

Notes on Compost Teas: A Supplement to the ATTRA Publication "Compost Teas for Plant Disease Control"

Pest Management Technical Note

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March 2002

The ATTRA publication *Compost Teas for Plant Disease Control*, published in 1998, will be updated in 2002. In the meantime, here are a few supplemental notes and resource listings. Two additional items are enclosed as well:

- ◆ *Compost Teas: A Tool for Rhizosphere + Phyllosphere Agriculture* (PowerPoint slide notes)
- ◆ *Compost Teas for Plant Disease Control*, the 1998 publication

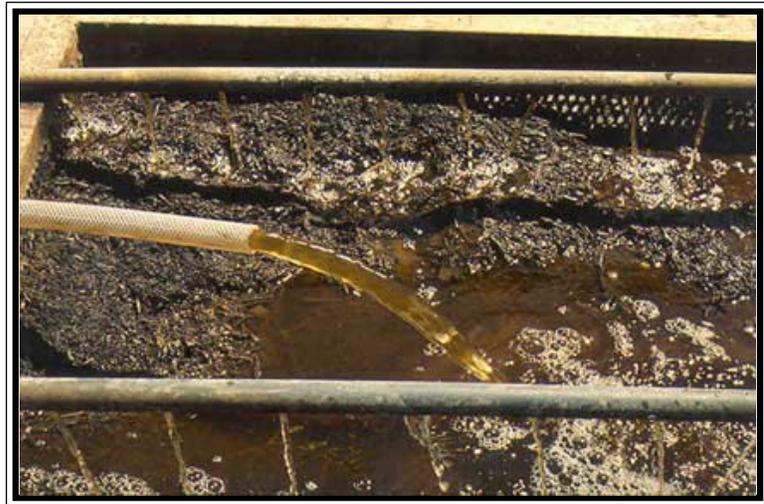


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Compost Teas vs. Compost Extracts

First, it may be helpful to share some common terminology and practices associated with compost teas. How do compost teas differ from compost extracts or compost leachates?

Compost Leachate

Compost windrow leachate – the dark-colored solution that leaches out of the bottom of the compost pile – most likely will be rich in soluble nutrients; **but**, in the early stage of composting it may also contain pathogens. It would be viewed as a pollution source if allowed to run off-site. Compost leachate needs further bioremediation and is not suitable or recommended as a foliar spray.

Compost Extract

Compost watery extract – made from compost suspended in a barrel of water for 7 to 14 days, usually soaking in a burlap sack – a centuries-old technique. The primary benefit of the *extract* will be a supply of soluble nutrients, which can be used as a liquid fertilizer.

Compost Tea

Compost tea, in modern terminology, is a compost extract brewed with a microbial food source – molasses, kelp, rock dust, humic-fulvic acids. The compost-tea brewing technique, an aerobic process, *extracts* and *grows* populations of beneficial microorganisms.

Summary: Compost teas are distinguished from compost extracts both in method of production and in the way they are used. Teas are actively brewed with microbial food and catalyst sources added to the solution, and a sump pump bubbles and aerates the solution, supplying plenty of much-needed oxygen. The aim of the brewing process is to *extract* beneficial microbes from the compost itself, followed by *growing* these populations of microbes during the 24- to 36-hour brew period. The compost provides the source of microbes, and the microbial food and catalyst amendments promote the growth and multiplication of microbes in the tea. Some

examples of microbial food sources: molasses, kelp powder, and fish powder. Some examples of microbial catalysts: humic acid, yucca extract, and rock dust.

Liquid Organic Extracts vs. Compost Teas

Building on the concept of compost teas as a liquid organic extract, what are some other common organic extracts used as a liquid drench or foliar spray?

Manure Tea

Manure-based extracts – a soluble nutrient source made from raw animal manure soaked in water. For all practical purposes, manure tea is prepared in the same way as the compost extracts described in the preceding section. The manure is placed in a burlap sack and suspended in a barrel of water for 7 to 14 days. The primary benefit of the tea will be a supply of soluble nutrients, which can be used as a liquid fertilizer.

Herbal Tea

Plant-based extracts – stinging nettle, horse tail, comfrey, clover. A common method is to stuff a barrel about three-quarters full of fresh green plant material, then top off the barrel with tepid water. The tea is allowed to ferment at ambient temperatures for 3 to 10 days. The finished product is strained, then diluted in portions of 1:10 or 1:5 and used as a foliar spray or soil drench. Herbal teas provide a supply of soluble nutrients as well as bioactive plant compounds.

Liquid Manures

Mixtures of plant and animal byproducts seeped as an extract – stinging nettle, comfrey, seaweed, fish wastes, fish meal. Liquid manures are a blend of marine products (local fish wastes, seaweed extract, kelp meal) and locally harvested herbs, soaked and fermented at ambient temperatures for 3 to 10 days. Liquid manures are prepared similarly to herbal tea – the material is fully immersed in the barrel during the fermenting period, then strained and diluted and used as a foliar

spray or soil drench. Liquid manures supply soluble nutrients and bioactive compounds.

Summary: Compost teas and herbal teas are tools that can be made on the farm to enhance crop fertility and to inoculate the phyllosphere and rhizosphere with soluble nutrients, beneficial microbes, and the beneficial metabolites of microbes.

Caution: Whereas raw animal manures are used as a compost windrow feedstock, the composting process – thermophilic heating to 135-160° F for 10-15 days – assures pathogen reduction. The raw organic matter initially present in the compost windrow undergoes a complete transformation, with humus as an end product. Any pathogens associated with raw manures will be gone. So caution is extended: Manure teas are **NOT** the same thing as compost teas or compost extracts. Because of concerns over new pathogenic strains of *E. coli*, the author advises growers to reconsider manure teas and/or to work with a microbial lab to ensure a safe, worthwhile product.

Methods of Compost Tea Production

Bucket-Fermentation Method

“Passive” compost tea is prepared by immersing a burlap sack filled with compost into a bucket or tank, stirring occasionally. Usually the brew time is longer, from 7 to 10 days. This is the method that dates back hundreds of years in Europe, and is more akin to a compost watery extract than a “brewed” and aerated compost tea.

Bucket-Bubbler Method

The equipment setup and scale of production are similar to the bucket method, except that an aquarium-size pump and air bubbler are used in association with microbial food and catalyst sources added to the solution as an amendment. Since aeration is critical, as many as three sump pumps may be used in a bucket simultaneously.

