# Eco-Tea Engineered Compost Tea

*Updated December 2015*

**What is ECO-TEA?**

ECO-TEA is an organic aerobic compost tea created from the highest quality ingredients. It is a living liquid teeming with trillions of microorganisms in every gallon that breathe oxygen, and are beneficial to your plants and soil. ECO-TEA contains an abundance of bacteria, fungi, protozoa, nematodes, and other soil micro-invertebrates, as well as many soluble nutrients in sufficient quantities, such as Nitrogen, Calcium, Magnesium, Iron, Zinc, and Copper all of which help to create an optimal environment for plant growth.
ECO-TEA is a great organic amendment for any garden or lawn. Our superior brewing equipment and ingredients ensure that our product is always the best. We start with the highest quality ingredients available! The night-crawler worm castings are obtained through an organic worm farm that feeds the worms with high quality food. This results in consistent, high quality worm castings. Next we add our compost and biostimulants. This provides an optimal environment rich in oxygen, allowing the microorganisms to multiply by $10^9$ times. In fact, one gallon of ECO-TEA contains roughly the same number of microbes as 2000 lb of worm castings alone!

ECO-TEA is a general fertilizer beneficial to all plants. When considering alternatives to ECO-TEA, please consider the following:

- ECO-TEA works differently than synthetic fertilizers. The effects of ECO-TEA increase and improve with time instead of being depleted and used up as the growing season progresses. This is a result of the organisms within ECO-TEA reproducing in the soil surrounding your plants once it has been applied.

- Chemical fertilizers and pesticides destroy soil biodiversity by creating salt compounds. Salts are toxic to most organisms and contribute to problems such as nutrient leaching and acidification of soil. ECO-TEA restores the soil biodiversity helping to reduce nutrient leaching by creating stable soil structure. The microorganisms that are introduced into the soil by the application of ECO-TEA also help break down both chemical and plant produced toxic compounds.

- ECO-TEA is a general use tea as opposed to other teas that target a particular plant or a specific result (i.e. bat guano adds P for increased fruit and flower production). You can use ECO-TEA on any crop, plant, or tree to increase the biodiversity of microorganisms on the leaf surfaces and in the soil.

- ECO-TEA is an aerobic tea meaning that the bacteria within ECO-TEA breathe oxygen. Caution: There are many anaerobic teas (lacking oxygen). Anaerobic tea is the result of poor aeration. When a tea becomes anaerobic it becomes toxic to plants. NEVER apply anaerobic teas to your plants. Many pathogenic organisms proliferate under low oxygen conditions and thus if you apply this to your soil you introduce these pathogens and they begin to attack your plants, killing them. If your tea smells bad then it is bad. Good tea smells like soil.

There are many ways to make aerobic compost tea, much like there are many ways to make anaerobic compost teas. The main difference between ECO-TEA and other teas are the ingredients that go into it. The quality and consistency of ingredients makes a dramatic difference on the final product. ECO-TEA is consistent in terms of its microorganism counts and diversity. We also make sure that we apply ECO-TEA within the 12 hours post brewing. That is sufficient time window to keep the ECO-TEA aerobic. After 24 hours the oxygen reserves would be depleted and the beneficial microorganisms would essentially suffocate.

**ECO-TEA Restores Soil**

Many, if not all agricultural soils are constantly under stress from chemical fertilizers, pesticides, herbicides and fungicides which are applied in order to increase growth and thwart off pathogens. These chemicals eliminate much of the soil biodiversity. Under these conditions micro-invertebrate, bacterial and fungal pests are able to proliferate, in turn negatively affecting plants. ECO-TEA re-introduces the beneficial microorganisms into the soil and restores it to a more natural, healthy form. Invariably a healthier soil naturally leads to healthier grass, crops, trees, flowers and fruits.

**ECO-TEA is 100% natural and 100% safe**

All the ingredients in ECO-TEA are natural. The compost used in the brewing of the ECO-TEA comes from an organic plant farm, and does not have any animal manure or any other animal by-products. This means that ECO-TEA does not contain harmful pathogens, like E. coli and Salmonella found in animal manure, which can pose serious health risks if not handled properly. ECO-TEA also does not contain any harmful chemicals normally found in synthetic fertilizers, pesticides, herbicides, and fungicides. Earthworms can only survive in healthy soils because they breathe through their skin and many pollutants will kill them. ECO-TEA will not harm the environment and is completely safe for our children and pets.

