

# Cost Effective Bio-fertility with DIY Microbial Cultures

How to Make and Use Extracts,  
Inoculants and Ferments on Farm



# Microbes and Plant Production

## Why?

Plants and the microbes that live on or around them function as a whole system. Microbes promote the health of plants they associate with as it is in their best interest to look after their energy suppliers.

The range of services carried out by plant microbial associates include:

- Accessing, acquiring, accumulating, assembling, improving availability and cycling of nutrients.
- Structuring/aggregation of soil, humus production
- producing growth regulating hormones and enzymes
- suppressing pathogenic microbes and inducing resistance to pest and disease attack
- triggering physiological changes within plants to cope with environmental stresses

## Where?

Well, everywhere really! Greater numbers are found where there is food and appropriate habitat. i.e. in decomposing organic litter, topsoil and in, on and around plants and animals.

## When?

Microbe activity is triggered by environmental and biological cues.

At any one time the vast majority of soil microbes are in a dormant state which enables them to survive until conditions are favorable.

## What?

The population and behaviour of microbes in any situation is largely determined by the inherent characteristics of the local environment and management practices.

Microbes can also express themselves in numerous ways, at any one time a type of microbe may act pathogenically or beneficially based on signals from their surrounds. The effectiveness of introduced microbial products used for agricultural/horticultural purposes can vary dramatically based on the materials used, method of application and the living conditions.

## Way?

### Promote

- Soil coverage with living plants and organic residue
- Biological nutrition, P&D management and weed control
- Traffic management
- Conservation, non inversion and no tilling
- Rotational grazing
- Diversity, stacked enterprises

### Hinder

- Bare fallow, burning stubble, overgrazing
- Synthetic fertilizers, herbicides, pesticides and fungicides
- Compaction
- Heavy tilling, especially in the warm season
- Set stocking
- Monoculture production

# Plant/Soil Microbe Cultures

## **Aerobic Soil Microbes**

- Saprophytic Fungi – Trichoderma, etc...
- Protozoa – Flagellates, Ciliates, Amoebae
- Nematodes – Bacterial Feeding, Fungal Feeding, Predatory, Omnivorous
- Bacteria – Azotobacter, Azospirillum, Clostridium, Streptomyces...

Culture – aerobic composts, compost teas, commercial inoculants





## Plant Microbial Colonizers

- Bacteria – Rhizobia...
- Fungi - Mycorrhizal Fungi
- Viruses etc...

Culture – root fragments, populated substrate, commercial inoculants

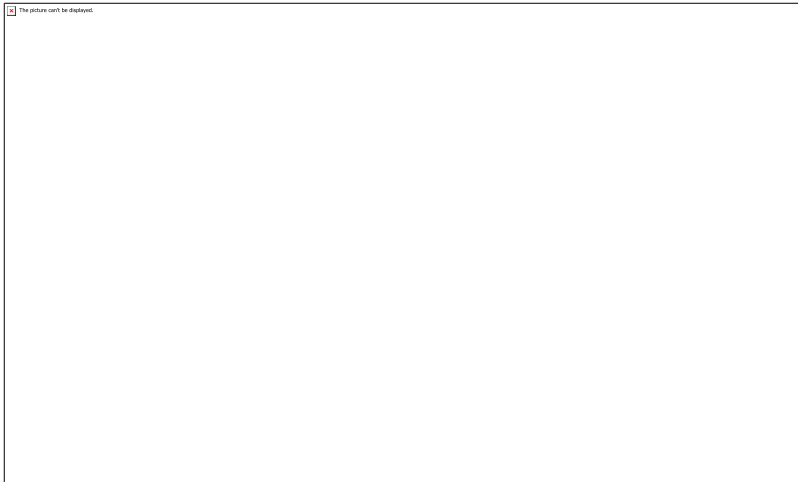




## Facultative Anaerobes

- Bacteria – Pseudomonas, Lactobacillus, Rhodobacter...
- Yeasts – Saccharomyces...

