How to make Worm Tea

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What is worm tea

Worm tea is the liquid that is produced from worm castings (vermicast). The microbes involved in the breakdown of organic waste are also the microbes that encourage resistance in healthy soil.

Modern agricultural chemicals, such as cidal agents, and repetitive fertilizer use, alter the soil's biological qualities and ultimately reduce biodiversity. Exposing soil to the sun through the removal of cover also has a detrimental effect on soil through UV sterilization of microbes and increased desiccation of the soil itself. Tillage of soil is another detrimental process that uproots the fine fungal mycelium that exist in the soil, and exposes labile organic carbon which quickly breaks down when exposed to air.

Once soil is damaged, it will remain so until the biological portion of the soil is replaced. Although the air is filled with spores of bacteria and fungi which continually colonise the surface of the soil, rarely are these the beneficial microbes distributed around the root system of healthy ecosystems.

Plants and the life forms in soil form a symbiotic relationship. It is being established that roots secrete exudates, which facilitate the sharing of nutrients between all organisms and the minerals in the soil. Bacteria and other microbes have the ability to withdraw nutrients from the insoluble nutrient sources contained in soil. The microbes can then pass these nutrients forward up the chain from mineral to microbe to plant. Worm tea provides a cost effective mechanism for transferring beneficial soil microbes from a small source to a large application. Compared with the vermicompost, where physical application could be performed by conventional spreading. Worm tea can be created from a small supply, multiplied, and then spread over a much larger area. Around 20 kilograms of un-screened vermicompost can produce 1000L of worm tea. Foliar spray requires 50L per hectare.

Special points of interest:

- Not all worm tea is good for your plants.
- In all environments, greater diversity indicates a healthier ecosystem.
- Feedstock used to feed earthworms does not affect the worm tea, so long as the waste has sufficiently broken down.
- Worm tea is an excellent foliar spray.
- A good worm tea protects plants from common infections such as leaf curl.
- If you are not sure what good worm castings are you can buy them from any AWGAVI member.

How do I make worm tea

There are many ways to make worm tea. Firstly, a worm tea is brewed for a period of time and generally has aeration and several additional nutrient sources for added microbial selection. A worm extract on the other hand is simpler. An extract is very similar to worm leachate, which is the liquid that leaches from a worm bin. Unlike the worm leachate, which when left to stand becomes putrid anaerobic, an extract is made just before time of use.

Worm teas and extract both start with the same first step.

Step 1: Create a worm bed which is healthy and aerobic (see previous info sheet).

Step 2: Collect worm castings to wash out beneficial microbes. Depending on the source, ratios of 1:5 to 1:20 castings to water can be used. The better the castings, the less you require. Worm teas generally require less castings, as they are brewed to encourage growth after the extraction phase.

Step 3: Extraction phase. Place the castings in a fine mesh and thoroughly extract out as much of the fines as possible, while attempting to prevent any bigger particulate that will block the application device, such as a watering can. The more vigorous the extraction phase, the higher the microbial load will be in the resultant extract. (For Extract move to step 8).

Step 4: Brewing a worm tea is a lot like learning to cook. Trying new things will never hurt so long as you ensure the end product doesn't have a foul odour to it. A foul odour is symptomatic of putrid anaerobic bacteria being present in your brew. Once putrid anaerobic conditions exist, bio-films will become increasingly evident. This is an indicator that phytotoxic compounds are present. Ciliates will also be visible though any low powered microscope, which is also a negative sign for the end product. To ensure that the worm tea does not become anaerobic, its production requires a small aerator, such as would be found in a fish tank.

Step 5: Adding in nutrients during the aeration phase can alter the biological qualities of a product. Adding in seaweed extract is thought to increase the level of fungi, while molasses can improve bacterial levels.

Step 6: Aeration times will vary widely, and this may require the use of a microscope to assess the presence of indicator organisms such as ciliates. This is an indication of partial putrid anaerobic conditions. EM as an additive can assist in alleviating this.

Step 7: Additions (see back page)

Molasses can be used to boost bacteria levels and assists with foliar sprays sticking to the leaves.

Fungi can be cultivated from seaweed extracts and other humus sources.

Foliar spray: 50L per HA. They can have ciliates present and can be bacteria rich, however this is not ideal.