**ECO-TEA Provides Immediate Nutrients**

The nutrients present in soil must be in particular forms in order for plants to benefit from them (i.e. uptake them to grow). Most nutrients which plants require are locked up in humic materials within soil aggregates. Humic materials are processed by bacteria and protozoa

unlocking the stored nutrients, Nitrogen in particular, into forms useful to plants. Often animal manures contain too much available Nitrogen and plants die from fertilizer overdose. ECO-TEA is different. The beneficial organisms in ECO-TEA feed on substances naturally present in the soil, unlocking them for plant use as required by plants. Thus, by using ECO-TEA your soil will be enriched with microbes that will increase growth and health of your plants immediately and long term.

**ECO-TEA Improves Soil Structure:**

Good, healthy soil structure is essential to obtain healthy plants. ECO-TEA will naturally improve the structure of your soil via microbial, fungal and invertebrate action. Good soil structure helps oxygen move into and through the soil. Oxygen is essential for the maintenance of the healthy, vibrant biodiversity in soil. A healthy soil structure allows plants to easily move their roots through the soil, leading to an extensive, healthier root system, which in turn leads to healthier plants. Another benefit of healthy soil structure is the improvement in moisture retention. Water retention is important because it is a natural solvent, without it nothing happens nutrients cannot be dissolved into available forms. When soil is moist the organisms present in the soil are free to swim and move around feeding and plants can obtain water and nutrients as required. Finally, a healthy soil structure will also make it easier for your soil to deal with erosion and compaction.

**ECO-TEA Improves Soil Nutrient Retention**

When synthetic nutrients are added to soil, nothing really holds them there. With irrigation and rainfall, nutrients often swiftly drift below the root zone rendering them useless to plants. Nutrient leaching contributes to ground water contamination in areas of intense agriculture and leads to soil acidification. ECO-TEA contains an abundance of beneficial fungi and microorganisms. Also, ECO-TEA, unlike animal manures and hot composts, ECO-TEA will NEVER burn your plants.

**ECO-TEA Stimulates Plant Growth**

As mentioned earlier, ECO-TEA contains an abundance of beneficial bacteria, fungi and other microorganisms. These microorganisms release micro-nutrients, plant hormones and enzymes into the root zones, readily available for plant uptake. In return, the plant releases sugars into the surrounding soil as a fuel source for microbes. By utilizing these hormones and enzymes, plants do not need to expend energy creating them and in turn can focus on more vigorous growth. Ultimately, if used in a regular program ECO-TEA will aid your plants in producing larger, more numerous, tastier, more fragrant and longer lasting flowers and fruits.

**ECO-TEA Increases Pest Resistance and Disease Suppression**

**This is the main benefit to using ECO-TEA.** When you apply ECO-TEA, you re-introduce beneficial microorganisms into the soil. These beneficial microorganisms consume harmful herbivores and pathogenic organisms as well as compete for the space and resources with harmful bacteria and pests. By outcompeting and consuming harmful organisms, the beneficial microorganisms inhibit their presence. This creates healthier plants. Pest insects will likely prey on weak and unhealthy plants. When you have stronger and healthier plants, you make them better suited to resist the attack of pest insects. Please note that ECO-TEA does not harm beneficial insects. ECO-TEA has been shown to prevent dollar spot and other common fungal pathogens. ECO-TEA can save your establishment thousands of dollars in fungicide costs and stop your reliance on harmful chemical fertilizers and pesticides.

**Why Eco-Tea?**

High quality, aerobic compost tea is made from diverse sources of composts and other natural ingredients. The "brewer" extracts the beneficial microbes from these composts etc. and with the addition of food sources for the microbes to grow on, these microbes will multiply many times over. Oxygen levels are maintained at a high level to ensure that only the beneficial aerobic microbes reproduce and grow – not the potentially harmful anaerobic microbes. These microbes will repopulate the microbial population in the soil and on the leaves provided they are given what they need. These microbes have a variety of jobs including,

In the soil:

* Breaking down crop residues, reducing sites that over-winter disease
* Attacking disease organisms
* Fixing nitrogen
* Releasing soil nutrients
* Adding organic matter back into soil as they build humus

On the leaves:

* Protect leaf surfaces
* Symbiotic relationship with leaves - (they feed each other)

By adding these beneficial microbes back into the soil and onto the leaves, you are replenishing this invisible army, so it can go to work for you.

