Compost tea

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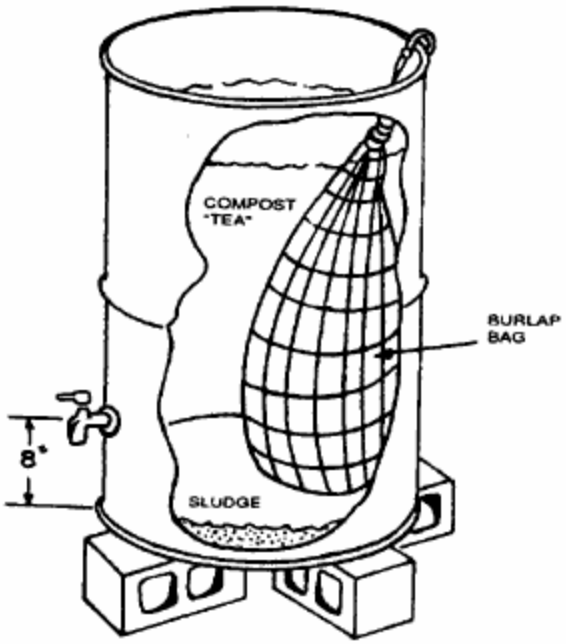
Compost tea

1. What is it?
2. What is it used for?
3. Does it work? How?
4. Is it safe?
5. Does it comply with national organic standards?

What is Compost Tea?

- The liquid portion of compost soaked ("steeped") in water
  - Non-aerated
    - 1 part compost, 3-10 parts water
    - Occasional stirring
    - 1-3 weeks
  - Aerated
    - 1 part compost, 10-50 parts water
    - Air injection or constant circulation for 6-24 hours
    - Often made with additives (molasses, yeast extract, algal powder, kelp) to increase microbial biomass




ARBICO
SUPER COMPOST TEA


earth elixir
Quality Compost Tea
1 Litre
earth elixir
Quality Compost Tea
2 Litres

