

Bellwether Innovations, LLC

50 Gallon Compost Tea Brewer

Assembly and Use

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Chapter 1 – Introduction

Compost tea can be used in at least 3 ways:

- Added to soil around the plants in your garden
- Added to water in your aquaponics system
- Diluted and sprayed on the leaves and stems of the plants in your garden

A good compost tea brewer must thoroughly mix and aerate the contents in order to facilitate the targeted rapid increase of microbes. Moreover, it is only in this rapid growth phase that the microbes develop the biofilm glue that enables them to stick to plants when the tea is to be applied as a foliar spray to inhibit plant pathogens. This rapid growth in a brewer can often result in populations doubling every 20 minutes and without extreme oxygenation and mixing the brewer can go drop below the required dissolved oxygen (DO) levels.

Design Considerations

This is why, unlike most other brewers, the Fibonacci does not use air stones or bubblers. Instead, a novel air lift pump based on the Fibonacci spiral model is utilized. Contents are actively circulated both vertically and in rotation using only air. This approach not only promotes thorough mixing but maintains a highly oxygenated solution for the duration of the brew. The entire contents of the barrel are turned over every 5 min. to keep all nutrients and microbes well distributed in the water column.

This brewer is designed for free suspension of nutrients and compost to maximize microbial growth. There is no restriction on the solids flowing through the riser pipe to the top. The chamber can handle very large particles that would normally foul a water circulation pump. There are no dead spots at the bottom of the barrel blocked by the brewer. Tea is pulled from all directions as it is drawn upward to the surface by air in the Fibonacci Air Lift Chamber.

Oxygenation occurs by air being violently mixed with the tea as it drawn to the surface and then splashed back into the barrel. The violence causes the microbiology to lose its grip on whatever organic material it was attached to and be released into the water. There, it consumes the provided food, reproduces, and gets eaten by other microbiology.

The result of all this microscopic activity is the organic way that the chasm between inorganic minerals and organic plants is bridged. Microbiology is the storehouse of what plants need to grow.

The pulsating stream of air and tea also breaks the surface tension of the brew to release CO₂, which is a byproduct of the microbial respiration. A buildup of CO₂ can inhibit the oxygenation of the tea. The violent splashing also breaks down compost particle size to increase surface area for microbial reproduction throughout the water column.

This approach is able to maintain ultra-high dissolved oxygen (DO) levels even 48 hours into brewing.

It is important that each part of the brewer be cleaned carefully after each brew. If not, the wrong sort of microbiology will reproduce on the surfaces and gradually decrease the productivity of your brewing process. To facilitate this, we have designed the Fibonacci brewer with as few parts as possible and for easy disassembly and cleaning. For example, the riser pipe comes in 2 pieces (with a coupler) so that you can use an ordinary bottle brush to clean the inside of each piece.

Video of the brewer in action

If you have not already viewed the video of the compost tea brewer in action on our website, we encourage you to take a few minutes and watch it. Here is the URL:

<https://youtu.be/LllcG1ST1FM>

What is Included with the Fibonacci Tea Brewer

- Fibonacci Chamber (white 3D printed)
- Coupler for Riser pipes
- Two - 15" Riser pipes
- Stream Divider Tee
- Outlet Stream – two 90° elbow
- Outlet Joiner Pipe – two @ 4"
- 6 feet of air tubing
- Worm-drive band clamp for air tubing
- Two 24" bungee cords
- 19" rubber strap
- 600 Micron strainer bag for pumping and solids removal

What is Not Included

- An Air Pump
- One or two Barrels
- Ingredients for Brewing
- Cleaning brush for the inside of the riser pipe and the sides of the barrel.

Chapter 2 – Notes on Items Not Included

The Air Pump

Requirements

You will need purchase an air pump able to produce at least 100 cfm at 8 psi. In other words, this typically means a large aquarium pump and not a regenerative blower. The pump must be capable of pumping air into 3 feet of water.

The air hose is 3/8" (inside diameter). So, if your pump does not accommodate this size you will need to secure an adapter to convert it.

Considerations

The larger the pump, the more energy they use and the louder they are. So don't go overboard with a huge pump. Within the same general size of air pumps the prices can vary up to 3X in cost. The more money you spend the quieter and more durable it will be. The least suitable pump for example is very cheap, but also very loud and more importantly we did not find it held up very well.

The model EOCP284 from Elemental is a good compromise unit that is a bit quieter than the ECO 5 and a lot more durable, but not near as quiet as an Altair for example. Your brewer will be running several days so be sure to locate your brewer where the splashing and pump noise will not drive you crazy.

The pump must be kept above the level of the water in the barrel to avoid accidentally damaging the pump by turning pump off before you remove the air hose from the barrel.