**Biological Factors to Consider:**

In order to keep plants healthy, beneficial microbes need to be established in the soil and on the leaf surfaces ahead of times of stress or pathogenic invasion.

In the soil the beneficial microbes have a large variety of jobs including retaining nutrients and unlocking nutrients as the plant needs them. Over the years growers are finding they have to use more and more fertilizer to keep up with their crops. They have to add lime on a regular basis. A major reason for this is the fact that the beneficial microbes gradually get killed off in the process of intensive farming due to pesticide use, soil compaction, extensive tilling, etc. If these microbes are not replaced, nutrients will no longer remain held in the soil and will leach away into the ground water. By replenishing these microbes with good quality aerobic compost tea, you are putting the biology back into the soil where it can again work for you.

When the beneficial microbes are not present in sufficient numbers, the disease organisms multiply in abundance causing more need for chemicals. The beneficial microbes in the soil take time to multiply and grow, so applications are best done the previous fall for a crop this spring, although spring applications are still beneficial if none were done last fall. Many diseases over winter in the soil and the microbes need time to find food, multiply, and start their work.

These microbes need food. Applying the microbes without any food to grow on, will have limited benefit. If applied to the leaves, you need to spray the tea on with an activator or microbial food, so the microbes can get started. An active bacteria secretes a sticky substance that will stick it to the leaf. After the microbes have established on the leaf, they will feed on exudates from the leaf and the leaves will feed on the exudates from the microbes. If fungicides are used and/or certain insecticides, these beneficials are likely to be destroyed. If it becomes necessary to use a fungicide, a follow up application of tea will help replace the beneficial microbes lost.

Aerobic compost tea contains only a small amount of available nutrients, however it contains biological life that will significantly increase the benefits of the nutrients already in the soil. It is still important that these nutrients be well managed and balanced. Failure to do so, will decrease the benefits obtained by the tea.

**Application**:
With the above background, it is not hard to realize that there are certain principles that must be kept in mind during application. Oxygen levels must be kept up until application, but this is quite easy using simple fish/aquarium equipment. There is some particulate matter in the tea, so larger filters (>25 mesh) and therefore larger nozzles are necessary. A

diaphram pump is recommended if possible. Applying the tea with a sprayer containing pesticide residues, may reduce effectiveness and too much pressure will harm the organisms as they are sprayed onto the leaf or soil surface. These things need to be worked out ahead of application time so that the fungi and bacteria are not screened out or damaged too much in application.

If applying to foliage, it is important that there be good beneficial organism coverage on both sides of the leaf. Applying with equipment that will ensure uniform coverage and using appropriate microbial foods to stimulate microbial growth will help to ensure that the microbes get well established.

Aerobic compost tea is best applied in the cool of the morning or the evening so the microbes get a chance to establish before the sun is too bright. On the leaves, it is important to apply when it is not raining, so they are not washed off before they can stick on. If doing a soil application, during or just before a light rain would be ideal. If applying with large volumes of water as in during an irrigation event, then bright light is not a problem due to water volume.

## Making Eco-Tea & Application Guidelines

Please follow the manual that comes with your specific tea-making machine (50-75 gallon brewer, 250 gallon brewer, Arrakis) for set up information. Here are some additional notes to help you make Eco-Tea with your new machine.

There are quite a few factors that can affect the quality of the final compost tea so it is important to understand a few basics.

