



Microbial-Rich Solution or Dirty Brown Water

The concept and the use of organic teas and solutions are rapidly developing in the hydroponics industry. Gardeners are beginning to understand the benefits of micro-biology and the rewards of organic methods. This article informs growers of the wide range of organic teas and solutions, and the difference between good quality microbial-rich solution and dirty brown water.

Extensive testing has shown that optimal plant results are achieved when the root zone is filled with a high concentration of beneficial biology with diversity in excess of 10,000, (Dr. Elaine Ingham, SFI Lab). Beneficial biology is aerobic or oxygen breathing microbes. Research shows anaerobic or non-oxygen breathing microbes are unbeneficial and/or can be pathogenic and toxic. When beneficial bio-diversity reaches over 10,000+ this means there are 10,000 different types of beneficial micro-organism species. This diversity is imperative for hydro-organics.

A few standard items should be looked at when using an organic tea, or solution:

- Bio-diversity of micro-organisms
- Total and active micro-organisms
- Full range levels of biology (bacteria, Fungal, chitinase and cellulase producing microbes, Protozoa which includes amoebas, ciliates, flagellates, and beneficial nematodes.)
- Base material being used for extraction
- Overall biological levels of the tea or solution

There are many different tea and solution products on the market. Which one will give you the best results? To determine the quality of the tea or solution, one has to establish what base material is being used, and the process in which the base material is being used to extract tea. Here are some different types of tea, and the process in which they are made.

Bottled Biology Products: In most cases the “biology in a bottle” is beneficial but the diversity of the micro-organism species is limited. This liquid can provide an improvement in soil biology but is limited due to limited diversity. To use a biological mix that has little diversity in hydroponics can often cause more deficiencies than improvements. The results can vary but research shows that an imbalance of microbes in an aqueous hydroponics system can lead to organic material build up which can breed pathogenic competitors. Biological liquid with a low diversity does not have the capability of producing recyclers which will compete and use those pathogenic competitors as a food source. The largest species variety in these products is ~ 100. This means that there are a total of 100 different beneficial species. These organisms must be put to sleep by being “pickled” to be able to be bottled. To achieve this, the pH must be lowered below 3 so the organisms will not multiply, and respiration gases will not explode the container.

Worm Bed Tea: Some products are the liquid produced from worm beds. Most worm beds are fed various animal manures (dairy, horse, swine, or chicken). This liquid that passes from worm

beds in most cases has NOT been processed by the worms. The liquid is the excess that is released as the manure decays. This liquid is usually very high in pathogens (e-coli, salmonella, helminth ova and others). These pathogens can make you very ill. Because the liquid comes from a worm bed does not mean this liquid has passed through the worms gut. If it has not been digested by the earthworms it can be quite toxic.

Compost Tea: There are a large number of compost tea products on the market. Historically “compost tea” has been anaerobic manure leachate. This means that manure was put into a barrel with water and allowed to set for 30 days or more. In many cases this type of process leads to anaerobic pathogens such as e-coli, salmonella and other human pathogens. “Static compost tea” has not been produced in an aerobic environment with a dissolved oxygen level in excess of 6 ppm. This results in the anaerobic organisms multiplying rather than the beneficial aerobic organisms. With dissolved oxygen in excess of 6ppm the tea will be aerobic but will be limited in diversity, unbalanced in both bacterial and fungal levels, and will not produce the proper levels needed for a symbiotic relationship with the plant.

The pathogen presence found in “compost tea” has lead the NOP (National Organic Program) to outlaw the use of “compost tea” on food crops within 120 days of harvest.

Aerobic microbial-rich solution:

Aerobically brewed solution is not a new concept. Recent bio-technology has greatly improved the understanding and the use of this bio-technology.

Manufacturers have joined forces with researchers to develop a feed for Eisenia Fotida earthworms. This proprietary feed excludes any animal waste, which usually contains pathogenic organisms; the feed also excludes landscape trimmings which may contain pesticides, herbicides, or fungicides. This feed mix greatly enhances the biology of the worm casting. Tests have shown biological diversity at 30,000+. Using a rich biological source like specifically fed worm castings is only the first step to producing a quality microbial-rich solution.

The next step is to extract the biology from the worm casting. With 10 years of expensive and diligent research, manufacturers and researchers have developed an exact feed mix containing specific and precisely measured sugars and carbohydrates. This feed mix is very critical. If too many sugars are provided the bacterial organisms will grow and overwhelm the needed fungal. The balance of bacterial and fungal is very important to create a symbiotic relationship with the plant. The feed mix also takes into account the growth of recyclers such as amoebas, ciliates, flagellates, beneficial nematodes. The “proper mix” or sugars and carbohydrates must have fungal attachment sites to develop beneficial communities of fungal. This is no longer just a tea, and by no means is this “compost tea.”

The mix is then cultured and brewed aerobically. This process must be done in water that is low in salts and chlorine. Chlorine is used to stop biological growth in the city water and pools. If chlorine is evident, then growth is slowed or stopped. The salts should be less than 50 ppm and the chlorine less than 10 ppm. The best results originate from using reverse osmosis treated water for the extraction process.

These organisms must then be aerobically brewed for 24 hours in an environment where the dissolved oxygen level is maintained above 6 ppm during the whole brewing process. The temperature of the brewing water must be maintained from 60-85F. This material can now accurately be called “**Biologically Active Microbial-rich Solution.**”

This process, if done correctly, will multiply the organisms in the range of 9 billion times (9×10^9) resulting in one gallon having the same biology as 2,000 pounds of quality eisenia foetida earthworm castings.

