubilization, negative fungal pathogens just to name a few.

One of the keys to healthy soils is a well-balanced soil biological community and food sources for biological soil flora, micro flora such as fungi, bacteria and algae along with fauna and micro fauna such as protozoa and beneficial nematodes which in turn assists in superior plant growth and performance.

Bactivate Liquid can be of great assistance in many of the areas where degradation has taken place in one form or another. With the objective being to apply beneficial bacillus not only as an amelioration to assist the soil but also in the form of assisting regrouping of the provenance native biology already in the degraded soil. These symbiotic relationships taking place in the soil profile, when given time to prolificate, are hugely beneficial to many of the issues that come from common farming practices.

## What is Bactivate Liquid?

Bactivate Plus is a unique combination of bacillus bacteria that has been developed as a complete soil rebuilder, providing essential bacteria to the soil while simultaneously developing biological activity.

The bacteria in Bactivate convert the nutrients available in the product into useable plant foods. This process is conducted in the area of the plant's developing root system and encourages improvement of the soil structure, thus increasing plant development and yield improvement. Bactivate contains specific, individual antagonistic strains of bacillus bacteria, each of which has a specific function in nature. These functions can facilitate the reduction of chemicals and chemical fertilisers and feed the plant naturally, as nature designed it.

## How Do Bactivate Liquid Bacillus Work?

The majority of Bactivate Liquid bacillus have complex colony forming habits in the rhizophere of a plants root system, and sometimes within the general soil structure, they are reproducing in these colonies when the correct food sources and soil components, such as plant exudates or carbohydrates and proteins are available.

Bactivate Plus contain three beneficial strains of beneficial soil bacillus, B. subtilus, B licheniformis, and B megaterium. This combination has the potential to assist soil in a considerable manner of ways.

*Bacillus megaterium*

*Bacillus megaterium* has a strong ability to decompose phosphorus compounds in soil. The bacterium is also a saprophyte (which is to say that it decomposes animal and plant remains in the soil forms accessible for uptake by plants to use for healthy growing. Phosphorus is one of the three major or primary nutrients for plants that were originally rich in the soil. However, most agricultural soils have a lack of plant- available phosphorus. This, in conjunction with the practice of using phosphate fertilisers in large amounts in search of high yields leads to a situation where there are often significant amounts of phosphorus compounds sitting undissolved in the soil.

The bacillus bacteria in Bactivate with their phosphorus decomposing effect promote the availability of the phosphorus that is often already sitting in the soil after heavy over-fertilisation. *Bacillus megaterium* therefore is of great assistance to improve the utilisation of the phosphorus element in the soil for increased and healthy plant growth.

*Bacillus subtilis*

*Bacillus subtilis* is known for its capacity to multiply quickly in the soil. It also shares the ability common to the other bacteria in Bactivate in that they have the ability to form a tough, protective endospore, allowing the organisms to tolerate extreme environmental conditions. It has a strong capacity to produce proteinase, diastase and pectase. It is the major bacillus that decomposes animal and plant remains into available nitrogen in the soil. These bacteria live within specialized nodules on the root systems of plants, where they process atmospheric nitrogen into a form available for the plants to use. Thus, *bacillus subtilis* frees up soil nutrients in both soil and air for plant use.

*Bacillus licheniformis*

*Bacillus licheniformis* is a facultative anaerobe bacterium that proliferates in soil. It is capable of decomposing protein and lignin to provide nutrition for plants in forms such as amino acids. It can effectively decompose organic matter in the soil and thereby provides nutrition for the growth of plants. The strain present in Bactivate has extensive colonization and competitive abilities for sustainable soil management, and plays a key role in plant growth and performance.

## Research

Much research has been completed on many soil beneficial PGPR and bellow is a sample of works completed using strains of B subtilus. Further reference papers are available online.

Application of B subtilis trials on tomato plants.