With homemade compost tea brewing, a compost “sock” is commonly used as a filter-strainer. Ideally, the mesh size will strain compost particulate matter but still allow beneficial microbes – including fungal hyphae and nematodes – to migrate into solution. Single-strand mesh materials such as nylon stockings, laundry bags, and paint bags are some of the materials being used; fungal hyphae tend to get caught in polywoven fabrics. If burlap is used, it should be “aged” burlap.

Trough Method

Large-scale production of compost teas employs homemade tanks and pumps. An 8- or 12-inch-diameter PVC pipe is cut in half, drilled full of holes, and lined with burlap. Compost is placed in this makeshift trough. The PVC trough is supported above the tank, several feet in the air. The tank is filled with water, and microbial food sources are added as an amendment. A sump pump sucks the solution from the bottom of the tank and distributes the solution to a trickle line running horizontally along the top of the PVC trough filled with compost. As the solution runs through the burlap bags containing the compost, a leachate is created which then drops several feet through the air back into the open tank below. A sump pump in the bottom of the tank collects this “tea” and distributes it back through the water line at the top of the trough, and so on. Through this process, which lasts about seven days, the compost tea is recirculated, bubbled, and aerated. The purpose of the microbial food source is to grow a large population of beneficial microorganisms.

Commercial Tea Brewers

Commercial equipment is available for the production of brewed compost teas (see a list of suppliers below). Usually there is a compost sack or a compost leachate basket with drainage holes, either of which are used to hold a certain volume of compost. The compost-filled container is placed in a specially designed tank filled with chlorine-free water. Microbial food sources are added to the solution. A pump

supplies oxygen to a specially-designed aeration device which bubbles and aerates the compost tea brewing in the tank.

Summary: Depending on your scale of production and the level of financial resources available to purchase commercial brewing equipment vs. making some kind of homemade brewer, there are several methods to choose from. Research at Soil Foodweb, Inc. in Corvallis, Oregon has shown that differences exist in the beneficial attributes of compost teas, with commercial tea brewers producing the greatest numbers and diversity of beneficial microorganisms.

Compost Tea Brewing Equipment

Growing Solutions, Inc.

160 Madison Street

Eugene, OR 97402

888-600-9558 Toll-Free

541-343-8727 Local

541-343-8374 Fax

info@growingsolutions.com

<http://www.growingsolutions.com>

Growing Solutions carries the System25™ (25-gallon), System100™ (100-gallon), and System500™ (500-gallon) models. Each model consists of a tank, pump, aeration device, and a compost leachate basket. Growing Solutions also makes a pre-packaged microbial food/catalyst source for compost tea brewing (dry mix). They also carry a specialized 27-gallon sprayer designed to handle the larger particulate matter found in compost teas.

Soil Soup, Inc.

9792 Edmonds Way #247

Edmonds, WA 98020

877-711-7687 Toll-Free

206-542-9304 Local

206-533-0748 Fax

Farming@soilsoup.com

<http://www.soilsoup.com>

The Soil Soup™ system consists of a polyethylene mixing tub, a synthetic felt compost bag, the BioBlender™ aeration pump, and the Soil Soup Nutrient Solution containing a microbial food/catalyst source (liquid mix). The regular systems come with 6.5-gallon, 12-

gallon, and 30-gallon tanks, but they also make 175-gallon, 500-gallon, and 1050-gallon tanks.

Microb Brewer

182 Capital Lane

Roseburg, OR 97470

info@microbbrewer.com

<http://www.microbbrewer.com>

The Microb Brewer™ system – designed for brewing compost teas, plant extracts, and manure teas – consists of a funnel-shaped tank, pump, vortex nozzles for agitation and aeration, and a compost leachate basket. Tanks are available in 12-, 50-, and 500-gallon sizes.

EPM Inc. – Earth Tea Brewer

P.O. Box 1295

Cottage Grove, OR 97424

541-767-2747

541-767-2744 Fax

sales@fish-world.com

<http://www.composttea.com>

EPM Inc. carries the Earth Tea Brewer™ in 100- and 500-gallon tank sizes; each model consists of a tank, a pump, and a compost leachate basket. It features two aeration devices – venturi nozzles and air-stones – for diffusion of oxygen. EPM also makes a prepackaged microbial food/catalyst source for compost tea brewing (dry mix). EPM is a sister company to Worm Wigwam™, and promotes vermicompost – also known as worm compost – for the production of compost teas.

Compara – Xtractor

Compara Co. in The Netherlands

Bob Baars

+31 71 34 19873

office@compara.nl

<http://www.compara.nl/>

[Compost_Tea_Systems.htm/English](http://www.compara.nl/Compost_Tea_Systems.htm/English)

Compara is the biological farming company in The Netherlands managed by Bob Baars. The Xtractor™ series – Xtractor2™, Xtractor10™, Xtractor20™ – is a Do-It-Yourself Kit with aeration and tubing components to make compost tea in 50-, 250-, and 500-gallon barrels or tanks, purchased locally by the grower. Compara ships the DIY Kits overseas. Compara also makes a pre-packaged microbial food/catalyst source for compost tea brewing (dry mix).

Soil Foodweb: Concepts, Microbial Analysis, Application

Humus – and organic matter in its many forms – provides both food and shelter for soil organisms. Soils and composts contain a rich diversity of life. The soil foodweb is the community of micro- and macro-organisms that live in these environments.

Essentially, compost tea production is a brewing process that extracts microorganisms from compost followed by microbial growth and multiplication. This includes beneficial bacteria, fungi, protozoa, and nematodes. When compost teas are sprayed onto the leaf surface, these *beneficial organisms* occupy *spatial niches* on the leaf surface and gobble up *leaf exudates* that pathogenic organisms would otherwise feed on to prosper; other microbes directly interfere with *pathogenic organisms* through *antagonism*.

Ideally, compost teas contain both an **Abundance** (immense total number) and a **Diversity** (vast mixture) of beneficial microorganisms which perform different functions. Pathogenic organisms that land on the leaf surface simply cannot compete with the beneficial organisms and therefore have a greatly reduced chance to initiate disease in the first place.

Dr. Elaine Ingham, a microbial ecologist in Corvallis, Oregon, has elevated our collective knowledge of the soil foodweb. In her graduate studies, as well as in her work as Associate Professor at Oregon State University, Ingham pioneered research into microbial analysis of soils, composts, and compost teas. Using the “direct look” method, she views and counts microorganisms with high-performance light microscopy enhanced with epifluorescent staining and illumination. In the late 1990s, she established a commercial lab known as Soil Foodweb, Inc. (SFI), thus providing a service that allows farmers and land managers to gain insight into the soil foodweb condition of their soils and composts.

