

# Make Your Own Liquid Garden Fertilizers

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In permaculture and sustainable agriculture we strive to produce an abundance of healthy plant products while actively working to enhance the health of the ecosystem that supports us. To do this effectively, we need to enhance the cycling of nutrients and fertility on our farms and in our gardens to ensure that we do not deplete soil reserves and provide the proper nutrients to plants at the optimal time in their growth cycle. While fertilizers of all types are readily available at garden centers, to create truly sustainable agricultural systems it becomes essential to explore ways to cycle and enhance fertility from resources we produce on site. Creating your own plant fertilizers is a fun and empowering process too!

There are a number of simple, effective liquid solutions and brews we can make with more-or-less readily available materials to transform the health and character of our plants and soil. This document is a primer on several of these including comfrey, nettle, horsetail and seaweed teas; urine and aerobic compost tea.

## Why Use Liquid Fertilizers?

Liquid fertilizers provide plants with high concentrations of easily-absorbed, soluble nutrients, thereby enhancing their health and productivity. Easy to make with readily-available biological materials, these fertilizers are completely organic and cost nothing to make. Improved yields; pest and disease suppression; enhanced soil texture, structure and fertility; reduced watering; and the elimination of the need to use additional fertilizers and pesticides are all benefits to be gleaned from these homemade brews.

## What types of fertilizers can you make?

Depending on your resources and needs, different fertilizers can be made to provide different results. Plant teas are made by steeping leaves in water for several weeks, thereby dissolving the nutrients into the solution. These teas are used to supply specific macro and micronutrients to plants at the appropriate time of year.

**Aerobic compost tea** is literally a liquid inoculum of beneficial micro-organisms that work to actively build healthy soil and plants. This is explored in detail below.

While not covered here, you can also make 'leachate' brews using compost, worm compost and manure by steeping the dry material in water (or pouring water through the screened material). Some care should be taken here though to ensure that the solution is not applied when anaerobic as this may adversely affect the health of the plants and soil biology we're working to enhance.

## Comfrey, Nettle and Horsetail Teas

### What are their benefits?

These liquid fertilizers are rich in important plant nutrients and can be easily stored and transported and applied to plants by watering or spraying. The nutrients they contain are readily available and only need be applied in small quantities. Nitrogen (N) stimulates leaf growth, potassium (K) promotes developing flowers and fruit and phosphorus (P) enhances root growth.

### Comfrey

Comfrey supplies extra potassium unavailable to most other plants. The plant's deep roots accumulate potassium from subsoil and its leaves are high in nitrogen (even more than livestock manure). It has an N : P : K ratio of about 8 : 2.6 : 20.5 %.

Because comfrey is high in potassium, it promotes the development of flowers and fruit and so should be applied after the first flowers have set on plants like tomatoes and peppers. Regular feeding may then support better flower and fruit development. Be advised though that in excess, potassium somewhat stunts growth and coarsens leaves.

Due to its high K concentration, comfrey tea may be considered too strong for regular use. It can however be adapted by mixing with other garden-made fertilizers like a dilution of 1:19 with worm tea, providing an estimated NPK ratio of 2.5 : 2.2 : 2.5 % which can then be diluted with water. The nitrogen supplied by comfrey is more likely to occur as ammonium, but the worm tea nitrogen is probably nitrate.

## **Nettles**

Nitrogen-rich nettles are high in silica and encourage plant growth in early spring. Ideally, harvest plants before they flower.

## **Horsetail**

Horsetail is high in silica and the infused stem is an effective fungicide against mildew, mint rust and blackspot. This is believed to be due to the horsetail tea enhancing plants' light absorbing capabilities.

## **How do you make them?**

For comfrey, if you are starting with a newly established plant, cut the leaves once in June to prevent flowering and allow the plant to grow and die back so as to build up reserves. Once the plant is well established, cut it before flowering in May when about 2ft high. Don't cut later than September to allow the plant to recover food reserves before winter dormancy. As comfrey plants become strong they will be ready for cutting every 4 or 5 weeks giving 3 to 5 cuts per season. Nettles and horsetail can be harvested from the wild. It's best to harvest **nettles** before plants go to flower - I am unaware of harvest timing recommendations for horsetail.