If you are going to position the air pump on a 2nd barrel use a rubber mat or dense foam pad under the pump. This can help prevent the pump from moving and lower noise from vibration.

Another option is suspend the pump over the barrel with a rope. This isolates the pump vibrations.

UPS Backup

It is important the unit remain running without more than a few minutes of disruption, otherwise it will go anaerobic and the brew is lost. If you live in area prone to power outages, we encourage you to make provisions for this in the form of a battery backup.

Safety

Since the pump is around water make sure it is plugged into a GFCI receptacle.

Barrel(s)

You need one barrel for brewing but you may want a 2nd barrel as a convenient place to hold the air pump as shown below and in the video.

The pump must be located above the water line of the barrel to avoid accidentally damaging the pump by water flowing down into the air pump. Another option is to suspend the pump from overhead with rope or other sling. Suspending the pump will result in quieter operation because the pump's vibration doesn't have anything with which to resonate. If your situation allows you to do this, you will only need one barrel.



Barrel Specifications:

- Height: 34.5 inches
- Diameter from edge of rim: 23.25 inches
- Inside Diameter just below rim: 21.5 inches
- Maximum inside diameter where it widens slightly: 22.75 inches

Notes about Barrels

- Recycled plastic barrels can usually be readily sourced. However, make sure that the barrels have only been used for food or other non-toxic purposes. (no chemicals or petroleum products)
- It is important to use a barrel with a wide flat bottom, wide top and a height under 35 inches
- Translucent barrels are said to potentially encourage the growth of phototrophic microbes which contribute to the microbial nutrient cycle but they are not essential for a good brew
- It is more difficult to check the cleaning progress of a darker colored barrel.

How to prepare a 55 gallon barrel for use as a tea brewer

YouTube has several videos on how to prepare a recycled Barrel. Here is a link to a fairly good one.

<https://www.youtube.com/watch?v=Yz66eO79wBE>

In addition to cutting out the top, you need to drill 2 holes on opposite sides of the barrel for hooking the rubber strap.

Chapter 3 – Ingredients for your Brew

Overview

The purpose of a compost tea brewer is to rapidly increase the quantity and variety of microbes faster than would occur naturally. Since the amount of nutrients available to plants is a direct correlation to the diversity and quantity of microbes, actively aerated compost tea, teeming with microbes, will increase the health and vitality of your plants.

You need a starting culture of microbes and a food source for them. These two types of elements make up a compost tea recipe.

Starting Culture of Microbes - Compost:

Starting cultures for compost tea are compost. The brewing is a cold process, so it is important that your compost be pasteurized. That means the bad microbes should be largely eliminated. You don't want to grow E-coli for example. There are 2 ways to pasteurize microbes, one is with heat and the other is with red wiggler worms. Worms will naturally remove the non-beneficial microbes.

Compost piles properly turned and monitored for proper heating will also kill pathogens. However, if you do not carefully monitor temperature and the other parameters of a compost pile, I would recommend you purchase your compost from a reliable source that does monitor their compost. Be very careful that your supplier uses good source material and regularly checks the microbes in its compost.

Many areas do not have high quality compost suppliers. If this is true for you, you can use worm compost. Vermi-composting is easy to do yourself on a small scale; it is fairly easy to find a good local supplier.

If you have both types of compost available, use both, ½ and ½. You want as wide a variety of microbes in your starting culture as possible. Your results can't have any particular microbiology which wasn't in the compost with which you started.

Microbial Food

The microbes will need something to eat for their massive population growth. Generally, the most common food is liquid molasses. It is high in sugar and grows microbes really well.

Another common food is powdered Kelp. Kelp is harder to break down and most people find it slows down microbial growth a bit at the start of the brew. However, many feel it tends to result in a more diverse microbial population that is less dominated by bacteria and has a better balance of fungi, and other higher order microbes. Plus, being from the sea, it naturally introduces trace elements into the nutrient profile. We generally use Kelp as our basic food.

Since vegetables tend to prefer bacteria dominated environments, molasses-only brews can also work well.

Water

High quality water is essential.

If you are on city water you must remove chlorine, chloramine, and fluoride. These chemicals are meant to **kill** microbes, so water with these compounds in it will never produce a good tea. Contaminates of any kind should not be present in the water used for brewing.

Water Temperature

There are two approaches to brewing temperature.

1. brew for maximum culture growth - water temperature controlled to 65-75°F.
2. brew at the same temperature as where the compost tea is to be applied.

Brewing to maximize culture size

Some believe that a large, self-supporting population has a better chance of survival. A consistent temperature also allows for more uniform brews. Brewing at colder temperatures, for example, can require longer brewing times

Brewing to maximize microbes for the area being applied

Microbes can have very specific environmental profiles, especially temperature. They can wake up or go to sleep depending on the environment. So if you only brew at the optimum temperature you can miss development of microbes optimized for the prevailing temperature at the time.