Foliar-applied plant extracts, liquid manures, and compost teas can be further understood in the context of their influence on the rhizosphere and phyllosphere. These terms refer to those biologically-active regions surrounding the root surface and leaf surface where microbial communities exist. The enclosed PowerPoint slide show – [Compost Teas: A Tool for Rhizosphere+Phyllosphere Agriculture](#) – provides a complementary introduction to this topic.

In collaboration with the people who have on-the-ground experience with compost teas – namely the organic farmers using compost teas and the manufacturers of compost tea brewing equipment – Dr. Ingham and Soil Foodweb, Inc. have pioneered advancements in aerobic compost tea brewing on the West Coast. The following characteristics of a healthy soil foodweb, good-quality compost, and good-quality compost tea are based on her work.

Characteristics of a Healthy Soil Foodweb, per Gram of Soil:

600 million bacterial individuals; 15,000 to 20,000 bacterial species
150 to 300 meters of fungal biomass; 5,000 to 10,000 fungal species
10,000 protozoa
20–30 beneficial nematodes: bacterial-feeding, fungal-feeding, predatory
200,000 arthropods per square meter

Minimum Standards for Compost (for Row Crop Plants), per Gram of Compost:

50–70%	moisture
2–10 µg	active bacteria
150–300 µg	total bacteria
2–10 µg	active fungi
150–300 µg	total fungi
10,000	flagellates
10,000	amoebas
50–100	ciliates
10–50	beneficial nematodes

Minimum Standards for Compost Tea, per Milli-Liter of Compost Tea:

10–150 µg	active bacteria
150–300 µg	total bacteria
2–10 µg	active fungi
5–20 µg	total fungi
1,000	flagellates
1,000	amoeba
20–50	ciliates
2–10	beneficial nematodes

The *Soil Biology Primer* is a landmark publication from the USDA on the living components of the soil. It provides a graphics-rich summary of the soil foodweb and relates foodweb health to soil health. It features individual chapters on soil bacteria, fungi, protozoa, nematodes, arthropods, and earthworms. Printed copies can be ordered through: Soil and Water Conservation Service at 1-800-THE-SOIL, or by email at <pubs@swcs.org>. An online version can be accessed at:

Soil Biology Primer

Soil Quality Institute, NRCS

http://www.statlab.iastate.edu/survey/SQI/SoilBiology/soil_biology_primer.htm

Laboratories that Specialize in Microbial Analysis for Compost Teas

Soil Foodweb, Inc.

980 NW Circle Blvd

Corvallis, OR 97330

541-752-5066

541-752-5142 Fax

Contact: Elaine Ingham

sfi@soilfoodweb.com

<http://www.soilfoodweb.com>

BBC Laboratories, Inc.

1217 North Stadem Dr.

Tempe, AZ 85281

480-967-5931

480-967-5036 Fax

Contact: Vicki Bess

bbclabs@aol.com

<http://www.bbc-labs.com>

Key Literature

Compost Tea Brewing Manual. 2000. By Elaine R. Ingham. Soil Foodweb, Inc., Corvallis, OR. 60 pages. \$25 through SFI.
<http://www.soilfoodweb.com/multimedia/compostteamanual.html>

I highly recommend this manual to anybody who plans to make and use compost teas. It provides a practical summary of compost teas underpinned with a scientific understanding of applied microbiology. Includes: how to use compost teas; factors affecting compost tea quality; beneficial organisms; compost tea production methods; application methods; matching compost teas to plants and soils; bacterial- vs. fungal-dominated compost teas; compost tea recipes; microbial food resources for different microorganism groups; and experimental results.

Organic Farming Research Foundation
Information Bulletin No. 9, Winter 2001
<http://www.ofrf.org/publications/news/ib9.pdf>

The Winter 2001 issue contains a special report on OFRF-funded compost tea research, pages 8–20. This is a 1,895K PDF file, so be patient waiting for it to download. Included among the items in the compost teas issue is “Benefits of Compost Tea: A Review of the Research Literature.” It lists 53 citations, but the full report—see below—contains 88 references in total. Other items include: “Apparatus and Experimental Protocol for Organic Compost Teas,” which describes and illustrates a homemade on-farm compost tea brewer; and “Effectiveness of Compost Tea Extracts as Diseases Suppressants in Fresh Market Crops,” which summarizes research on compost tea extracts applied to strawberries, lettuce, leeks, and broccoli in British Columbia.

Organic Teas from Composts and Manures
Richard Merrill, OFRF Grant Report 97-40
<http://www.ofrf.org/publications/Grant%20reports/97Fall.1of5a.Merrill97-40.IB9.pdf>

The full OFRF report reviewed above; a 51-page PDF download, with 88 literature references in the bibliography, “Selected References for Organic Tea Extract Studies.”

Effectiveness of Compost Extracts as Disease Suppressants in Fresh Market Crops in British Columbia

Sylvia Welke, OFRF Grant Report 99-31
<http://www.ofrf.org/publications/Grant%20reports/99Spr.1of11.Welke99-31.IB9.pdf>

The full OFRF report reviewed above; a 10-page PDF download.

Compost Tea for Organic Farming and Gardening. 2001. By William Quarles. The IPM Practitioner. Vol. 23, No. 9 (September). p. 1–8.

The September 2001 issue of *The IPM Practitioner*—the monthly journal from Bio-Integral Resource Center—featured compost teas. An 8-page reprint is available for \$7.50 total through:

Bio-Integral Resource Center (BIRC)
P.O. Box 7414
Berkeley, CA 94707
510-524-2567
510-524-1758 Fax
birc@igc.org
<http://www.birc.org>

Investigations into Liquid Compost Extracts (“Teas”) for the Control of Plant Pathogenic Fungi

William F. Brinton and Andreas Trankner; a *BioCycle* conference paper

http://www.woodsends.org/compost_tea.pdf

A 12-page PDF download, featuring the work of Dr. William Brinton of Woods End Research Laboratory in Maine.

Compost Practices for Control of Grape Powdery Mildew (*Uncinula necator*)

Andreas Trankner and William F. Brinton; a *Biodynamic* journal reprint

<http://www.woodsends.org/will2.pdf>

An 8-page PDF download, featuring the work of Dr. William Brinton of Woods End Research Laboratory in Maine.

