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2000 to 2002

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# Evaluating the Benefits of Compost Teas to the Small Market Grower

## Project Summary

Four growers who raise a variety of vegetables, small fruits, and flowers cooperated on this study of compost tea. All of us experienced disease in our production areas and wished to decrease disease impacts in a cost effective, least toxic manner. We hoped that compost tea would be an effective way to deal with disease problems and also boost yields.

We made and applied compost tea as a foliar spray and soil drench to grapes, ornamental flowers, and vegetables. Microbial analyses of soils, compost, and compost tea were used to determine the needs of our sites as well as how effectively we were making compost and tea. The extent of disease between treated and untreated plots was evaluated. Differences in harvest weights in grapes were also compared to evaluate the impact of compost tea on production.

## Project Description

This project is a collaboration among four small market growers to study compost tea. Our farms are nestled among the bluffs, prairies, and forests of SE Minnesota. Two of us are certified organic, operate community shared agriculture farms, and sell to restaurants. Three sell vegetables, fruits, and flowers at farmers' markets. One sells grapes to a winery and home winemakers. Two also raise livestock and field crops. Three of us have areas of heavy clay soils. All have had difficulty with fungal and bacterial diseases on some crops and wish to prevent or treat these diseases in a sustainable way.

During the first two years of the project, we experimented with brewing compost tea and adding amendments to increase its potency. We learned about the microbial community in our soils, compost, and teas. We have learned the importance of making or buying temperature controlled, aerobic compost in order to supply a rich variety of microorganisms to make tea. See *Greenbook 2001* and *2002* for details of our previous results.

The goals of the project were to determine whether compost tea was a useful tool in suppressing disease and increasing yields in a variety of crops. The questions that we have tried to answer are: 1) how good is the compost tea that we brewed; and 2) did the tea have an impact on the crops we grew?

To evaluate the compost and compost tea, we sent samples to a laboratory that specializes in microbial analyses, Soil Foodweb Inc. We evaluated soil, compost, and tea for total and active bacterial biomass, total and active



*Pat and Peggy analyze grape quality with a refractometer.*

fungal biomass, ratios of fungi to bacteria, protozoa counts, and total nematode counts. There was also an evaluation of whether any of the nematodes were root feeders.

To test the impact of the compost tea on crops we tried to determine whether crops that were sprayed or had their soil drenched with tea, had less observable disease. In the case of grapes, yield differences were also evaluated. We feel that compost and compost tea could be extremely important in moving agriculture toward less toxic and less costly means for dealing with disease. In addition more composting could help turn waste such as manures and biosolids into useful products.

## Results

The 2002 highlights were: 1) higher grape yields were found in those rows where compost tea had been applied; 2) compost tea used on starts in the greenhouse reduced damping off considerably; and, 3) fungal attributes were generally low for soil and tea samples as had been seen in previous years.

*Microbial and soil chemistry analysis.* Soil samples from the vineyard were sent to Soil Foodweb Inc. in 2002 for microbial analyses. Five vineyard treatments included: 1) an untreated control; 2) synthetic fertilizer; 3) synthetic fertilizer plus synthetic sprays (conventional); 4) tea; and, 5) conventional plus tea. Total fungal biomass and the ratio of fungal to bacterial biomass were increased in the soil samples treated with synthetic fertilizer plus synthetic spray. Beneficial protozoa including flagellates and amoebae were increased for the groups treated with tea. Ciliated protozoa were high in all five groups, indicating anaerobic soil conditions consistent with our heavy, waterlogged spring soils. Total nematodes were increased in the conventional treatment. However, even the highest nematode value was well below the normal range of 20-40/g, which suggests the teas, and perhaps the composts, were deficient in nematodes.

*Forest floor inoculants.* The lack of fungal biomass in the previous year's compost tea samples suggested that fungal inoculants were needed. Two forest duff samples were evaluated to determine the value of adding these to compost as inoculants for fungi and other microbial attributes. The result suggested that the forest duff chosen did not provide great benefit as inoculants.