Compost tea uses

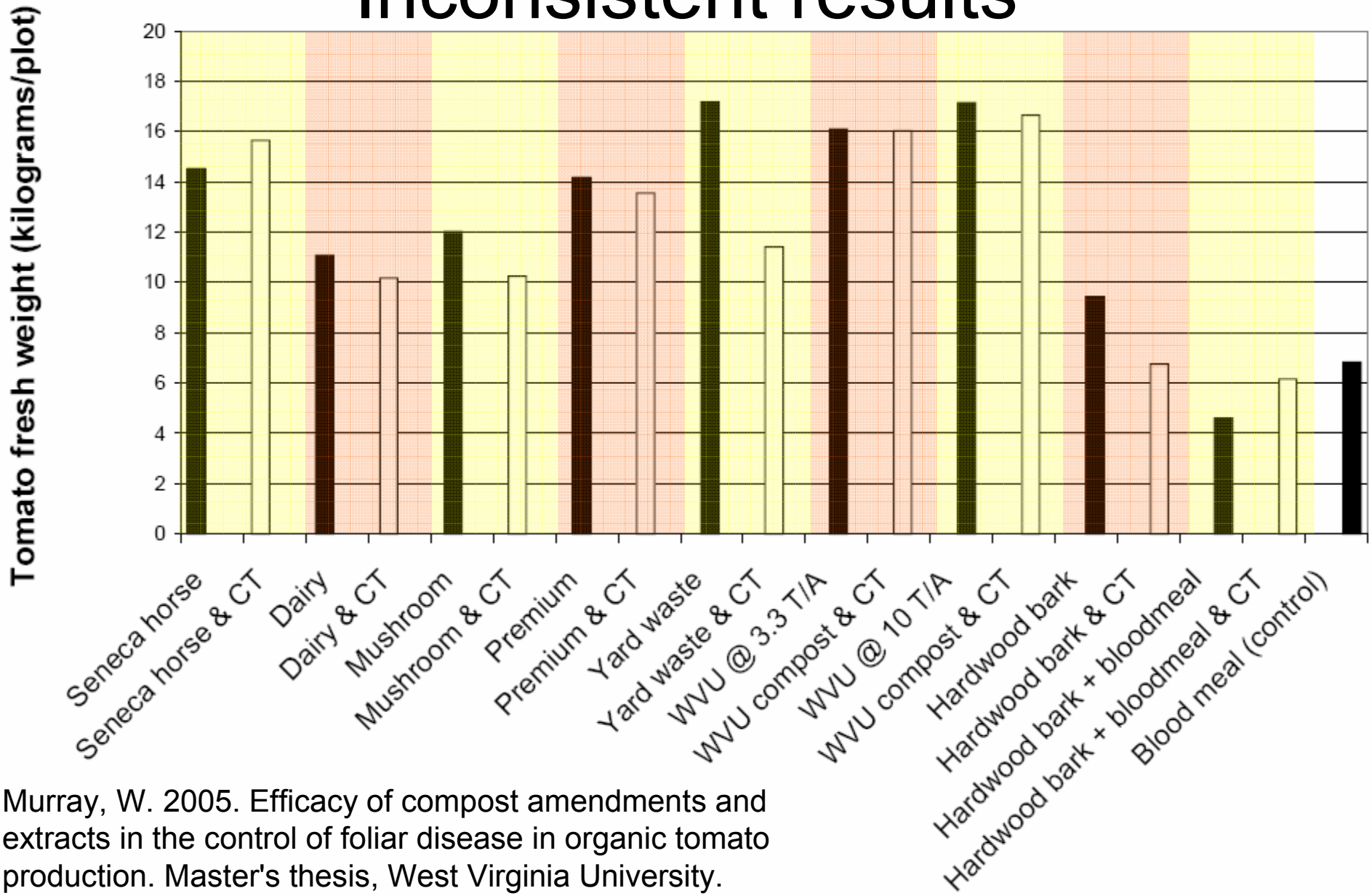
- Foliar fertilizer
- Disease suppression
  - Foliar
  - Soil-borne
- Residue decomposition
- Enhanced soil biology
- Pest suppression

Steve Wright, Pennsylvania vineyard. Rodale Institute Photo.

Does foliar feeding work?