B. subtilis isolate B7 was effective in reducing disease incidence and severity levels on tomato plants when added to the F. oxysporum and R. solani-infested soil 3 days before planting tomato as compared to

F. oxysporum and R. solani-infested soil receiving no bacteria as a control. B. subtilis isolate B7 stimulated the growth of tomato plants compared to the other treatments since the fresh and dry shoot weights (6.952 and 0.990 g, respectively) and fresh and dry root weights (1.267 and 0.212 g, respectively) increased significantly. Control treatment inoculated with F. oxysporum and R. solani without antagonistic agent (B. subtilis isolate B7) had significantly less fresh and dry weight of shoot and root.

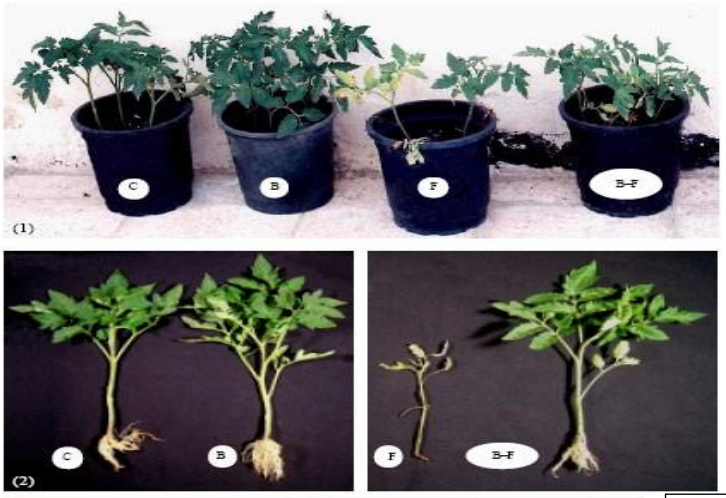


Fig 4: Effect of Bacillus subtilis isolate B7 on the growth and development of tomato plants growing in soil infested with Fusarium oxysporum; (1) shoot and (2) root growth. C, Control; B, B. subtilis isolate B7; F, F. oxysporum; B-F, B. subtilis isolate B7-F. oxysporum

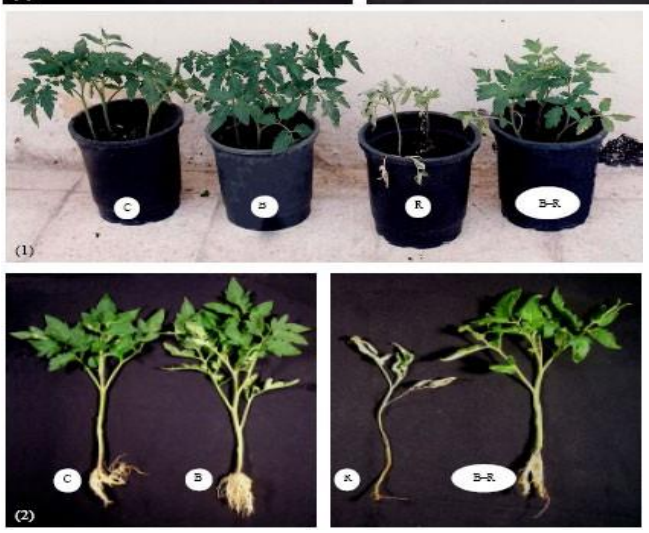


Fig. 5: Effect of Bacillus subtilis isolate B7 on the growth and development of tomato plants growing in soil infested with Rhizoctonia solani; (1) shoot and (2) root growth. C, Control; B, B. subtilis isolate B7; R, R. solani (R1); B-R, B. subtilis isolate B7- R. solani

Effect of Bacillus subtilis isolate B7 on the growth and development of tomato plants growing in soil infested with Fusarium oxysporum; (1) shoot and (2) root growth. C, Control; B, B. subtilis isolate B7; F, F. oxysporum; B-F, B. subtilis isolate B7-F. oxysporum

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