*Vegetable garden soils.* Microbial analysis of soils from two of Sandy's garden beds showed that a high level of microbial variability can be found within a single garden area. One bed had high protozoa indicating excellent nutrient cycling. This same bed had good active fungal biomass compared to a nearby bed. These differences were

due to the long-term cropping history and not the treatments applied in this study. The recommendations for improving these two beds were different because of the different microbial communities present. Such variability makes it difficult to know how to proceed in treating the soil unless extensive and expensive microbial analyses are done.

*Compost tea microbial analysis.* One sample of compost tea that was used on grapes and ornamental flowers was analyzed for microbes. Both bacterial activity and total biomass were good to excellent, but no fungi were apparently present. Ciliated protozoa were adequate. Other protozoa and nematodes were deficient. Overall, the compost tea was rich in bacteria but deficient in nearly all other analyzed microbes. These findings agree with previous years analyses.

This problem can be attributed to one of three things: 1) the compost is deficient of fungi; 2) the sock used to hold the compost does not allow fungi to move into the liquid; and/or, 3) the brewer does not adequately extract the fungi. To evaluate the last two possibilities, the design of the sock has been changed and different brands of brewers are being tried. The technology in the compost tea business is constantly changing. When we started the grant there were only two commercial brewers available. There are now at least eight.

*Compost tea recipes.* The following sample recipe was used on grapes and flowers. Place 12 gallons of rainwater in a muck bucket. Put one pint cow manure compost in the sock designed to hold and filter the compost plus 2 oz black strap molasses, 1 oz azomite, 2 oz Algamin, 1 oz Omega 1-5-5, 1 oz Humax, 1 oz MicroHume, and a handful of comfrey leaves. Brew tea with a commercial brewer for 24 to 48 hr or until the smell of molasses is nearly gone and the tea is frothing. Recipes for other batches of compost tea for grapes and flowers were similar, depending on whether the goal was for a tea dominated by fungi or bacteria.

The following recipe was used on greenhouse plants and other vegetables. Place compost (from pig and chicken manure, straw, wood chips, and alfalfa) and forest soil in a muck bucket sock. Add molasses, fish emulsion, kelp, nettles, and a handful of German chamomile. Brew tea until the desired frothiness appears (24 to 48 hr).

*Tea effectiveness on grapes.* The Frontenac grape vines displayed an early June outbreak of anthracnose. No other serious diseases were detected. The severity of the outbreak was evaluated on June 12. The standard treatment of synthetic fertilizers and foliar sprays reduced the anthracnose, with the treated vines showing less than one-third the symptoms of untreated vines. Compost tea reduced the incidence of anthracnose but not sufficiently to control the disease.

Due to the severe anthracnose infection, the study protocol was broken on June 13 to allow all treatment groups to be treated with standard sprays. Applications of compost tea were continued in the designated tea rows.

The 4-year-old Frontenac vines produced their first crop in September 2002. The differences among treatments were striking:

- untreated vines produced only 4 lb/vine;
- the group treated with synthetic fertilizer produced 6.5 lb/vine;
- the compost tea treated grapes produced 8.3 lb/vine;
- the vines treated conventionally produced 12.3 lb/vine; and,
- the conventional plus tea vines produced 13.8 lb/vine.

The additional 1.5 lb/vine obtained by adding tea to the standard sprays would translate to approximately one-half ton additional fruit per acre.

Compost tea alone did not appear to effectively reduce severity of anthracnose infection in Frontenac grapes. However, it was gratifying to see that tea alone produced more grapes than no treatment or only fertilizer, and that conventional production plus tea produced more than conventional. These differences can be meaningful financially, and may indicate greater vine health and fruit quality in future years if the use of tea continues.

*Tea effectiveness on zinnias.* Zinnias were planted in early July and treated on three separate occasions with compost tea. Untreated beds were sprayed with water. As in previous years, leaf spots developed in mid-August. Plants were analyzed for disease severity on August 30 and September 6. There was no significant difference in disease pressure as a result of the application of the tea. Last year the use of tea reduced disease, suggesting that this year's compost tea preparation was not as effective.

*Tea effectiveness on sunflowers.* Sunflowers were planted in early July and treated with compost tea on three separate occasions. Leaf spots similar to those on the zinnias, as had been observed in years past, developed on the sunflowers. Disease pressure was evaluated on September 20. There was no significant difference between treated and untreated plots. Overall, the amount of disease was low, making the impact of the tea hard to discern.