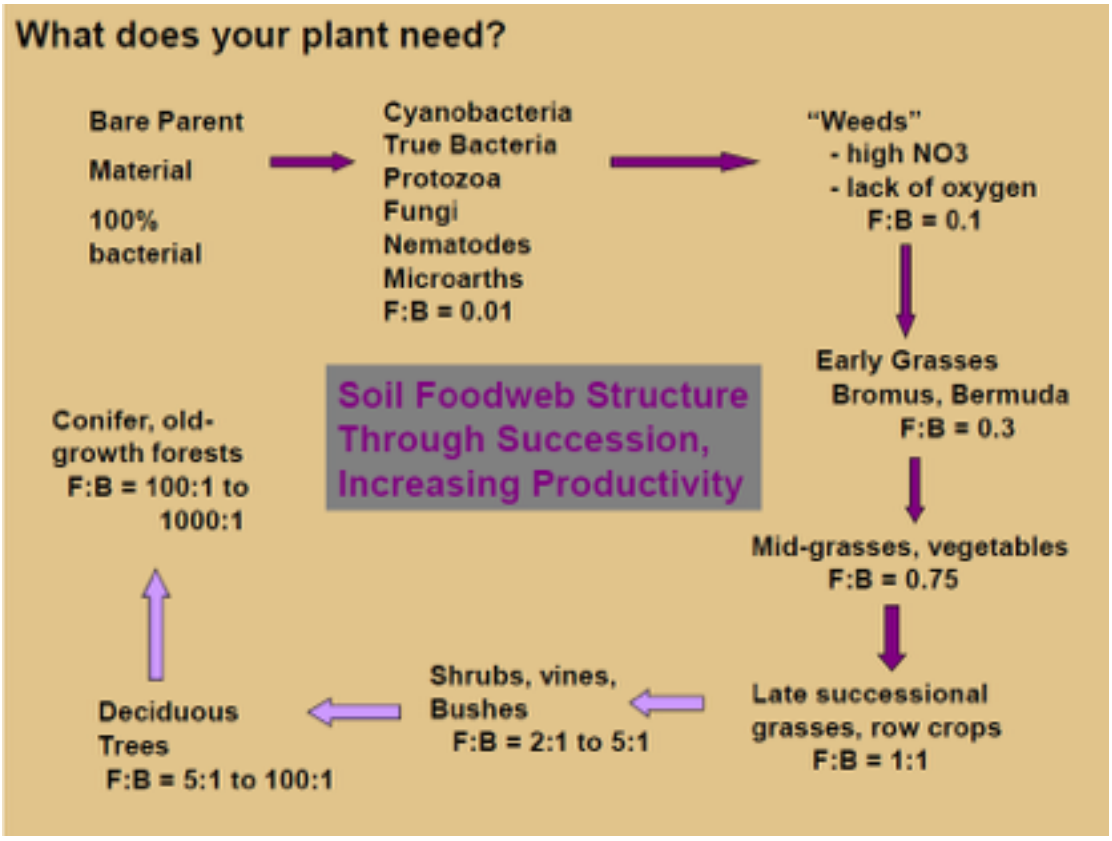
1) Compost is the inoculum, so it must be of the highest quality. We do not recommend that you substitute another compost source without testing the biology of the new compost source before using it.
2) Compost should always have room to move around in the compost bag. Do not use more than the recommended amount without emptying the bag first.
3) The aeration tube should always go to the bottom of the brewing container so that good thorough mixing action is achieved.

4) Sufficient aeration maintains good levels of oxygen in the water thereby allowing the growth of beneficial fungi, bacteria, and protozoa. Compost tea should always end with a good earthy smell. If it has any kind of a bad or foul odor, then something has gone wrong in the brewing process.
5) We recommend that your starting water temperature be a few degrees warmer than soil temperature, but never over 21ºC (72ºF). Brewing at lower temperatures (13ºC (55ºF) requires more like 72 hours to complete the process whereas brewing at 21ºC (72ºF) will allow brew to be done in 24 hours.
6) The foods we provide are specially selected to promote beneficial microbe growth and quantities are matched to the amount of aeration that the machine is capable of doing. Do not increase food amounts over the recommended rate or use other food sources without testing oxygen levels, or your tea may go anaerobic and harm your plants.
7) Make sure to use good clean well water or equivalent. Chlorinated or Fluoridated water can kill the organisms before they have a chance to grow.
8) Clean the machine regularly after each use. A black scum buildup can ruin subsequent batches of tea due to the anaerobic toxins produced in the slime layer.
9) There will be a fair amount of small compost particles left in the tea after the brewing cycle is complete. These particles may clog an ordinary sprayer. We provide a small screen so you can pour the tea through this screen before application, but you may need to increase your sprayer nozzle and/or filter size to prevent plugging. There is lots of beneficial microbial life resident in the organic matter particles, so the more you have to screen out, the less beneficial life will be left in the tea.
10) Due to the beneficial organic matter and biology in the tea, it will settle quite rapidly without aeration. Compost tea should be kept mixed while being applied.
11) Sometimes the compost tea may foam up some during the brew cycle. If this happens, don't be alarmed, just add a small amount (1 tsp) of sunflower oil or similar vegetable oil. The oil will reduce the foaming and be an added food for the microbes.
12) The tea is ready for use in about 24 hours, but as long as the extraction chamber has been removed, the compost tea can be stored for up to 5 days provided the aeration is kept going.
13) Application rates:
    a. For small-scale applications, we recommend a mixture of one part tea to three parts water applied as a heavy spray or light watering over foliage and into the soil around the plants.
    b. For larger applications, we recommend 20 gal./acre (200l/ha) for a soil application and 5-10 gal./ac (50-100l/ha) for foliar sprays.