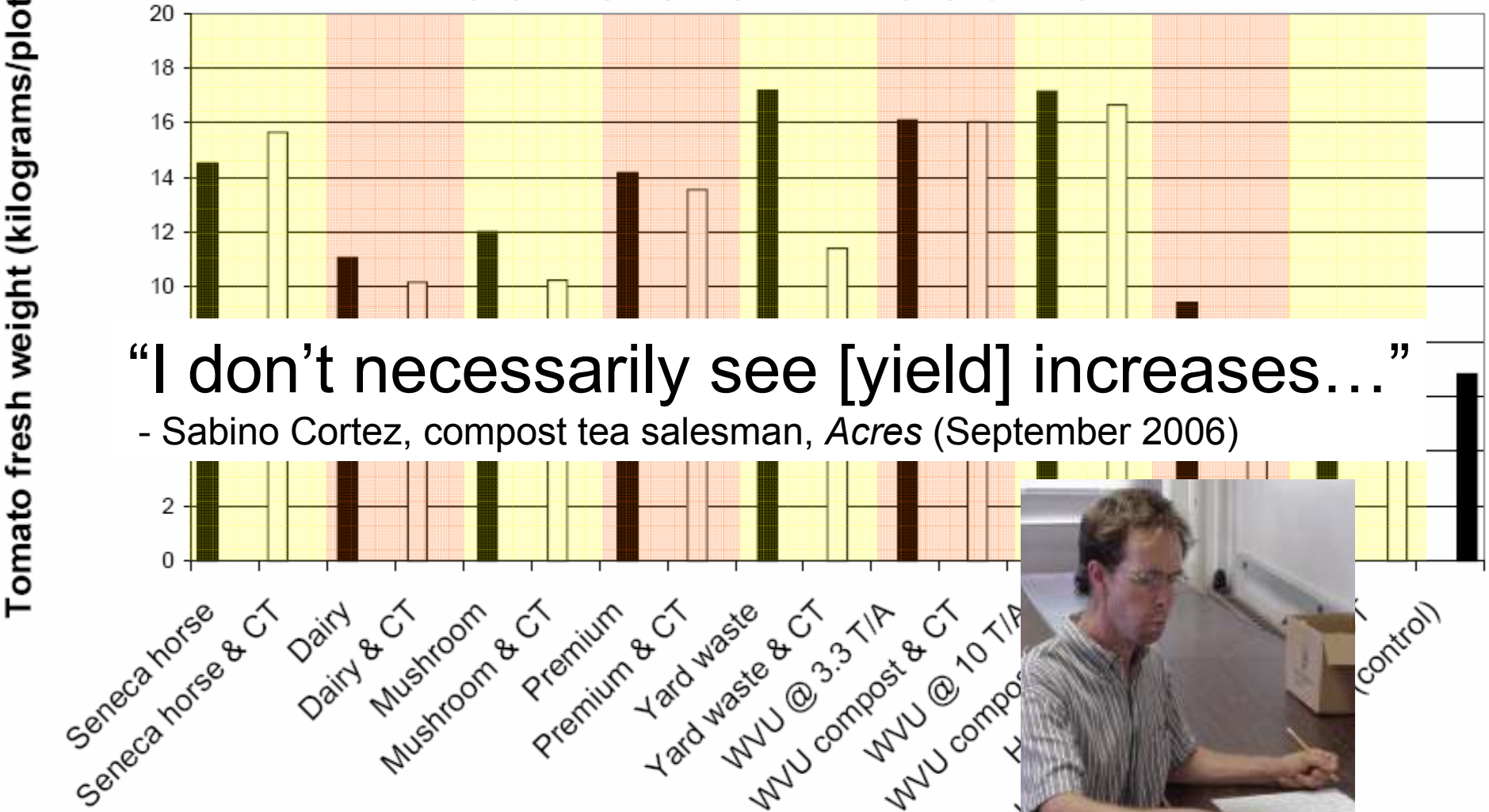
- Foliar fertilization… works sometimes, not always
  - Gives quick shot of micronutrients, taken up rapidly by plant
    - Radioactively labeled micronutrients applied as foliar fertilizer can be found in plant roots 60 minutes later
  - Very helpful for certain deficiencies
    - Ca deficiency in fruit
    - Zn deficiency
    - Nutrients unavailable due to acid soils
  - Works best when stomata are open (morning and evening, cool, moist conditions)
  - Mist works better than drench
  - Short-term solution; not a substitute for long-term soil building

Foliar feeding with compost tea: Inconsistent results



Murray, W. 2005. Efficacy of compost amendments and extracts in the control of foliar disease in organic tomato production. Master's thesis, West Virginia University.

Foliar feeding with compost tea: Inconsistent results



"I don't necessarily see [yield] increases…"

- Sabino Cortez, compost tea salesman, *Acres* (September 2006)

Murray, W. 2005. Efficacy of compost amendments and extracts in the control of foliar disease in organic tomato production. Master's thesis, West Virginia University.

Can compost tea suppress disease?

- Yes!
  - Litterick et al. (2004) lists 24 unique crop/pathogen combinations in which disease has been suppressed by compost tea*
    - Tomato early blight, late blight, powdery mildew & bacterial spot
    - Grape leaf blight, grey mould, downy mildew & powdery mildew
    - Strawberry grey mould & redcore
- … and no.
  - Control is unpredictable and sometimes insufficient

*Litterick, A.M.; Harrier, L.; Wallace, P.; Watson, C.A. & Wood, M. 2004. The Role of Uncomposted Materials, Composts, Manures, and Compost Extracts in Reducing Pest and Disease Incidence and Severity in Sustainable Temperate Agricultural and Horticultural Crop Production: A Review. *Critical Reviews in Plant Sciences* **23**(6), 453--479.