Place the plant's leaves into a large container, preferably one with a tap or hole at the bottom, and a tight lid at the top to exclude water and flies and keep any smell inside. Some recommend simply covering the bottom of the bucket/container with leaves while others advise to fill the bucket full - I tend towards the latter. A black liquid smelling of ammonia will soon collect in the bottom. The solution needs to be diluted 15 - 20 times with water before application in the garden (For comfrey, this results in an N.P.K. = 0.5 : 0.4 : 3.8. - high in K).

## **Seaweed**

Seaweed is an incredible source of trace minerals as well as a rich source of potassium — up to 12%. Plants sprayed with seaweed are frequently more resistant to pest insect outbreaks and often show renewed growth and vigor. Seaweed is relatively poor in nitrogen and phosphate, but the addition of fish emulsion or another nitrogen rich fertilizer can make a very well-balanced solution.

To make a liquid seaweed brew, collect several plastic trash bags of kelp, empty them into a 55-gallon drum, fill it with water, and cover. As the seaweed begins to decompose, the water turns brown. Within about two months, the seaweed should be fully decomposed. This liquid can be used as a concentrate and diluted with water before spraying it on or pouring it around plants. The only drawback is the fishy, oceanic odor detectable for a day or two after application.

## **Urine**

It's been found that the annual nitrogen output of humans is roughly equivalent to the nitrogen needs of the plants that feed us throughout the year. We are living in a world of broken cycles - the cycle of human waste and fertility being a primary one. In much of the western world, this high nitrogen resource is treated like a pollutant, diluted into drinking water and then extracted/purified through energy and chemical intensive means.

That said, in parts of Scandinavia, urine separating/diverting toilets are the norm, directing the 'liquid gold' into tanks from which farmers collect the resource and apply it to their fields. Start to see the value of our 'wastes' and recognize that the real issue is not the product but rather **the way we manage it**.

Fresh human urine is sterile (unless there is a urinary tract infection – this urine should not be used) and free from bacteria. Dilute urine 10-15 parts water to 1 part urine for application on plants in the growth stage. Dilute to 30-50 parts water to 1 part urine for use on potted plants as they are much more sensitive to fertilizers of any kind. Trees, shrubs and lawn should cope well without dilution, but it's important not to overload individual plants with a consistent nitrogen input. Apply the diluted solution to the soil beneath fruiting plants and avoid getting it on the fruit and foliage as the high nitrogen levels can 'burn' leaves.

Stop using urine liquid fertilizer on all food plants at least two weeks before harvesting. Adding undiluted human urine to your compost heap will help heat it up quickly and will add to the overall nutrient value.

## **Aerobic Compost Tea** - much of this information is borrowed from the work of **Dr. Elaine Ingham**

There are several approaches to making fertility- and biologically-rich compost teas. Instead of just leaching the valuable water soluble nutrients from compost or manure into water (which can also be valuable liquid amendments), you can actively alter the biological character of the soil by breeding a concentrated population of beneficial aerobic bacteria and fungi in the tea (Aerobic Compost Tea - ACT) which are then applied to the soil and plant foliage. ACT can dramatically improve yields, reduce or eliminate soil compaction, reduce water needs by 70%, eliminate the use of fertilizers, pesticides and herbicides and re-invigorate diseased and dying plants. *It is the 'microherd' in our soil, compost, and teas, that is really more important in soil development and disease control than simply the soluble nutrients.* In making ACT, essentially we are dislodging the abundant population of microbiology present in healthy, aerobic compost, holding it in suspension and encouraging the rapid growth of their populations through vigorous aeration and the selective feeding of additives.

### **Its benefits**

Aerobic microherd populations work to actively enhance the fertility, texture and microbiological character of the soil. They reduce offensive smells and speed up decomposition in compost piles, break down poisons and pathogens into safe nutrients, and work to actively control disease outbreaks. When sprayed on the leaves, compost tea helps suppress foliar diseases, increases the amount of nutrients available to the plant, and speeds the breakdown of toxins. Using compost tea has even been shown to increase nutritional quality and improve the flavor of vegetables. The soil microherd continues to work over months and years consuming insoluble organic matter in the soil and breaking it down into available soluble nutrients for plants.