14) We know of no adverse side affects from over-applying. Suggest you apply to the soil at least twice per year and up to as often as monthly. For foliar applications, suggest you apply every one to two weeks during stressful periods.
15) We always add additional microbial foods with the compost tea when we apply it, in order to feed the biology as it finds a new home in the soil and on the leaves. Once these additional foods are added, the compost tea should be applied right away - definitely within two hours maximum. The microbes eat these foods rapidly and the subsequent oxygen demand is high. If not sprayed out soon, the oxygen levels can drop and cause damage to the microbes in the brew.
16) Over years of trials and developing recipes, we've come up with custom foods for a variety of applications. These recipes will be provided in the recipe section.
    a. Fungal blend
        i. For trees, shrubs, and bushes
    b. Balanced blend
        i. For general gardens and turf applications
    c. Bacterial blend
        i. For golf courses and areas needing a boost in bacterial growth
    d. Foliar blend
        i. For foliar applications of compost tea.

# Eco-Tea Recipes

We have come up with a basic set of recipes that work in most applications. Use the successional chart along with biology testing to help you determine what your specific soil and crop needs. Alternatively, you can use some generalizations based on history and the crop you are growing to come up with a program to get started.




Compost tea making compost is the most important part of compost tea making. It must have good levels of as big a diversity of beneficial biology as possible. This gives you the best chance that your application will be successful and helpful.

I. Premium Compost Blend for Compost Tea Making
   a. Mixing
      i. These are mixed together in a large pile and put in a bulk sack or other place to preserve moisture while preventing weather to get in.
      ii. Like to leave in the bulk bag for a couple weeks before wrapping up or boxing to allow stabilization of the mixture.
      iii. Tried to blow air in and then tested at different layers and came to the conclusion that blowing air in did not make much difference.
   b. Testing
      i. We send a sample to Soil Foodweb two weeks after mixing a new batch. This gives us a record of each batch and allows us to send the sample results to any customer who would like them.
   c. Boxing for customers
      i. After the mix has cured for a couple weeks, it can be boxed for sale. Be

sure to poke holes in the bag used inside the box.