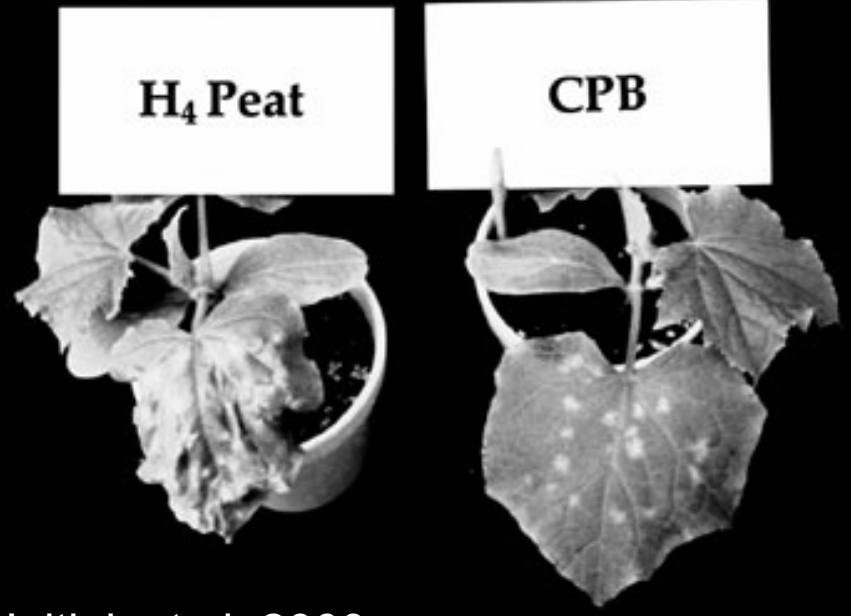
Mechanisms of disease suppression

- Competition: organisms compete for resources
  - *Pythium* and *Phytophthora* spp. are susceptible.
- Antibiosis: one organism suppresses another's growth
  - *Trichoderma viride* produces an antibiotic that controls armillaria root rot, pythium and rhizoctonia damping off, and crown gall

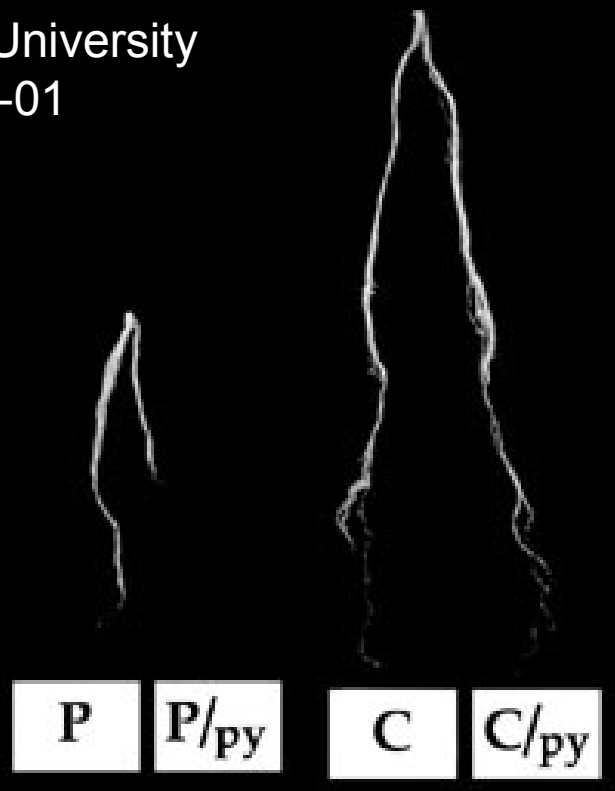
Gladis M. Zinati. 2005. Compost in the 20th Century: A Tool to Control Plant Diseases in Nursery and Vegetable Crops. *HortTechnology* 15: 61-66.

