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Compost tea: Examining the science behind the claims

WSU Master Gardeners are often asked about compost tea (and other products) but may not have ready access to objective information. This column is dedicated to those hard-working volunteers who want the current best science on products and practices so that they can continue to learn and inform others.

What is compost tea?

The historical manufacture and use of compost leachates and extracts is a straightforward, centuries-old practice. Plant and animal wastes were placed into a permeable bag and held in a bucket of water until the water turned black. (It's easy to see how the analogy to tea emerged.)

Both indoor and outdoor plants could be watered with this solution which contained nutrients and microbes. More recently, the process has been adapted for the compost tea market. One can buy a compost tea brewer, or purchase ready-made teas at nursery and garden centers.

The original method of compost extraction was passive: it did not require an energy input. This method produces anaerobic or nonaerated compost

tea whose principal components are anaerobic microbes and nutrients.

In contrast, compost tea brewers require an energy input in the form of an aerator. This constantly oxygenated mixture forms aerated compost tea, which contains aerobic microbes and nutrients. [Aerated tea will become Nonaerated

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if aeration stops; likewise, Nonaerated tea will be converted into aerated tea if aerated.]

Nonaerated teas have been around for a long time and were originally used as a liquid fertilizer. Sales literature for aerated

Questions to ask when assessing scientific objectivity and credibility of gray or popular literature

- 1) *Does the author have legitimate ties to a mainstream academic or scientific institution?*
 - 2) *Does the article refrain from attempts to sell a product?*
 - 3) *Does the article present verifiable information?*
 - 4) *Does the article appeal to reason rather than emotion?*
- If the answers to these questions are "yes," then the likelihood is high that the information is objective and credible.*

teas and compost tea brewers states that aerated tea will produce “lush foliage,” “beautiful blooms,” “delicious fruits and vegetables,” and “thick, green turf” while keeping “garden plants, turf, and crops free of disease.” This information is presented as factual, and when combined with the imagery of nurturing an ailing garden with a cup of tea, proves irresistible to many people.

Does compost tea work?

This is a complicated question that can only be answered by reviewing the scientific literature on Nonaerated and aerated teas. Scientific literature is the body of information that has been peer-reviewed and is often geared to an academic audience. Extension publications are also in this category, since they are peer-reviewed but target a more general audience. When an article appears in a peer-reviewed journal or book, it means the methods, results, and conclusions were found to be scientifically valid by objective outside experts.

Other information sources include gray and popular literature, neither of which is peer-reviewed and primarily focus on professional and general audiences, respectively. (*MasterGardener* magazine, for instance, would fall into this category.) These resources can be valuable as well, but the objectivity and credibility of the information need to be assessed (see sidebar). For the purposes of this article, only those results reported in the scientific literature are reviewed.

Scientific research on compost tea has focused most commonly on foliar disease control. As of this writing, there have been 34 papers published on the efficacy of Nonaerated tea on disease control. Often, good results are found under laboratory conditions though field results are more variable. There appears to be a trend for Nonaerated teas to reduce the incidence, but not the severity, of foliar diseases.

In comparison, there have been seven papers published on aerated teas and

disease control. Again, there was some success with fungal control in Petri dishes

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in the lab (1 paper), but less consistency in greenhouse conditions (3 papers). Two field-based studies report that aerated teas were not only ineffective in preventing foliar pathogens, they exacerbated disease organisms in both apples and potatoes. Clearly, the science is not strong for aerated tea use on crop plants, much less on lawns, shrubs, and trees.

Why isn't there more scientific research on compost tea?

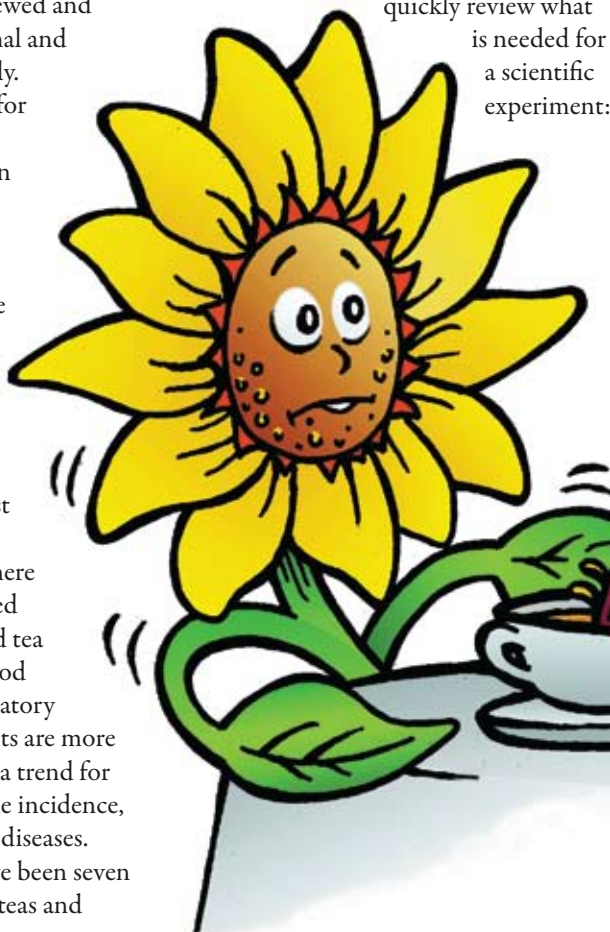
While a number of universities are investigating the effect of aerated teas on disease control, few studies have been published. To understand why, let's quickly review what is needed for a scientific experiment:

- *Controls:* For every plant that is treated with compost tea, another needs to be treated with water.