One aspect must be realized when using biologically active microbial-rich solution. Once the beneficial biology has been activated and multiplied it does not stop growing at the end of the brew cycle. When placed in a bottle the biology continues to grow and feed off the provided oxygen. Once the bottled oxygen has depleted the organisms begin to starve and die. This liquid must be placed in a reservoir or in soil 8-10 hours after brewing process has stopped. The best viability comes when the "solution" is used directly after decanting the extractor. Refrigeration at 40F will slow the rapid growth of the biology, extending the shelf life to 5 days.

The quality of "solution" can be determined by a biological test. These tests are not the tests used to provide typical soils reports. The bacterial levels should be: 10-150 micro-gram/milliliter (mg/ml) Active and 150-300+ mg/ml Total. The fungal levels need to be: 2-10 mg/ml Active and 2-20+ mg/ml Total. There must be a balance of both bacterial and fungal. Bacterial organisms are easy to grow and can overwhelm the fungal if the feed mix is not properly controlled. The hyphal diameter of the fungi needs to be 2.5+ micrometers. The protozoa should show flagellates in the range of 1,000 /ml, amoebae at 1,000/ml, and ciliates at 20-50/ml. The beneficial nematodes should range at 2-10/ml. The chitin degraders and cellulose degraders should both be above 100 million cfu/dwg. The protozoa and nematodes are the large sized recyclers. The chitin degraders and cellulose degraders are small sized but very active recyclers. These make the nutrients from the bacterial and fungal biology available for the plants. If the test numbers do not show values in these ranges, assume the material is not optimal.

The following photos of rice production show the resulting improvement in plant performance by using a quality "solution" with diversity in excess of 30,000 and the properly balanced biology. The results from rice paddy production are very close to the results seen in hydroponic applications. Hydroponics food production has also been tested with superb results. This testing was performed under the authority of Japanese Agriculture for organic rice production at 14 different farms. Each test plot was a minimum of .5 hectares (~1.25 acres).

The average increase in yield was over 250%. Japanese rice farmers sell their rice based on quality. Good farmers will get 50% #1 rated rice, 20-30% #2 rated and the rest below. #1 rated rice sell for 1,000 yen/Kg (~\$4/pound). #2 rice sells for 700 Yen/Kg. #8 sells for 50 Yen/Kg. So the farmer wants as much #1 rice as possible. 100% of the "solution" fed rice from 14 different test farms were rated #1. The solution was added as the only feed for this test protocol.

Plant Vitality and Yield Comparison



	Solution Rice	Standard Protocol
	5 Gal "Solution"/Acre	Chemical Feed
Average Yield:	3500-4000 grains	1250-1500 grains

Plant Strength & Root Mass Comparison

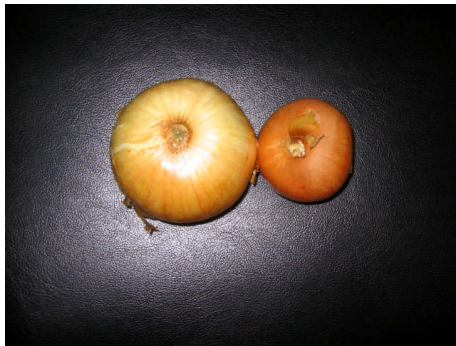


	Solution Rice	Chemical Feed
Stem Count	60-80	20-30
Stem Size	2x	1x
Root Ball	10" x 20"	3" x 4"

The following photos of onions shows the average results from eight different farms. This research was performed under the authorization of Japanese Agriculture. Eight farms were used

for the onion testing. Each test plot was .5 hectare (~1.25 acres). The test onions were fed only “solution” and a small amount of chicken waste. One of the test goals was to determine production of organic qualified produce. Japan has approved this solution for organic food production. (The demand for “organic” food products is equally as strong In Japan as elsewhere in the world). The side by side fields were planted and harvested the same time to see growth rate difference in a real production.

A significant improvement in shelf life was seen in each crop tested and is credited to the balanced biology in the growth phase. It is theorized that a balance of competing organisms are available within the vegetables. The organisms that “rot” vegetables do not predominate because of the beneficial competition. The “solution” onions are consistently showing more than six months shelf life. This gives a dramatic savings in the food industry.



Average Dia Size:		4 -6 inch		1.5 – 2 inch
Brix (sugar content)	10		2	
Shelf Life		6 months +		2 months

The results of testing various “solution” applications have convinced Japanese Agriculture that this method can be used to produce high quality organic food products in field and hydroponics applications. Two of the scientists who worked in this research have been awarded the positions responsible for granting “organic” approval for Japan.

The new bio-technology of “microbial-rich solution” can provide significant benefits for organic hydroponics production. The balanced and concentrated biology will provide the ability to produce crops that can be approved for organic certification.

Hydroponics and organics is a relationship that is determined to see eye to eye. When using teas or solutions in hydroponic applications, understanding what is in the bottle is important. The labels on bottles and containers of any product must be registered by the state’s department of agriculture. Words that are used for description are approved by the state, and special guide lines must be taken with every inference or claim. Organic tea and microbial-rich solution are two very different products and should be considered when applying organics to hydroponics.