Mechanisms of disease suppression

- Parasitism: one organism consumes another
  - Several *Trichoderma* species can eradicate *Rhizoctonia solani* (one of the fungi responsible for damping off)
- Induced systemic resistance
  - More plant defense compounds produced when cucumbers grown in compost-treated soils



Hoitink et al. 2000. Ohio State University Bulletin 177-01



Can compost tea help with residue decomposition?

- Maybe

Hall et al. 2006. Enhancing Sugarcane Field Residue Biodegradation by Grinding and Use of Compost Tea. *Compost Science and Utilization* 14: 32-39.

Not all compost is created equal

- Most biocontrol agents killed during composting
  - NOP requires C:N between 25:1 and 40:1 and temperature between 131 and 170ºF for 15 days. Sufficient to reduce human pathogen levels below detectable limits.
- Biocontrol agents must recolonize during curing process
  - Composts produced near forests have higher biocontrol agent concentration
  - Recolonization takes up to a month after temperatures fall

Gladis M. Zinati. 2005. Compost in the 20th Century: A Tool to Control Plant Diseases in Nursery and Vegetable Crops. *HortTechnology* 15: 61-66.

Not all compost is created equal

- Low sugar, high cellulose feedstock (e.g. tree bark)
  - Colonized by *Trichoderma* species
  - Helps control *Rhizoctonia solani* (damping off)
- High sugar, low cellulose feedstock (e.g. grape pomace)
  - Colonized by *Penicillium* and *Aspergillus* species
  - Helps control *Sclerotium rolfsii* (Southern blight)

Gladis M. Zinati. 2005. Compost in the 20th Century: A Tool to Control Plant Diseases in Nursery and Vegetable Crops. *HortTechnology* 15: 61-66.

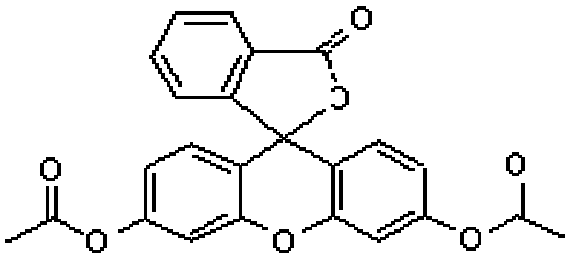
Not all compost is created equal

- Treatments with single biocontrol agents have little effect; diversity is better
- Create a compost microenvironment that favors many beneficial organisms
  - 40-50% water content
  - pH > 5.0
  - Low salinity (bark mulch compost has less salt than manure-based compost)
  - Low C:N (excessive N promotes many diseases)
  - Presence of decomposition-resistant material (lignins and cellulose) that supports beneficial microbes

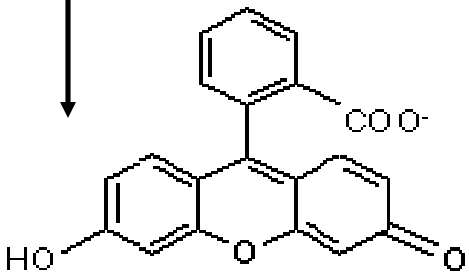
Gladis M. Zinati. 2005. Compost in the 20th Century: A Tool to Control Plant Diseases in Nursery and Vegetable Crops. *HortTechnology* 15: 61-66.