Further Web Resources

BioCycle Reprints: Compost Teas and Compost Microbiology

Understanding Compost Tea

Vicki Bess, *BioCycle*, October 2000
<http://www.jgpress.com/BCArticles/2000/100071.html>

Time for (Compost) Tea in the Northwest

Adrienne Touart, *BioCycle*, October 2000
<http://www.jgpress.com/BCArticles/2000/100074.html>

Brewing Up Solutions To Pest Problems

Lisa Wickland, Todd Murray and Joyce Jimerson, *BioCycle*, March 2001
<http://www.jgpress.com/BCArticles/2001/030164.html>

Evaluating Microbiology of Compost

Vicki Bess, *BioCycle*, May 1999
<http://www.jgpress.com/BCArticles/1999/0599Art4.htm>

Using Compost To Control Plant Diseases

Tom De Ceuster and Harry Hoitink, *BioCycle*, June 1999
<http://www.jgpress.com/BCArticles/1999/0699Art5.htm>

Anaerobic Bacteria and Compost Tea

Elaine Ingham; a *BioCycle* reprint
<http://www.soilfoodweb.com/anaerobic.html>

Microbial Profiles: Fine-tuning the Soil Foodweb

Karen Grobe; a *BioCycle* reprint, January 1998
<http://www.soilfoodweb.com/biocyclus1.html>

Compost Microbiology

Compost Microbiology and the Soil Food Web

California Integrated Waste Management Board
<http://www.ciwmb.ca.gov/publications/default.asp?pubid=857>
<http://www.ciwmb.ca.gov/publications/Organics/44200013.doc>

6-page MS-Word download.

Microbial Activity and Diversity of Soils and Composts

Vicki Bess, BBC Laboratories, Tempe, AZ
<http://www.bbclabs.com/toppage3.htm>

Dr. Elaine Ingham: The Soil Foodweb & Compost Teas

The Soil Foodweb

Elaine Ingham, Soil Foodweb, Inc.
<http://www.soilfoodweb.com/thesfw.html>

Soil Foodweb Information

Elaine Ingham, Soil Foodweb, Inc.
<http://www.soilfoodweb.com/sfwinfo.html>

The Soil Foodweb Structure

Elaine Ingham, Soil Foodweb, Inc.
<http://www.soilfoodweb.com/sfwstructure.html>

Foodweb “Funtions” in a Living Soil: The Benefits to Plants and Soils

Elaine Ingham, Soil Foodweb, Inc.
<http://www.soilfoodweb.com/foodwebfunc.html>

Soil Organisms: Why Are They Important?

Elaine Ingham; article reprint at *Compara.nl*
http://www.compara.nl/soil_organisms.htm

The Soil Foodweb: Its Importance in Ecosystem Health

Elaine Ingham; article reprint at *Don't Panic Eat Organic*
<http://www.rain.org/~sals/ingham.html>

Dr. Ingham's Monthly E-Zine

<http://www.soilfoodweb.com/ezine.html>

Note: The SFI E-Zine is a great place to keep up with Dr. Elaine Ingham's latest comments and notes on compost teas.

Anaerobic Bacteria and Compost Tea

Elaine Ingham; a *BioCycle* reprint

<http://www.soilfoodweb.com/anaerobic.html>

Brewing Compost Tea

Elaine Ingham; *A Kitchen Gardener* reprint

<http://www.taunton.com/finegardening/pages/g00030.asp>

Web Resource Collections on Soil Biology

Sustainable Soil Management: Web Links to Make Your Worms Happy!

Steve Diver, ATTRA

<http://ncatark.uark.edu/~steved/soil-links.html>

Soil Biology Information Resources For Land Managers, Resource Professionals, and Educators

Soil Quality Institute, NRCS

<http://www.statlab.iastate.edu/survey/SQI/SBinfo.htm>

Compost Specialists: David Granatstein & Harry Hoitink

Suppressing Plant Diseases with Compost

David Granatstein; *The Compost Connection for Washington Agriculture*, No. 5, October 1997

<http://csanr.wsu.edu/compost/newsletter/comcon5.html>

Foliar Disease Control Using Compost Tea

David Granatstein, *The Compost Connection for Western Agriculture*, No. 8, January 1999

<http://csanr.wsu.edu/compost/newsletter/Cc8.PDF>

Compost Teas and Liquid Humus

David Granatstein, CERWA

<http://www2.aste.usu.edu/compost/qanda/teas.htm>

Controlling the Compost Process: Compost-Amended Potting Mixes

Ohio State University, Fact Sheet CDFS-160

H. A. J. Hoitink, M. J. Boehm, J. E. Heimlich

<http://ohioline.osu.edu/cd-fact/0160.html>

Compost and Disease Suppression

Bibliography on Compost for Disease Suppression

Chloe Ringer,

USDA Soil Microbial Lab

<http://ncatark.uark.edu/~steved/compost-disease-biblio.html>

Disease Suppressive Potting Mixes

Steve Diver, ATTRA

<http://www.attra.org/attra-pub/dspotmix.html>

Sustainable Management of Soil-borne Plant Diseases

Preston Sullivan, ATTRA

<http://www.attra.org/attra-pub/soilborne.html>

Suppressing Plant Diseases with Compost

David Granatstein; *The Compost Connection for Washington Agriculture*, No. 5, October 1997

<http://csanr.wsu.edu/compost/newsletter/comcon5.html>

On-Farm Composting: Plant Disease Control / On-Farm Composting - A Review of the Literature

Alberta Agriculture, Food and Rural Development

<http://www.agric.gov.ab.ca/sustain/compost/plantdisease.html>

Composts for Disease Suppression

UConn Integrated Pest Management

<http://www.hort.uconn.edu/ipm/general/htms/composts.htm>

Microbial Ecology of Compost-induced Disease Suppression

Eric Nelson, et al.; Proceedings of the 5th International PGPR Workshop

<http://www.ag.auburn.edu/argentina/pdfmanuscripts/nelson.pdf>

Disease Suppressive Compost as an Alternative to Methyl Bromide

Methyl Bromide Alternative Case Study, EPA 430-R-97-030

10 Case Studies, Volume 3, September 1997

<http://www.epa.gov/spdpublic/mbr/compost3.html>

Compost Teas: Regional Reports

Compost Tea Trials Final Report

Submitted to Office of Environmental Management, City of Seattle.

Cascadia Consulting Group, March 8, 2001

<http://www.cityofseattle.net/environment/Documents/>

[Final%20Compost%20Tea%20report.pdf](http://www.cityofseattle.net/environment/Documents/Final%20Compost%20Tea%20report.pdf)

A 53-page PDF download

Alternatives for Use & Management of "Compost Tea"

Clean Washington Center

<http://cwc.org/organics/cm002.htm>

Access to HTML and PDF versions

Evaluation and Prioritization of Compost Facility Runoff Management Methods

Clean Washington Center

http://cwc.org/organics/organic_htms/cm002rpt.htm

<http://cwc.org/organics/org002rpt.pdf>

53-page PDF download. Report addresses the reuse of a pasteurized compost leachate from city zoo for use as a "tea" to fertilize crops. The liquid plant food, a compost tea product called *Zoo Broo*, will be marketed along with the zoo's other compost product, *Zoo Doo*.