#### ***Brewing compost tea with a bioblender.***

*Tea effectiveness on greenhouse flats of herbs and cucumbers.* Herbs and cucumbers were planted in the Whitewater Gardens greenhouse in an organic soil mix consisting of peat, vermicompost, perlite and trace minerals. Compost tea was used on selected starts. The tea was added to water that was used to bottom water flats of the starts. The control groups were given water but not tea. Tea was added to every other watering so that the treated plants were not overfed. Visual comparisons were made on cucumber plants and on oregano, thyme, and marjoram to determine the amount of damping off.

The control flats of herbs where only water was added lost approximately 25% of the plants to damping off. Herb flats that were treated with tea lost only 5% of the plants. Untreated cucumbers had an approximate loss of 50% due to damping off. Flats treated with tea fared considerably better with about a 10% loss.

*Tea effectiveness on heirloom greenhouse tomatoes.* Select heirloom tomato varieties were planted in an unheated hoop structure. Varieties included Thessoloniki, Dr. Wyches Yellow, Bulls Heart, German, Amish Paste, Rose de Berne, and Cherokee Purple. At planting, soil was amended with a dusting of calcium carbonate and each plant was watered with a mixture of water and compost tea. The tea was made from the same mix used for tea on greenhouse flats, but nettles and chamomile were not added to this brew. The plants were staked, tied, and pruned as they grew, and watered with the same tea recipe one more time about a month after planting.



Although fruits were not weighed or tested for brix, plants were observed for signs of any kind of blight. Tomato plants treated with compost tea and control plants were both free of blight during the season. Inadequate ventilation in the greenhouse caused some heat stress on both tomato plants and fruit. All plants continued to bear fruit until they finally were allowed to freeze in October.

*Tea effectiveness on sugar snap peas.* Three 100' rows of sugar snap peas were planted 4' apart and divided into 25' sections. Alternate sections were treated with a foliar spray of compost tea brewed from the same recipe used for the greenhouse tomatoes. The soil was also treated when plants were about 4 to 6" tall. The soil had been tested earlier in the year by Soil Foodweb, Inc. and was determined to need more beneficial fungi to insure the health of the legumes. All plants remained healthy and produced heavily on both treated and untreated sections.

### Management Tips

1. Start brewing tea in a small bucket with an aquarium aerator and play with recipes on one crop to limit the number of variables you are dealing with.
2. If you can't make quality compost yourself, buy or barter with a local composting expert.
3. Brew tea inside a greenhouse or garage to extend the season into early spring and late fall.
4. Think of compost tea as just one tool in an integrated pest management toolbox (crop variety selection, crop rotation, green manures, and soil health maintenance).
5. Due to concern over *E. Coli* and *Salmonella* contamination, organic certification is currently not offered for those using compost tea. This may change with more knowledge in the near future.

### Cooperators

*Sandra Gould, U of M Plant Disease Clinic, St. Paul, MN*  
*Russell Turner, Wabasha, MN*  
*Larry Shafer, Agro-K Corp., Minneapolis, MN*

### Project Location

Weaver Gardens is located on the north side of State Hwy. 74, .75 mile west of Hwy. 61. It is the last residence in Weaver going west. Contact Pat Bailey for directions to other sites.

### Other Resources

Cantisano, Amigo. 2000. Control plant diseases with compost teas. Growing for Market, Sept. 6.

Compost tea discussion group:  
<http://lists.ibiblio.org/mailman/listinfo>

Diver, Steven. 1998. Compost teas for plant disease control. Appropriate Technology Transfer for Rural Areas. Available at: 800-346-9140 or [www.attra.org](http://www.attra.org). Diver has recently published a supplement at: [www.attra.org/attra-pub/compost-tea-notes.html](http://www.attra.org/attra-pub/compost-tea-notes.html)

Ingham, Elaine, and Michael Alms. 1999. Compost tea manual. Available at: [www.soilfoodweb.com](http://www.soilfoodweb.com)

An extensive bibliography is available by contacting Pat Bailey at: 507-767-3225 or Mark Zumwinkle at: 651-282-6204.