Microbial activity estimated by hydrolysis of fluorescein diacetate

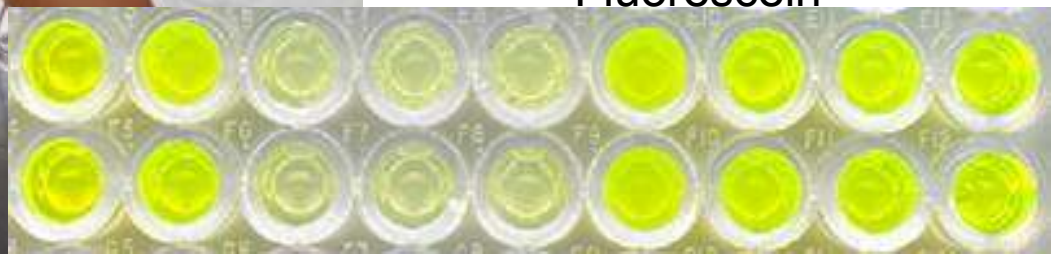
Fluorescein diacetate



Extracellular enzymes
(lipases, proteases, esterases)



Fluorescein



Compost tea and food safety: The next spinach scare?

- Composting reduces pathogens
- Compost teas without additives had no detectable *E. coli* or *Salmonella*; additives promoted growth of these pathogens
  - Soluble kelp
  - Fish hydrolysates
  - Molasses

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Washing spinach won't help; health officials struggle to find source of E. coli

Updated 9/15/2006 11:46 PM ET

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Enlarge By H. Darr Beiser, USA TODAY

Federal health officials blamed an e.coli outbreak on bagged fresh spinach. "We're advising people not to eat it," one FDA official said.

E.COLI Q&A

Some frequently asked questions about E. coli:

WASHINGTON (AP) — Even if you wash the spinach, you still could be at risk.

Sober warnings for salad lovers came from federal health officials Friday as they focused on a possible source of a multistate E. coli outbreak that killed one person and sickened nearly 100 more. Twenty-nine people have been hospitalized, 14 of them with kidney failure.

The outbreak was traced to Natural Selection Foods, a holding company based in San Juan Bautista, Calif., known for Earthbound Farm and other brands. The company has voluntarily recalled products containing spinach.

MORE ON THE OUTBREAK: Read the warning | Video

Food and Drug Administration officials stressed that the bacteria had not been isolated in products sold by Natural Selection Foods but that the connection was established by patient accounts of what they had eaten before becoming ill.

The investigation was continuing.

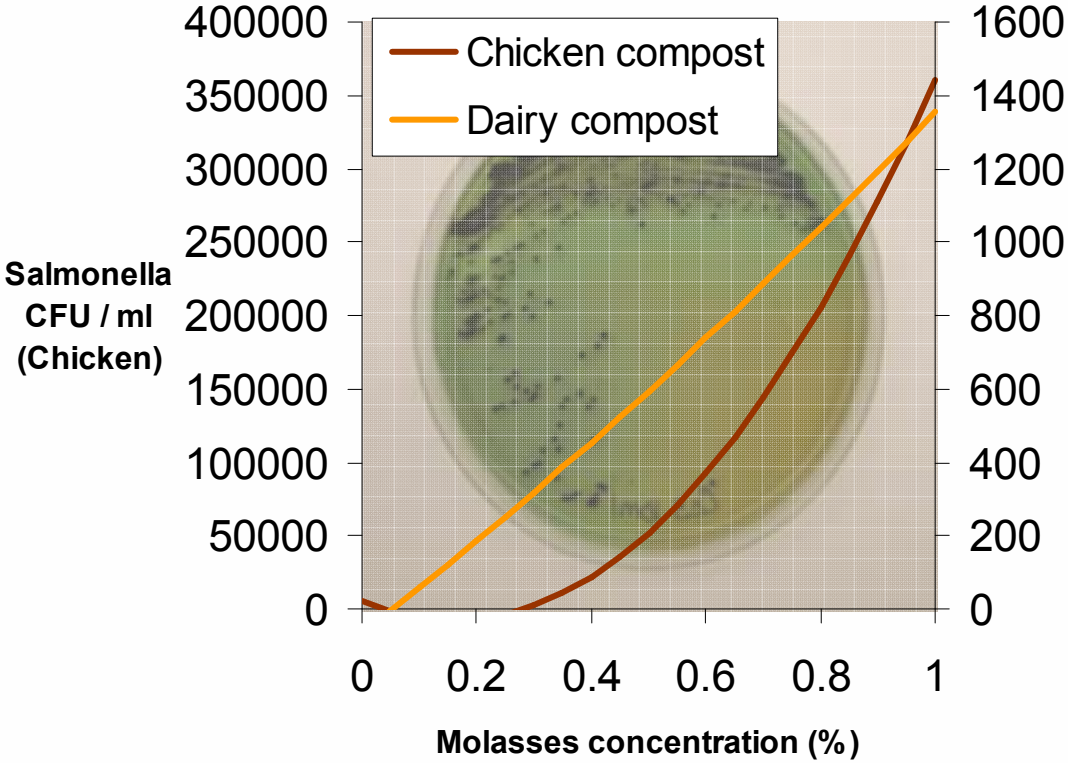
H. Durham 2006. Additives boost pathogens in compost tea. *Agricultural Research* 54:22