Evaluation of Compost "Tea" for Reuse Opportunities (1997 & 1998)

Clean Washington Center

<http://cwc.org/organics/cm981.htm>

Access to HTML and PDF versions

Evaluation of Compost Facility Runoff for Beneficial Reuse, Phase 2

Clean Washington Center

http://cwc.org/organics/organic_htms/cm981rpt.htm

<http://www.cwc.org/organics/org981rpt.pdf>

39-page PDF download. Phase 2 report on the compost leachate reuse project.

Compost Teas: Popular Press

Brewing Compost Tea

Elaine R. Ingham; *A Kitchen Gardener* reprint

<http://www.taunton.com/finegardening/pages/g00030.asp>

Bainbridge Island: Healing the Earth

Sue Edwards, *The SUN* newspaper of Bremerton, Washington, February 2000

<http://www.thesunlink.com/news/2000/february/0211a10a.html>

'Compost Tea' Allows Gardeners to Brew Greener Pastures

Steve Hill, *University Week*, University of Washington

http://depts.washington.edu/uweek/archives/2001.03.MAR_08/article9.html

Wake Up Your Garden With Compost Tea

Kathy LaLiberte, *The Innovative Gardener*, July 2001

<http://www.vg.com/gardening/igjuly01.asp>

Making Fermented Compost Tea

Natural Life Magazine #44

<http://www.life.ca/nl/44/compost.html>

From The Garden: Oxygen-Rich Compost Tea Can Help Ward Off Summer's Water Blues

Ann Lovejoy, Thursday, March 15, 2001, Special to the Post-Intelligencer

<http://seattlepi-i.nwsource.com/nwgardens/lovejoy15x.shtml>

Feed Your Foodweb: Compost Tea

Strengthens Plants, Defends Against Disease

Rachel Foster, *Eugene Weekly*

<http://www.eugeneweekly.com/gardens/gardens01.html>

Compost Teas: Research Reports

Response of *Alternaria spp.* Blight and *Septoria spp.* Leaf Spot to Biological Disease Control Agents in Tomatoes

Jeremy Barker Plotkin; OFRF on-farm research report

<http://www.ofrf.org/scoar/plotkin.PDF>

Compost Cures All

James Saper (from *Sustainable Farming Magazine*, Summer 1997, Vol. 7 No. 3)

http://www.genesis.ca/whatsnew_5.html

Peach Brown Rot Study at Woodleaf Farm, Oroville, CA

Carl Rosato; OFRF on-farm research report

<http://www.agroecology.org/cases/brownrot/studies.htm>

North Coast Apple Scab Trials 1993/1994, Organic and Conventional Materials Comparison

Paul Vossen and Doug Gubler; reprint from *UC Plant Protection Quarterly*

<http://www.sarep.ucdavis.edu/newsltr/v7n4/sa-8.htm>

University Research

Midwest Biosystems, Tampico, IL

<http://www.aeromasterequipment.com/research.html>

Compost Tea and Blossom Brown Rot

Washington State University

<http://depts.washington.edu/mulch/research/>

Compost Teas: *The Worm Digest Quarterly*

A Homemade Compost Tea Brewer

S. Zorba Frankel, *The Worm Digest*

<http://www.worndigest.org/articles/index.cgi?read=66>

Compost Teas: Brewing a Sweet Blend

Kelly Slocum, *The Worm Digest*

<http://www.worndigest.org/articles/index.cgi?read=65>

Compost Teas: Complementary ATTRA Resources

Compost Teas for Plant Disease Control

The 1998 ATTRA publication

<http://www.attra.org/attra-pub/comptea.html>

Compost Teas: A Tool for Rhizosphere+ Phyllosphere Agriculture

<http://ncatark.uark.edu/~steved/compost-tea-slides.pdf>

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Formatted by Ronda Vaughan

March 2002

IP118

The electronic version of **Notes on Compost Teas: A Supplement to the ATTRA Publication *Compost Teas for Plant Disease Control*** is located at:

HTML

<http://www.attra.ncat.org/attra-pub/compost-tea-notes.html>

PDF

<http://www.attra.ncat.org/attra-pub/PDF/compost-tea-notes.pdf>

Compost Teas: A Tool for Rhizosphere + Phyllosphere Agriculture slide notes

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**Appropriate Technology
Transfer for Rural Areas**



**Funded by USDA
Rural Business-Cooperative Service**

ATTRA is an NCAT-SARD project ...



National Center
for Appropriate
Technology

**Sustainable Agriculture and
Rural Development Program**

Compost Teas: A Tool for Rhizosphere + Phyllosphere Agriculture

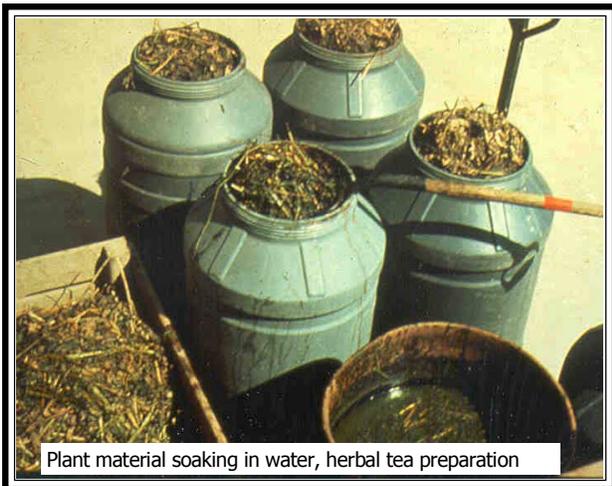
What are they
What's in it
Benefits and uses
How do you make them
How do you use them