Soil Dench: 200L per HA. Grasses and Brassicas require bacteria rich worm teas. Shrubs and trees require higher fungal levels.

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Variations on a theme

Worm tea can be created for specific conditions and plants. The level of technicality is left up to the end user. Before attempting anything too technical, ensure that you purchase a low powered microscope so you can ensure you are observing the affects of changing conditions.

Take notes and if possible, take photos of your different brews for records.

Fungi and bacteria in the worm tea

Your vermicompost and the waste you put in it has a limited microbiological diversity due to physical constrains. When you're travelling, think of taking a handful of soil to mix in to your compost. This will allow you to add diversity to your end product.

It is necessary to have a coarse mulch to cover your worm bin and over time this mulch will begin to turn in to compost. Mixing the left-over castings from the worm tea process with some compost makes it ideal for spreading on your garden.

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'Promote the use of earthworms to recycle organic waste for the betterment of the environment'

Amanita muscaria or Fly Agaric is a well known mycorrhizal fungus, which forms relationships with pines and some eucalypts.

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Improving your worm tea

Adding molasses increases bacterial growth and provides an adhesive factor for the bacteria and other microbes to adhere to the leaves' surfaces.

The best method for foliar spray will depend on individual circumstances, however some universal aspects to remain aware of are;

- 80-90% leaf cover is an effective application.
- Some pumps will damage the microbes by exposing them to mechanical damage or excessive pressures, which lysis microbes.

Ensuring good aeration occurs throughout the worm tea production will ensure active growth of beneficial microbes. Some worm teas can be allowed to go mildly fermentative and anaerobic with the use of EM, however if a foul odour is detected at all, the batch will not be recommended for use.

A list of additives to use is difficult to assess. If you have a microscope it is possible for you to determine the effects of varying additive types and levels of input. Clearly some additives are recommended to be avoided, such as any product from a mining activity or derived from an unsustainable source. Common additives such as coal dust and humic acid (humate) are generally very acidic and do nothing more than assist in sterilizing the resultant product.

Mycorrhizal worm teas

Mycorrhizal fungi are symbiotic rather than saprophytic. Although both types of fungi are extremely important in the make up of soil, saprophytic fungi aid in the breakdown of cellulose, lignin and hemicellulose, while mycorrhizal fungi link separate plants together forming a larger root surface area and encouraging greater environmental tolerance.

Mycorrhizal fungi come in two generic types. Firstly, like the Fly Agaric, some form fruiting bodies. This is a marker as to their presence. These are known as ectomycorrhizal fungi. The second type, endomycorrhizal, are far harder to locate due to their entire life cycle existing under ground. These are broadly referred to as the genus *Glomus*.

Finding these fungi in Australia can be a time consuming process and either requires the purchase of an already made inoculum, or identifying and isolating the fungi in the wild. When fungi hunting, ensure that you have a valid permit through your state's Environment department (not including the EPA) and that you notify the relevant parks authority. I recommend buying some books before you start and ensure you have researched the area extensively, as any areas that have been tilled, fertilized, sprayed with cidal agents or clear felled will most likely have a reduced variety of fungi.

Recommended reading would include 'Fungi of Southern Australia', 'A field guide to the fungi of Australia' and 'Common Australian fungi: A bushwalker's guide' are a good starting point for any enthusiast. Collecting fungi will also require you to ensure that they are well dried before storage, as they tend to 'melt' in to a goo if not desiccated in an adequate fashion.

What is staining?

Staining is the process of adding different chemical dyes to a dilute sample of suspended soil, such as worm tea. By following very specific procedures and safety protocol, it is possible to increase your ability to identify what is what under your microscope. Stains exist for different types of bacteria, such as the Gram stain, which allows the microbiologist to identify the difference between populations of gram positive bacteria and gram negative bacteria in a particular sample. For staining to be useful I would recommend the use of a powerful microscope. Otherwise the resolution of what you are trying to identify will be insignificant.

What is plate counting?

Plates and plate counting is another useful way to identify population types and quantities of microbes in your worm tea. This is the next step above staining and requires Bunsen burners, autoclaves, incubators, plates, agars, substrates for the agars and a whole host of microbiological hand tools. This is best left to the professionals, due to the expense and level of skill required for reliable results.