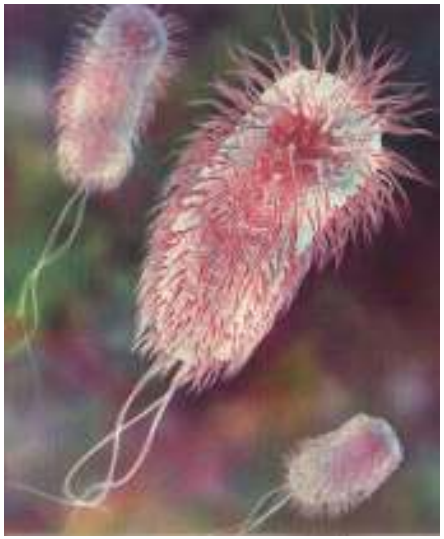
Compost tea and food safety: The next spinach scare?

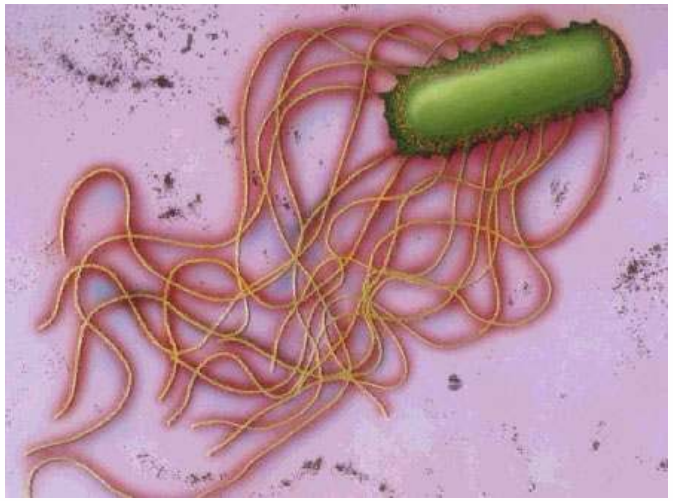
- No recorded cases of food-borne illness from compost tea treatment
  - "Absence of evidence is not evidence of absence."
    - Carl Sagan
  - "The producer must manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances."
    - NOP standards
  - "Pending further NOP policy development, [compost tea] must meet restrictions for use of raw manure."
    - OMRI Generic Materials List, June 2004