Recipe

Below is a basic combo recipe you can use as a starting point

Compost -- 4.5 quarts

- Vermicompost and/or other type of compost (leaf-mold or fungal)

Food -- 4 cups

- Kelp - 1 cup
- Molasses - 2 cups
- Alfalfa - 1 cup (check that it does not contain anti-microbial additive)

Time

The minimum recommended time for a brew is 24 hours.

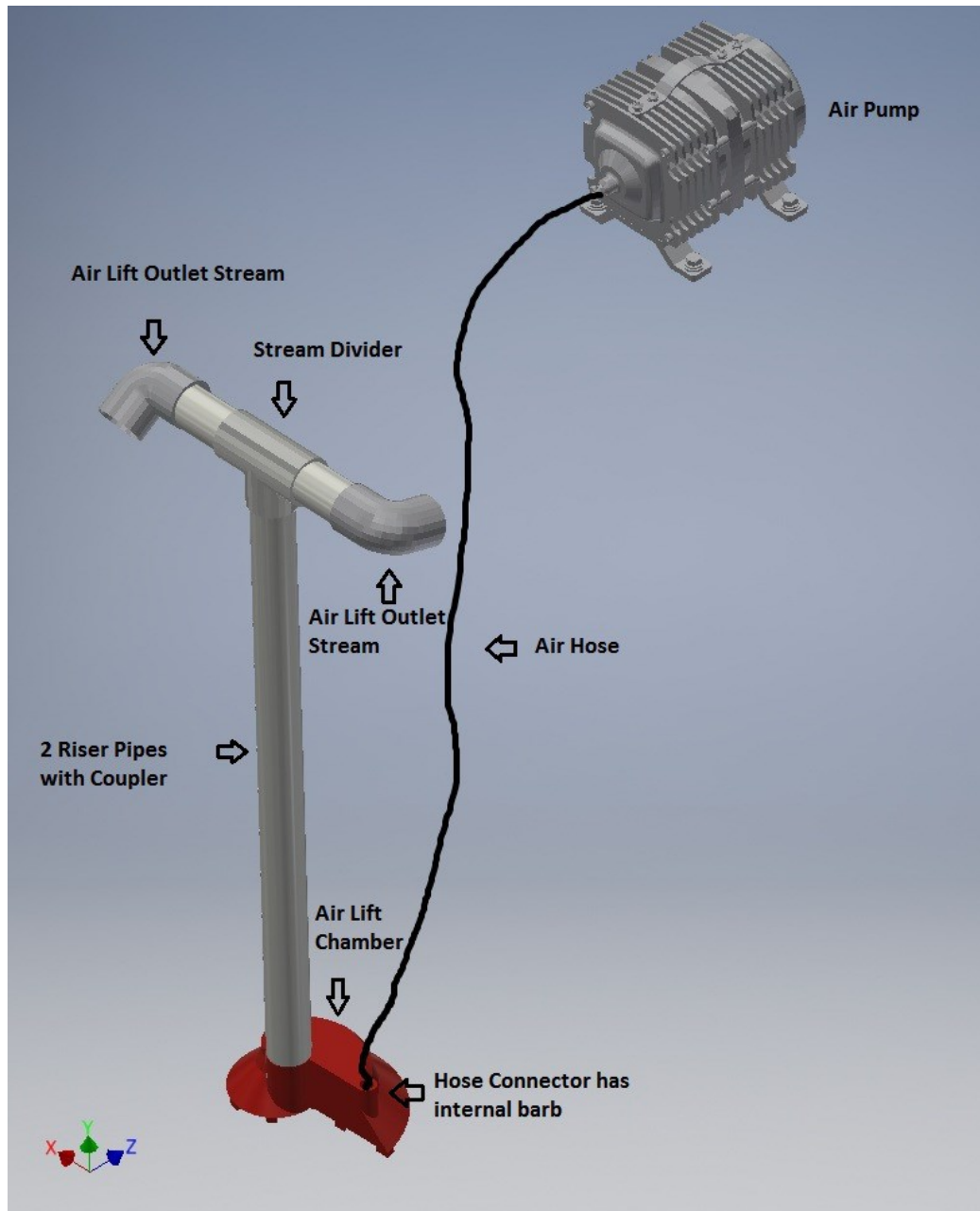
Ideally, you would examine it under a microscope at intervals after 24 hours to determine whether the brew has more microbiology. If the microbiology looks about the same, end the brew.

The higher order microbes, such as protozoa, don't appear in quantity until after 24 hours, generally speaking.

Without a microscope, we recommend 36-48 hours. There are so many variables in the compost content, temperature, water quality, etc.