Culture - ferments, yeast cultures, effective microorganisms, various brews...



# The Art of Making Fine Compost



<https://productiveecology.com.au/2022/02/08/making-compost/>



# Applying Compost

- Small amounts of high quality compost or vermicast extract can be used on or with seedlings at planting
- Mature compost contains a diverse array of microbe populations, mostly in a dormant state that can be applied to the soil and plants
- Over the life of a mature compost heap, successions of microbe populations release numerous biochemical compounds that are known to stimulate biological activity when applied to the growing environment
- The use of compost extracts is most effective at planting and in the early stages of plant growth as they promote the establishment of a healthy plant microbiome from the beginning
- Alternatively, compost extracts and foods can be applied to the soil and surface litter to prime the soil biology as a means to improve processes such as decomposition, humification, aggregation, nitrogen fixation, mitigate pathogen expression etc...

# Recipes

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# Plant Microbial Colonizers



## Culturing Plant Microbial Colonizers:

- These microbe groups are only active on living plants but can survive and spread in dormant states between growing seasons
- Plant parts such as root fragments, seeds and soil from around plant roots that contain reproductive material can be used to inoculate new growing environments
- Each plant species hosts specific types of microbes and must be selected to grow desired colonizing cultures such as rhizobia and mycorrhizae
- Legumes specifically host rhizobia species i.e. peas, beans, clovers etc...
- Certain annual plant species typically host a wide range of endomycorrhizae fungi species including sorghum, millet, oats, sunflowers etc...
- Some tree families host a wide range of ectomycorrhizal fungi species i.e. Pinaceae, Betulaceae, Fagaceae, Myrtaceae etc...

# Facultative Anaerobe Culture

It is a fairly simple process to culture many types of facultative anaerobe groups with readily available, affordable ingredients and materials





They are relatively hardy and adaptable cultures and can be employed in a number of ways:

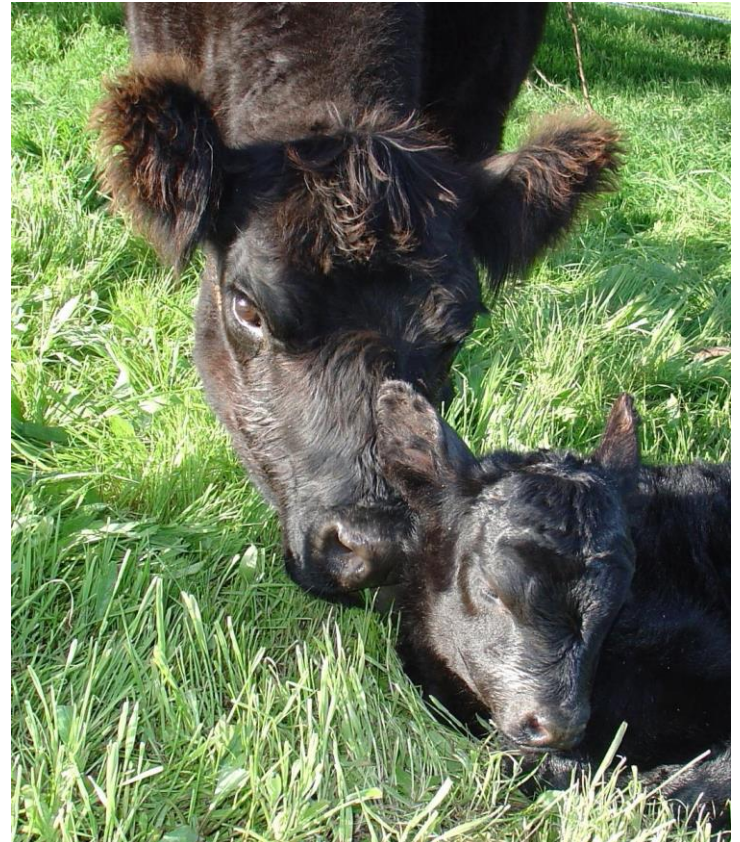
- to brew liquid fertilisers using animal, fish, plant, seaweed and sulphate/salt nutrients
- as an organic acid medium for the conversion and chelation/complexing of nutrients to improve plant availability
- in the fermentation of various foods and beverages
- as a culture for breaking down organic materials, i.e. SPICE and Bokashi
- for remediation of wastes and toxins
- for generating fuel by-products of organic matter digestion
- to make probiotic supplements for livestock
- as a biostimulant for field application