The soil is full of microorganisms that aid plant growth and plant health—decomposers like bacteria and fungi, and predators including protozoa, amoebas, micro-arthropods and beneficial nematodes. Additionally, we find 'bad guy' soil borne microbiology including disease-causing bacteria and fungi and root-feeding nematodes. When applying ACT, our strategy is to enhance the populations of beneficial microorganisms in this soil food web because they will work to actively help our plants.

The bad bacterial decomposers and the plant-toxic products they make are enhanced by anaerobic, or reduced-oxygen, conditions. By making sure the tea and the compost itself are well oxygenated and highly aerobic, you eliminate 75 percent of the potential plant-disease-causing bacteria. To control the other 25 percent of potential diseases and pests, be sure to inoculate the soil and 70% of foliar surfaces with beneficial biology when you apply ACT. Good biology counters detrimental ones in four ways: They consume the bad guys, they may produce antibiotics that inhibit them, they compete for nutrients, and they compete for space.

While the proportion varies with different plant types, plants do not use all of the energy they make through photosynthesis themselves. In fact, many vegetable plants send up to 60% of their energy to the root system, half of which is 'exuded' (released) into the soil. These 'exudates' are 90% sugar and the remainder is composed of carbohydrates and proteins. As the old micro-biologist joke goes - these are the ingredients used to make cookies and cake for soil biology. Representing nearly a third of the total energy output of a vegetable plant, this high energy food source is the plant's primary contribution to the essential symbiotic relationship that we see exhibited in the rhizosphere (root zone) between plants and soil biology, who in turn convert inorganic minerals into soluble nutrients available to plants exactly where it is most needed - next to the roots

## How do you make it?

The main ingredients necessary to make a good ACT are: aerobic compost, vigorous aeration and clean water. Don't try to make compost tea without aeration equipment. If the tea is not aerated constantly, the organisms in it will quickly use up the oxygen, and the tea will start to stink and become anaerobic. **An anaerobic tea can harm your plants.**

To brew aerobic compost tea, you'll need a pump, some air tubing, a bucket and a PVC 'air diffuser'. (There are also several companies that sell ACT brewers and can be found on-line)

- ✓ An aquarium pump - 500 gallon tank size is ideal for a five gallon batch
- ✓ Several feet of 1/8" tubing
- ✓ A strong fine-mesh bag in which to suspend the compost in the solution (400 micron is ideal)
- ✓ Four feet or so of 3/4" PVC pipe to disperse the air throughout the solution
- ✓ A bucket
- ✓ Good clean water - Chlorine/Chloramine Free

You can expect different microbial population levels in your tea based on weather, climate, temperature, seasons, etc. There will be seasonal variations in brewing time, odors, color, etc.

If you're using city water, run the bubblers in it for about an hour first, to blow off any chlorine. Otherwise, the chlorine will kill the beneficial organisms you're actively working to propagate. If your water is treated with chloramine, it will not volatilize with aeration so you'll instead need to run it through a humic acid filter to decontaminate it (**Humic acid** can be derived from compost or worm compost as a leachate liquid. Simply place your compost on a screen of some sort above a bucket, pour water over the compost, collecting the liquid below. Continue to do this until you have created a rich, deep brown liquid.)

To begin, fill a stiff 400 micron bag with about one pound of **good quality compost**. This can't be stressed enough - to make effective compost tea, you need to begin with biologically-active mature compost. Not all compost is created equal! Suspend the bag in the five gallon bucket and add four gallons of clean water (do not fill the bucket completely as a foamy layer develops during the brewing process that can make a mess)

When making your own compost, be aware of the fact that you can choose to steer the populations of bacteria and fungi to favor different types of plants. In nature, we find that early successional soils - those that are favoring annual 'weeds' tend to be dominated by bacterial populations whereas forest soils have a much more actively concentrated fungal population. Therefore, match the needs of your garden with the biological populations you encourage in your soil. Bacteria-dominated compost is best suited to vegetables and herbs, while fungi-dominated compost is good for berries and fruit trees. Research has shown that a foliar spray of bacteria-dominated compost tea is extremely useful to prevent the foliar diseases that plague most gardens.