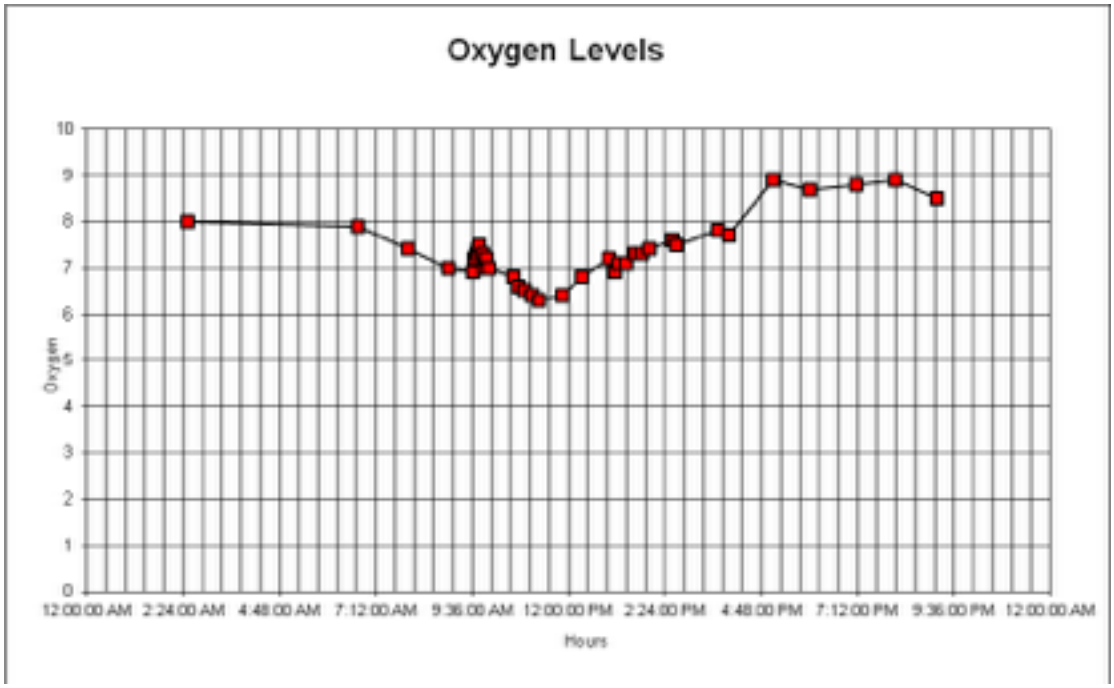
II. Nutrient mix or Microbial Foods
    a. Basics
        i. We screen all non-dissolving products through an 80 mesh screen or we source materials that are already screened finely enough
        ii. These are mixed together according our recipes and stored in a closed barrel.
    b. Storage
        i. The mix will store a couple weeks in a barrel, but will start to grow mould if not used fairly soon.
        ii. Mix should be weighed and sealed into a mylar or other non-breathable bag to help maintain freshness and good storage life
    c. Nutrient mix should be used at a rate of 5 kilos for every 250 gallons of compost tea or 1 kilo per 50 gallons.
    d. Addition to compost tea
        i. This nutrient mix should be added to the water in the brewer after any degassing is completed to remove chlorine or other contaminants.
        ii. Should also be added to the water when the water is aerating well. Do not add to the compost sock.

III. Water
    a. It is very important that the water used to brew compost tea be of good quality to allow maximum microbe growth
    b. Chlorine in the water must be gassed off prior to the start of the brew.
        i. This is done by aerating the water for about 30 minutes before putting compost or foods into the water
    c. Chloramine in the water should be removed with a pre-filter because this type of chlorine does not de-gas
    d. Floride treatments can also be harmful to microbial growth
    e. Best water comes from a clean well or from a clean stream or pond.
    f. It is important if using a pond or stream, to be sure the water is clean so that you are not growing harmful biology in the brew.

IV. Temperature and Aeration
    a. Oxygen levels
        i. Maximum Oxygen ppm is dependent on your elevation above sea level and your atmospheric pressure.
        ii. The holding capacity of water to hold oxygen is dependent on water temperature
            1. Cooler water holds more oxygen

b. Reproduction and biological activity
    i. Warmer temperatures generally mean more respiration due to greater activity.
    ii. Multiplication also happens more quickly at warmer temperatures
c. Aeration
    i. Aeration must be sufficient to maintain oxygen levels throughout the brew and create sufficient stirring action to prevent sludge build up and anaerobic conditions.
d. Temperature
    i. It is very important to monitor temperature and prevent it from going too high. We figure the upper threshold to be 22 C or 72 F. Over this and you enter a danger zone.
    ii. If you go below 18 C or 65 F then you slow the reproduction rate and will not necessarily have a finished brew in 24 hours
        1. Wild Blueberry growers will brew at 10C (50F) for three days to get a finished brew since they are applying during the cool seasons of the year.