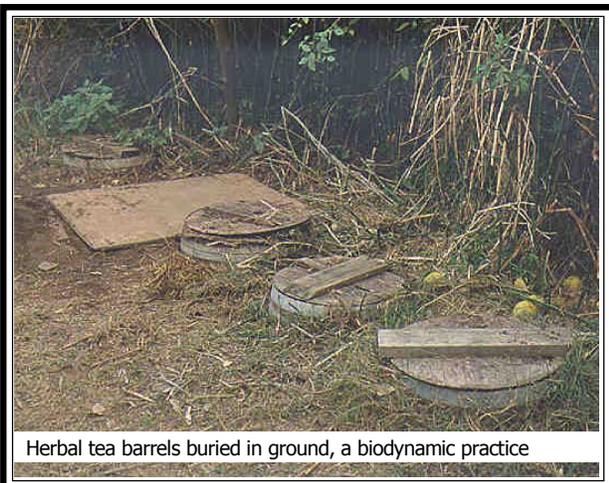
Liquid Organic Extracts vs Compost Teas

Manure Tea:
Manure-based extracts

Herbal Tea:
Plant-based extracts; E.g., nettle, horse tail, comfrey, chamomile, clover

Liquid Manures:
Fermented mixture of plants, fish, seaweed extracts





Liquid Organic Extracts vs Compost Teas

Compost Leachate:
Compost windrow leachate

Compost Extract:
Compost watery extract

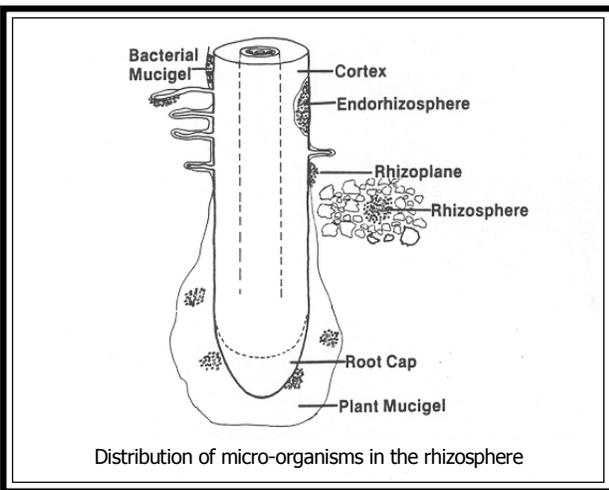
Compost Tea:
Compost watery extract brewed with microbial food source -- molasses, kelp, rock dust, humic-fulvic acids

Components of Compost Tea

- Soluble nutrients
- Humic substances
- Bacteria
- Fungi
- Nematodes
- Protozoa
- Microbial metabolites
- Goal = maximum diversity of "good guys"

Benefits of Compost Teas

- Inoculate rhizosphere = soil drench
- Inoculate phyllosphere = foliar spray
- Occupy plant surface with beneficial organisms = colonization
- Beneficials use exudates & microbial food sources = competition
- Biocontrol = antagonism, induced resistance
- Soluble nutrients, growth-promoting substances, metabolites

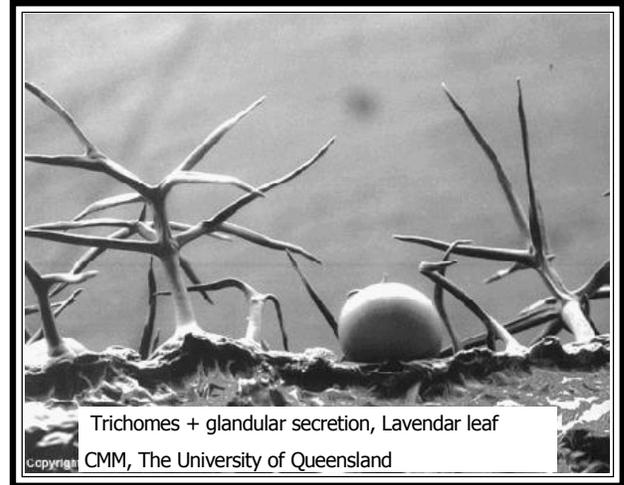
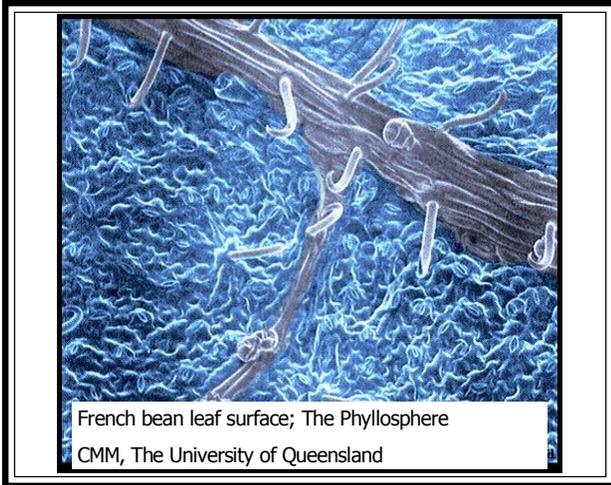


Rhizosphere Benefits for Microorganisms

Root Excretions

1. Amino acids
2. Organic acids
3. Carbohydrates = Sugars
4. Nucleic acids
5. Growth factors
6. Sloughed-off tissue

Key: Food + energy for microbes



“Active” Components in Compost Tea

Yeasts: *Sporobolomyces, Cryptococcus*
Bacteria: *Bacillus, Pseudomonas, Serratia, Penicillium, Etc*
Fungi: *Trichoderma, Gliocladium, Etc*
Chemical antagonists: phenols, amino acids
Key: 1. Microbial **Abundance** + **Biodiversity**
 2. Components of a healthy soil foodweb
 3. Beneficial bacteria, fungi, nematodes, protozoa

Compost Teas as a Natural “Fungicide”

Gray mold on beans, strawberry
Botrytis cinerea
 Downy & powdery mildew on grapes
Plasmopora viticola, Uncinula necator
 Apple scab
Venturia conidia
 Late blight of potato, tomato
Phytophthora infestans

Compost Tea Production Methods

Bucket-Fermentation Method: [aerobic + anaerobic]
 Compost in burlap sack immersed in water, compost “extract” vs compost “tea”

Bucket-Bubbler Method: [aerated = aerobic]
 Small-scale buckets, aquarium air bubbler
Trough Method:
 Farm-size tanks, sump pumps and trickle lines
Commercial Tea Brewers:
 Small- to Large-scale
 Tank, pump, aeration, leachate sock or basket

“Brewing” a Compost Tea

Bacterial tea = Foliar spray

- Bacterial compost
- Simple sugars = Molasses, cane syrup, apple juice, yeasts
- Kelp
- Plant extracts (yucca, nettle, comfrey)

Fungal tea = Soil drench

- Fungal compost
- Humic acid
- Kelp
- Yucca extract

**Example Compost Tea Recipe
Michael Blakely, Carnation, WA**

Initial recipe:

- 100 gallons water
- 10 gallons compost

Add:

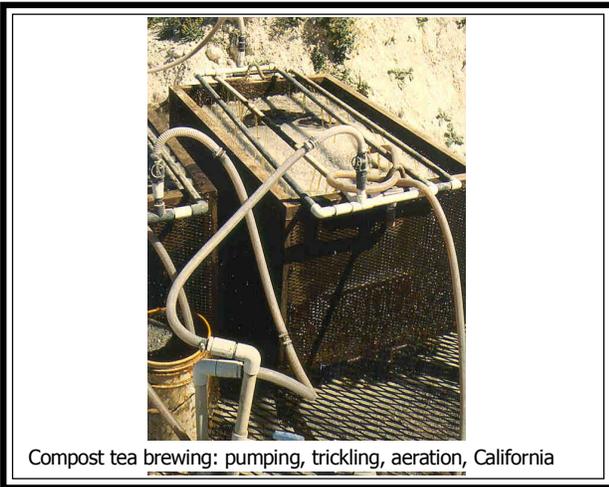
- 1 lb cold pressed kelp powder
- 1 lb Mermaid fish powder
- 1 gallon molasses
- 1 gallon barley malt

Experimental:

- Soluble phosphate, humic acid, raw milk, yucca extract



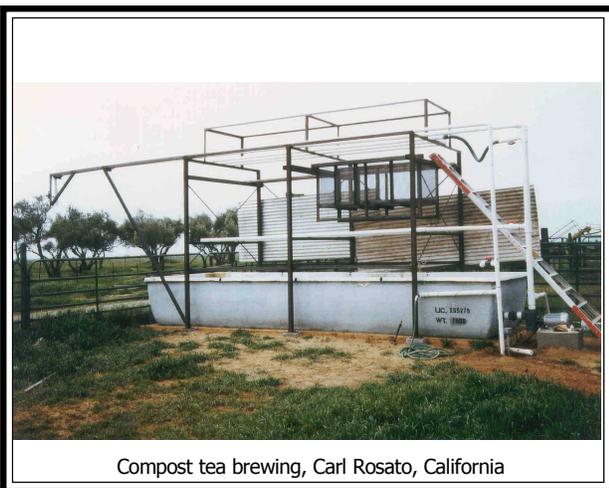
Compost tea brewing tank, 4,000 gallons, California



Compost tea brewing: pumping, trickling, aeration, California



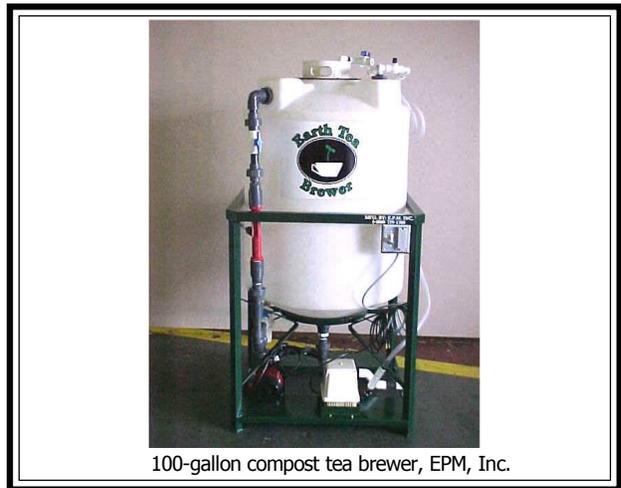
Compost tea brewing, 500 lbs compost, molasses, etc., California



Compost tea brewing, Carl Rosato, California



6.5-gallon compost tea brewer, Soil Soup





500-gallon compost tea brewer, EPM, Inc.

Commerical Compost Tea Brewers

Growing Solutions, Inc.
www.growingsolutions.com

Soil Soup, Inc.
www.soilsoup.com

Microb Brewer
www.microbbrewer.com

Earth Tea Brewer / EPM, Inc.
www.composttea.com

Xtractor / Compara
www.compara.nl/Compost_Tea_Systems.htm/English

Minimum Standards for Compost Tea, per ML

10-150 µg	active bacteria
150-300 µg	total bacteria
2-10 µg	active fungi
5-20 µg	total fungi
1,000	flagellates
1,000	amoebae
20-50	ciliates
2-10	beneficial nematodes

Source:
 Dr. Ingham's Monthly E-Zine
<http://www.soilfoodweb.com/ezine.html>

Compost Tea Application

Foliar

- 70% leaf coverage
- 5 gallons per acre, straight or diluted

Seed Treatments

- Mist or soak seeds prior to planting

Soil Drench

- Apply at transplant and seedling stages
- Apply to base of full-grown plants

Resources on Compost Tea

The Compost Tea Brewing Manual
 Elaine Ingham, Soil Foodweb, Inc.
www.soilfoodweb.com