- *Replicates:* To obtain statistically valid data, each treatment needs to be replicated. In controlled environments such as laboratories, there can be as few as three replicates. For more variable environments, such as greenhouses, there may be ten replicates. In a field situation—the real world—20 replicates is not uncommon.

- *Repetition:* To verify the results from the first trial, the experiment should be repeated. In general, three repetitions are considered the minimum.

Compost teas are highly variable in their microbial and nutrient content from batch to batch. This translates to high variation within data sets and often leads to inconclusive results.



Unfortunately, these results are often not published *even though they are as important as positive outcomes*. In other words, if a particular treatment doesn't work well under controlled experimental conditions, it's unlikely to work consistently anywhere else.

In addition to the published results discussed earlier, there are university reports of ongoing research that I've briefly summarized (*see sidebar*).

Can WSU Master Gardeners recommend compost tea use?

The short answer is no. Because WSU Master Gardeners are volunteer educators who rely on science-based information, they cannot recommend a practice or product that lacks a legitimate scientific basis. Furthermore, it is illegal to sell unregistered substances for use as pesticides. There are no compost tea products registered as pesticides with the U.S. Environmental Protection Agency. Neither WSU Master Gardener volunteers nor Web sites may encourage the use of compost tea as a pesticide.

If compost tea doesn't do anything, then how can it hurt to apply it?

"While the scientific evidence is certainly lacking for aerated compost tea activity in disease control, there is a serious, documented concern with these types of compost teas," says Dr. William R. Schneider, a research scientist in the Biopesticides & Pollution Prevention Division (Office of Pesticide Programs) of the Environmental Protection Agency.

He continues, "It is very difficult to do a microbial pesticide risk assessment on a mixture of unidentified microorganisms that could easily contain human and nontarget organism pathogens."

Indeed, this risk is significant in aerated teas that have been "enhanced" with molasses, kelp, and other high-nutrient additives. Such aerated teas have

been documented through scientific research to contain *E. coli* and *Salmonella* populations, both of which are human pathogens. The recent deaths due to *E. coli*-contaminated spinach illustrates how dangerous compost tea applications can be, particularly on food crops.

What are alternatives to compost tea?

Rather than spending time and money leaching materials out of compost, why not use the intact compost as part of an organic mulch layer? There is substantial evidence in the scientific literature that organic mulch benefits gardens and landscape by:

- Improving soil moisture
- Reducing soil erosion and compaction
- Maintaining optimal soil temperatures
- Increasing soil nutrition
- Improving plant establishment and growth
- Reducing weeds
- Reducing disease
- Reducing pesticide use

These last two points are particularly germane to our discussion. Organic mulch has been shown to suppress disease biologically, chemically, and physically through competition, chemical inhibition, and reduced pathogen dispersal, respectively. While compost alone may not be sufficient for a landscape mulch, it can be an important component.

Furthermore, mulched landscapes are usually more aesthetically appealing and of greater economic and environmental benefit as they require fewer additions of fertilizers and pesticides. Best of all, this management plan is based on objective plant and soil sciences, not wishful thinking.

(A complete bibliography of the scientific and gray literature on compost tea is available by e-mail from the author, or on our Web site, www.MasterGardenerOnline.com/CompostTeaBibliography.) ■

Unpublished university research studies on aerated compost teas

CROP	DISEASE	ACT EFFECTIVE?	INSTITUTION
Tomato	Septoria	No	Cornell
Powdery mildew	No		
Bacterial speck	No		
Tomato	Septoria	No	Iowa State
Pumpkin	Powdery mildew	No	Cornell
Bacterial wilt	No		
Downy mildew	No		
Squash	Powdery mildew	No	Ohio State
Rose	Black spot	No	U. of Minnesota
Powdery mildew	No		
Apples	Apple scab	No	Michigan State
Wine grapes	Phomopsis	No	Cornell
Downy mildew	No		
Black rot	No		
Potato leafhopper	No		
European red mite	No		
Wine grapes (greenhouse)	Powdery mildew	Some	Penn State
	Botrytis	Some	
Wine grapes (field)	Powdery mildew	No	Penn State
Turf grass	Brown patch	No	Rutgers

MORE INFORMATION:

www.puyallup.wsu.edu/~Linda%20Chalker-Scott/

Dr. Chalker-Scott has additional columns on numerous science-based topics at this carefully edited Web site.