# Starter Cultures

As they can live in both aerobic and anaerobic conditions, facultative anaerobes are fairly hardy and can be found everywhere in the environment.

Common starter cultures include:

- Native Microbe Seed
- Fresh Rumen Contents
- Lactobacillus Serum (LAB)
- BAM
- Kefir
- Effective Micro Organisms
- Yeast



# Biofertiliser Ferments





# Recipe for a 200L Barrel

- **Starter Culture**

40L Fresh rumen contents/Manure or 20L of Native Microbe Seed/Lab Serum/BAM/EM culture or 10L recently made Bio-fertiliser. (you can use any combination of the above, reducing the rates proportionately with the number of different starter cultures you use)

- **4 Litres of molasses**
- **8 Litres of milk/whey**
- **200g of bakers/brewers yeast (optional)**

## **Optional Extras:**

- **Up to 3kg - Basalt dust, rock phosphate, diatomaceous earth, dolomite, micronized guano etc...**
- **Up to 2kg - wood/grass/bone ash, soluble seaweed, sea minerals, blood and bone, fishmeal, sea salt, humic substances, ground biochar etc...**
- **(Place extras in a fine mesh sack/bag. Remove after a week)**

## Process

Put the starter culture in the barrel first.

Mix molasses with some warm water, milk and yeast then add to the barrel.

Top the barrel up with water leaving a 20 cm gap. Leave a larger gap if you plan to add subsequent ingredients and foods to the barrel.

Insert the sack/bag of optional extras.

Seal the barrel. The lid must be airtight and fitted with an airlock so gas can escape but air cannot get in.

The facultative anaerobes feed on the milk/whey (protein), molasses (energy) and minerals and go through cycles of growth, reproduction and death, forming spores and cysts when the food runs out.

The finished product contains a rich mix of amino acids, chelated/complexed nutrients, phyto-hormones, vitamins, enzymes etc...

# Foliar Nutrient Application Recipe

For 1 Hectare:

- In a 20L bucket add up to 20L Biofertiliser Ferment. Other useful additives or substitutes include up to 2L Fulvic Acid, up to 2L Fish Hydrolysate, up to 1L Molasses.
- Half the rates for broadacre application.
- Top the bucket up with water.
- Add appropriate amounts of sulphate/salt nutrients for a 1 hectare foliar application i.e. 1kg Iron Sulphate, 1kg Manganese Sulphate, 50g Sodium Molybdate, 250g Solubor, 2kg Manganese Sulphate etc...to the bucket and mix well
- Fill the spray tank with water and adjust pH to between 5 and 5.5 as necessary with citric acid.
- Add 20L bucket contents to the spray tank.
- Add surfactant/spreader/sticker agent.
- Spray out in the early part of the day before it warms up or towards dusk when conditions are dry.

# Integrating Bio-fertility Strategies

- Plant diversity supports microbial diversity so grow a wide range of plant species
- Use above ground plant material for mulch and compost
- Use root fragments and soil from the rhizosphere of mature plants to inoculate growing environments
- Make use of grazing animals as they incubate and spread a wide range of microbes
- Save seeds from healthy plants for subsequent planting
- Use compost and inoculants when planting
- Include compost extract in liquid nutritional applications

# Questions