If you want to favor bacterial populations in your brew, add one ounce of molasses (or maple syrup, brown sugar, or corn syrup). The molasses feeds bacteria and enhances their growth and development. Sugar

products are mostly carbon and the microherd consumes them quickly. For a more fungal tea add one teaspoon of humic acid per four gallon batch (see details above on how to make it).

For a four gallon batch, continue to aerate the brew for twenty four hours. The aerobic tea is ready to use when it has either an earthy or "yeasty" smell or a foamy layer on top. If it smells bad, continue to aerate it until the smell goes away. The extra brewing time helps microbes digest more of the insoluble bacterial and fungal foods that are available. If you plan to apply the tea with a sprayer, pour the brew into the container and let it sit for 10-20 minutes before you apply it. ACT can also be applied by simply pouring it onto and around plants or through a sprinkler/drip irrigation system.

Apply this tea as soon as possible - ideally within four to six hours. (If you need to store it any longer, continue to aerate it for up to four days.) If you have a large area to cover, recall that you can cut the tea with up to five parts water to cover up to one acre of garden (be sure to use chemical-free water). You can return the used compost to the compost pile or add it to the soil - there are plenty of good bacterial and fungal foods left in it. **\*\*\*It is essential to thoroughly clean all brewing and application equipment after each use to prevent the colonization of competitor biology. If ignored, they will actively compete with the beneficial organisms we're working to enhance in our brews.**

Between one and five gallons of ACT is enough to inoculate an the foliage of an entire acre of garden. If you apply as a soil drench, it will take between five and fifteen gallons of tea to cover an acre of garden soil. There is an equivalent amount of aerobic bacteria and fungi in a good five gallon batch of ACT to the microbial population of about 10 tons or 40 cubic yards of regular compost.

How often to spray your plants with tea depends on how healthy your garden is. Its generally recommended to spray plants and soil surfaces once in spring and two or three more times thereafter either to boost biological activity or to combat pest/disease outbreaks as they just begin to emerge Some recommend that if you don't have good levels of beneficial insects in your garden, spray at least once a month and as often as once every two weeks. Start when plants have developed their first set of true leaves. On trees and shrubs, spray two weeks before bud break, then every 10 to 14 days. If you have neighbors who use pesticides, you'll need to spray more frequently as biological populations are killed by most chemicals.

**Additives** - Depending on your plant and soil needs, you can elect to add the following products to customize your ACT

- 1-2 cans of mackerel, sardines, or other canned fish. Supplies extra NPK, fish oil for beneficial fungi, calcium from fish bones. Most commercial fish emulsions contain no fish oils and little to no aerobic bacteria. Fresh fish parts can be used, but to avoid strong odors compost them separately before adding to the tea. If you use canned fish products, let it sit mixed with finished compost for a few days before using because most canned meat products contain preservatives which may otherwise kill off microbial populations in the tea.
- 1 pack fresh seaweed - supplies up to 60 trace elements and lots of plant growth hormones. Seaweed is a beneficial fungal food source. Liquifying it makes it dissolve even faster.
- 1-2 cups of alfalfa meal, corn meal, cattle, horse or pond fish feed. Supplies extra proteins and bacteria. Corn meal is a natural fungicide and supplies food for beneficial fungi in the soil.
- Rotten fruit to enhance fungal populations. Add green weeds to supply extra bacterial foods to the tea.
- Garden soil is an excellent free biostimulant full of beneficial aerobic bacteria, fungi, and other great microbes. Forest soil is usually higher in beneficial fungi than rich garden soil
- 1-2 tbsp of apple cider vinegar to add about 30 extra trace minerals and make the brew more acidic. You can add extra magnesium and sulfur by adding 1-2 tbsp of Epsom salt to the tea.

Thanks for reading and happy liquid fertilization!!

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