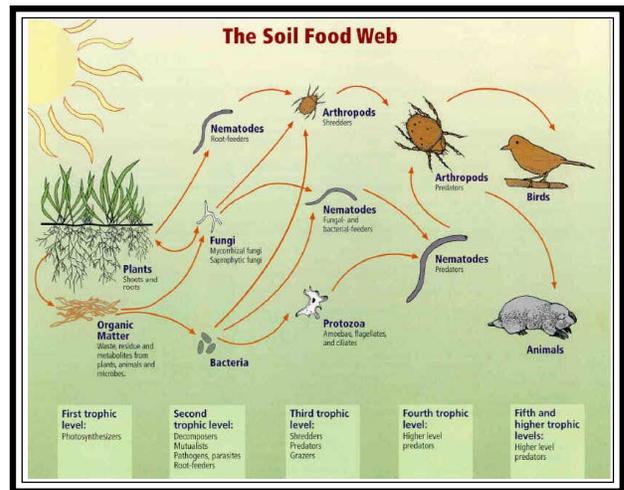
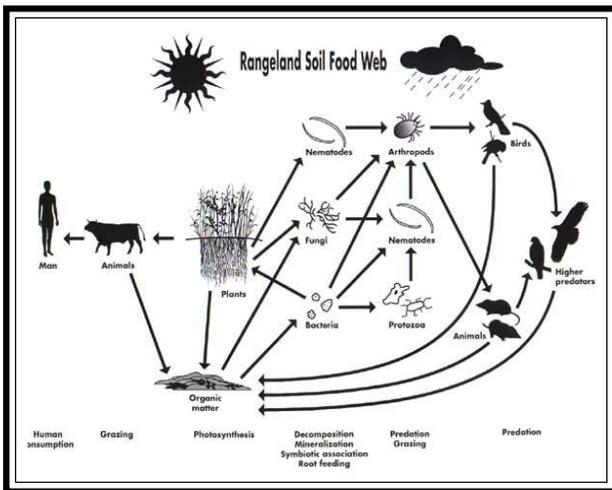
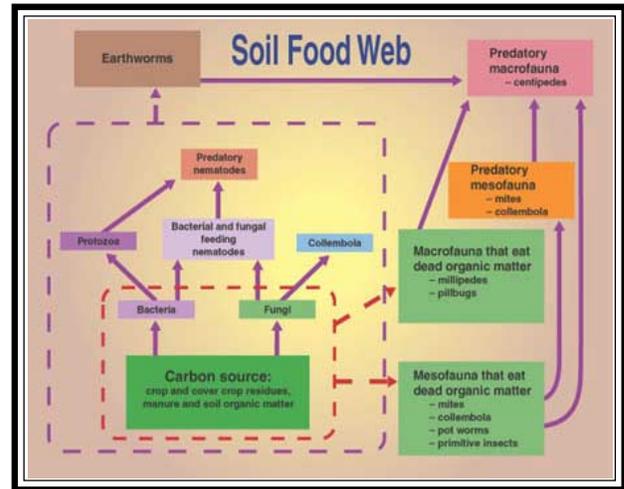
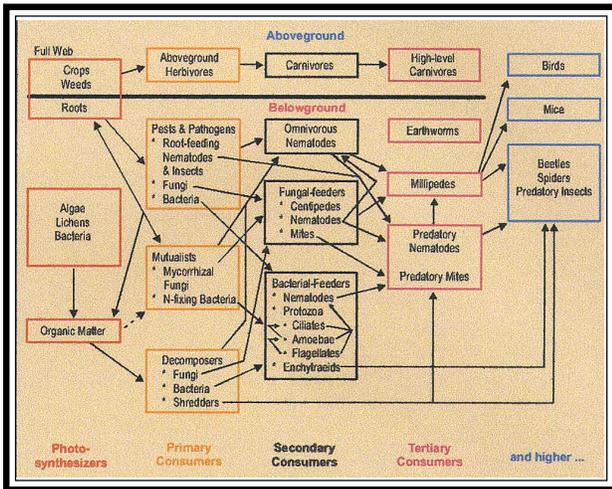
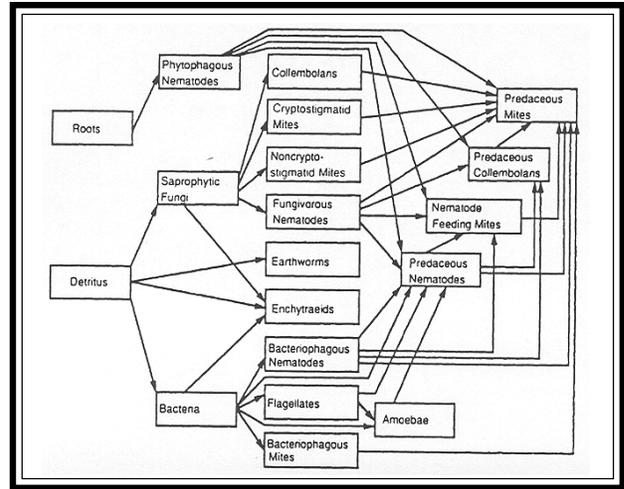
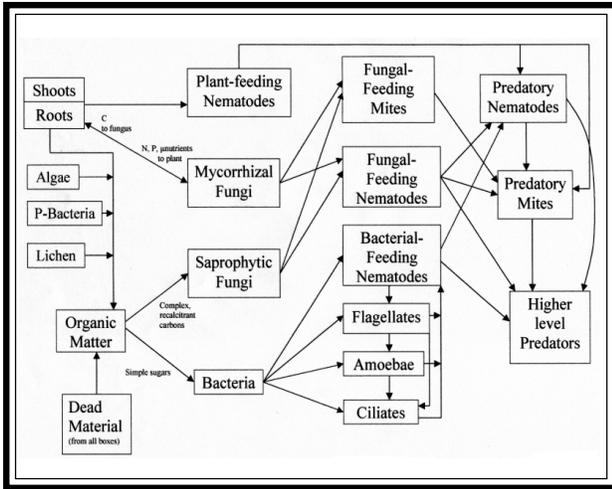
Organic Farming Research Foundation
 Information Bulletin, Winter 2001, No. 9
www.ofrf.org
 Special report on compost teas, pages 8-20

Compost Teas for Plant Disease Control
 Steve Diver, ATTRA
www.attra.org/attra-pub/comptea.html

Notes on Compost Tea
 Steve Diver, ATTRA
www.attra.org/attra-pub/compost-tea-notes.html

Six Ways to View Soil Food Webs

1. Elaine Ingham, Soil Foodweb, Inc.
2. De Ruiter, et al. 1993. J. Appl. Ecol. 30: 95-106.
3. Soil Quality Information Sheet: Soil Biodiversity
 NRCS Soil Quality Institute
4. Michigan Field Crop Pest Ecology and Management,
 MSU Extension Bulletin E-2704
5. GLIDE, Natural Resource Ecology Laboratory,
 Colorado State University
6. Soil Biology Primer, NRCS Soil Quality Institute



Acknowledgement

Slide:

Plant material soaking in water, herbal tea preparation

Eliot Coleman's European Farm Tour

Acknowledgement

Diagram:

Distribution of micro-organisms in the rhizosphere

Giddens, J. and R.L. Todd. 1984. Rhizosphere microorganisms - overview. p. 51-68. Microbial-Plant Interactions. ASA Special Publication No. 47. American Society of Agronomy, Madison, WI.

Acknowledgement

Leaf surface images:

The "Phyllosphere"

Nanoworld

**CMM - Centre for Microscopy and Microanalysis,
The University of Queensland
www.uq.edu.au/nanoworld/images_1.html**

Acknowledgement

Compost tea recipe:

Michael Blakely, Carnation, WA

Blakely, Michael. 2001. Compost tea - my experience. Washington Tilth. Vol. 9, No. 1. p. 12-13.

Acknowledgement

Compost tea brewers:

Soil Soup

Microb Brewer

System 100, Growing Solutions

Earth Tea Brewer, EPM

Photos used with permission

Presentation Source

Compost Teas: A Tool for Rhizosphere + Phyllosphere Agriculture

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Presented at:

Mountain Organic Growers School

March 17, 2001

Asheville, North Carolina

Updated:

January, 2002