Chapter 4 – Unit Assembly

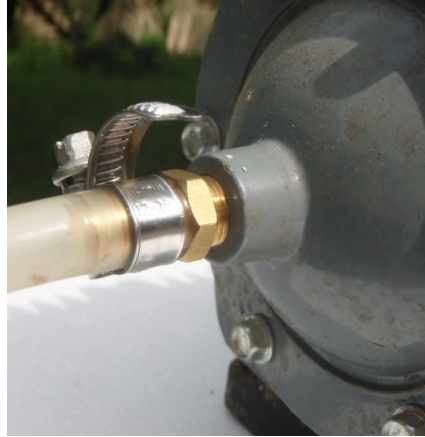
The Fibonacci air chamber is white. All the pipe that is connected to it is 1-1/4" PVC. We have split the tall vertical pipe in two for easy cleaning. One of the two 15" pieces has a blue stained end. That end has been sanded so that it will fit into the Fibonacci chamber more easily.



Step by Step Instructions

1. Add a 4" piece of pipe to each side of the tee (Stream Divider).

2. To each end of the short pipe add a 90° elbow (Stream Outlet). Face the elbows so that they shoot the water in opposite directions.
3. To one end of the tubing, slip on the worm drive clamp. Attach the brass fitting which came with your air pump to the air pump. Slip the tubing over the brass fitting and tighten the worm drive clamp. It should look like this:



4. Insert the 15" pipe which has a blue stain into the larger hole in the Fibonacci chamber.
5. Use the coupler to attach the two 15" pipes.
6. Put the assembled tee (Stream Divider) at the top of the vertical pipe.
7. Position the air pump so that it is above the water level in the 55 gallon barrel you are using to brew your tea. If you turn off the air pump when the pump is below the water level in the barrel, water pressure will put water into the air pump, probably ruining the pump.
8. Start filling the barrel with water.
9. Insert the other end of the tubing into the smaller hole in the Fibonacci chamber.
10. When the barrel is at least ½ full, turn on the air pump.
11. Add the brewer assembly to the barrel.
12. Attach the rubber strap across the top of the stream divider (tee).
13. The goal is to center the Fibonacci chamber in the brewing container. The riser pipe will necessarily be off center. The chamber needs to be flat on the bottom of the barrel and not tilted.
14. Wrap one bungee cord around the top pipe on each side and secure the ends so that it can't move.

15. It should look something like this:



16. These straps ensure that the PVC pipe and the brewer assembly won't change position as the air circulates the water and ingredients.

17. Continue filling the barrel with water so that there is 2" between the bottom of the 90° elbows and the top of the water

Turn on the air pump prior to placing the air lift chamber in the water.

Chapter 5 - Brewing, Extraction, and Cleaning

The Brew Process

- 1) Let the water circulate and aerate for several minutes to oxygenate the water.
- 2) Add your dry food ingredients, such as kelp powder and feather meal
- 3) After 5 or 10 minutes, add the compost and wet ingredients such as molasses
- 4) Note the time at this point.
- 5) In 24 - 48 hours or you can distribute the results.
- 6) If the starting water is cold, brew for a longer period

Remove the air lift assembly from the barrel prior to turning off the pump

Extraction Overview

The life cycle of the microbiology is such that the sooner you apply the compost tea, the better. Two hours should be your outside limit. You can extend that somewhat by continuing to actively aerate the compost tea as you distribute it.

Once your brew is complete the solution is poured or pumped through the provided 600 Micron bag. You can place your pump securely in this bag or pour the contents from the barrel through the bag to catch the solids.

You can allow the solids to settle for 20 to 30 minutes and pump from above it and then pour the remainder thru the bag. The mesh bag catches the solids from the brew as you move the compost tea to a container for distribution.

Do not use a paint strainer to filter the tea. The mesh is too fine and will capture some of the higher order microbes.

Disassembly

The microbiology forms a film (biofilm) which acts like a glue on all these fittings. Please use a twisting action (rather than a waggle) to separate the pieces, especially from the Fibonacci air lift chamber itself.

As you disassemble the pieces, throw them into a container of clean water while you distribute your compost tea. This will keep the biofilm from drying out. If the brewer pieces dry out dirty, clean-up is harder.

Spread the remaining solids from the mesh bag and the bottom of the bucket in a garden bed, yard, or compost pile.

Cleaning

Carefully wash down the barrel. Clean all the pieces of pipe and fittings so that they are the same color as they were when you started. Clean the inside of the pipes as well. A long brush for the riser pipes may be appropriate.

It is also possible to run the elbows, coupler, and tee through a dishwasher.

If you have some particular issue, you can also use bleach before putting the pieces away (not immediately before you are going to use it, however).