V. Putting it all together
a. Air supply, food resources, and water temperature all play an interactive role with each other to affect oxygen levels in the compost tea.
b. Oxygen levels should start near 9 ppm or more and not fall below 5.5 ppm at any given point in the cycle.
    i. The low point in oxygen is normally reached around the 8-12 hour mark then oxygen levels should climb back up as the food resources are used and bacterial growth nears its peak.
    ii. See next page for a sample graph showing oxygen levels over a one of our brew periods




iii. The low point in oxygen is when the bacterial growth and activity is at its peak – oxygen demand is greatest

c. Since oxygen holding ability of water goes down with increased temperature and the activity of the biology goes up with increased temperature, a brew can very quickly become anaerobic if temperature rises too much.

i. The two factors work (decreased oxygen and increased activity) against each other making high brewing temperatures particularly harmful.

VI. Screening

a. When compost tea is being applied with a sprayer, we always want to see it screened through a 300-800 micron mesh filter after brewing prior to putting in the sprayer. The 300 micron is needed if going into finer nozzles but the 800 micron is fine for larger nozzles.

i. 300 micron will work for 8005 teejet nozzles with no plugging.

1. There should be no plugging at all with an 06 nozzle or larger.

ii. 800 micron will work for 8008 teejet nozzles with only occasional plugging.

1. There should be no plugging at all with a 1 gpm nozzle or larger. (rating is done at 40 psi, but tea is normally applied at lower pressure)

b. It is important not to screen too fine or you will screen more of the goodies out.

c. It is also important to use a self cleaning screen or a screen with a water wash to prevent build up of particles that effectively reduce the hole size of the screen

d. When we transfer from our holding tank into our truck, we always like to have a safety screen on the end of the hose which is an 800 micron screen.
e. The importance of screening well cannot be underestimated since poor screening can easily cost a lot of down time with plugged nozzles and can lead to lost customers very quickly.

VII. Storage

a. We have found that compost tea will contain good diversity for 5 days after the finish of the brew cycle if it is kept aerated. Adding catalyst at the time of application will bring the activity back up.
b. About 4 hours is the maximum length of time you should leave compost tea without aeration.
    i. It is better to keep aerated the entire time.

VIII. Catalyst

a. We always recommend compost tea be mixed with a catalyst at the time of application.
b. The catalyst allows a well-rounded, diverse compost tea to be steered in the direction that the crop needs.
c. See chart on page 5 and correlate with the crop you are growing plus biology testing of the soil etc. to determine which catalyst is best suited to your needs.
d. Recipes

e. Comments on the recipes
    i. Balanced
        1. This recipe is for typical garden type applications. This is for where you want some fungal growth and some bacterial growth
    ii. Foliar
        1. Though all recipes can be applied to leaves, this recipe is specifically designed as an application primarily on the leaves.
        2. It can be applied to pretty much any plant species with the following conditions
            a. Due to higher amounts of seaweed extract, this recipe can produce extra leaf growth so should be avoided late in the season if the tree is shutting down for winter
                i. Can increase winter injury if the tree has fresh tender leaves too late in the season
            b. The seaweed component can cause extra tuber set in potatoes, which may or may not be desired. Be aware of this in your timing.

iii. Fugal recipe

1. This is for tree root zone care and for any situation where the soil requires beneficial fungi.
2. Some examples include
    a. Lawn applications after renovation and major disturbance
    b. Row crops that inherently involve a lot of soil tillage and/or soil disturbance.

f. Mixing

i. We do not recommend fish be mixed with these other blends if they are going to be stored for more than a week or two.
    1. The fish is acidic and can affect the storage life and smell of the other catalyst components, which are generally alkaline.
    2. Mixing is OK for short term provided there is maximum dilution between any kelps and fish otherwise they can coagulate.

ii. Mix the seaweed extract with water prior to mixing with any other liquids

iii. If adding fish to the mix, add the fish last and stir vigorously when adding it to ensure uniform mixing and a minimum of coagulation.

**Application Types, Rates and Pricing:**

| Application | Application Rates (gal/acre) | Number of Applications | Cost per Gallon with Arrakis | Cost per Acre |
|---|---|---|---|---|
| In Row/Furrow | 10 | 1 | $1.15 | $11.50 |
| Pre Seed | 10 | 1 | $1.15 | $11.50 |
| Foliar Application | 7 | 3 | $1.55 | 32.55 |
| Spring Drench | 10 or 20 | 1 | $1.15 | $11.50 or $23.00 |
| Residue Management (Fall) | 10 or 20 | 1 | $1.15 | $11.50 or $23.00 |