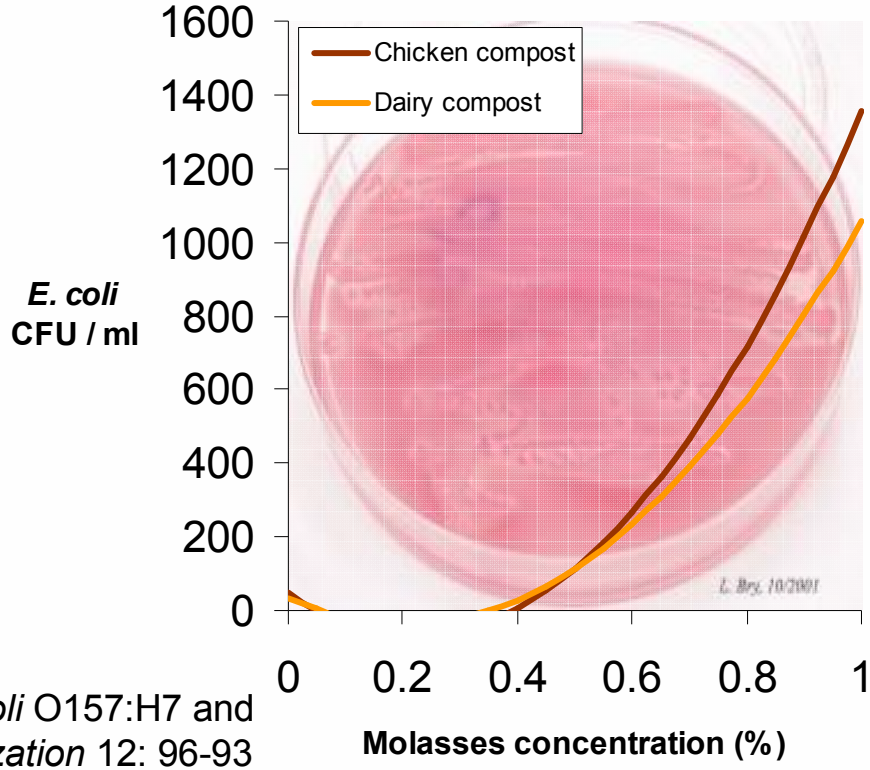
National Organic Program

OMRI™ Listed
Organic Materials Review Institute



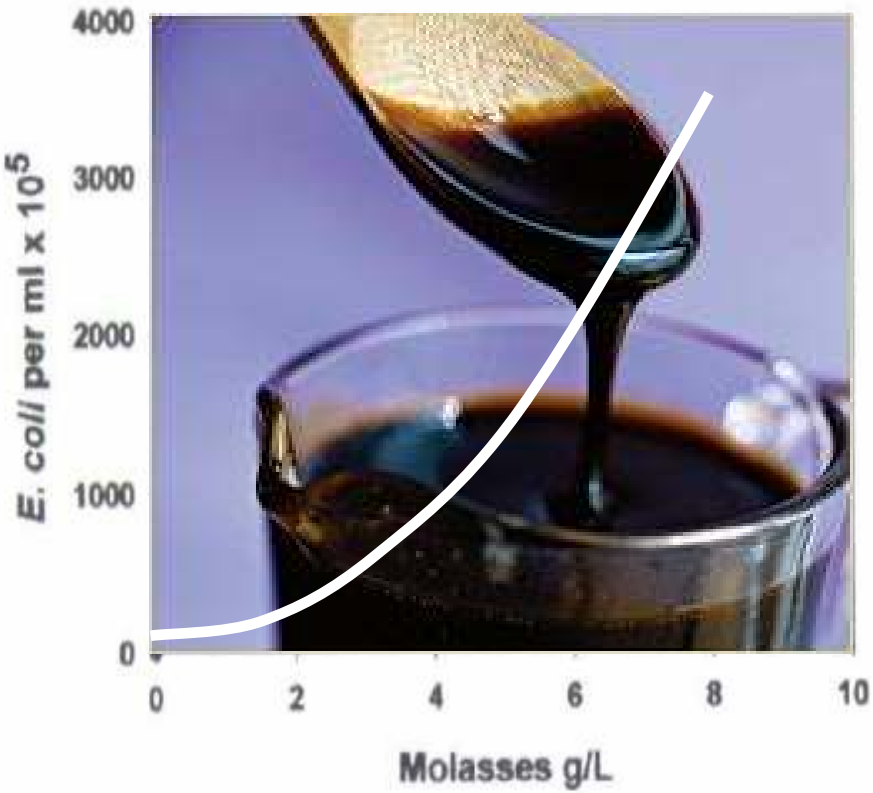


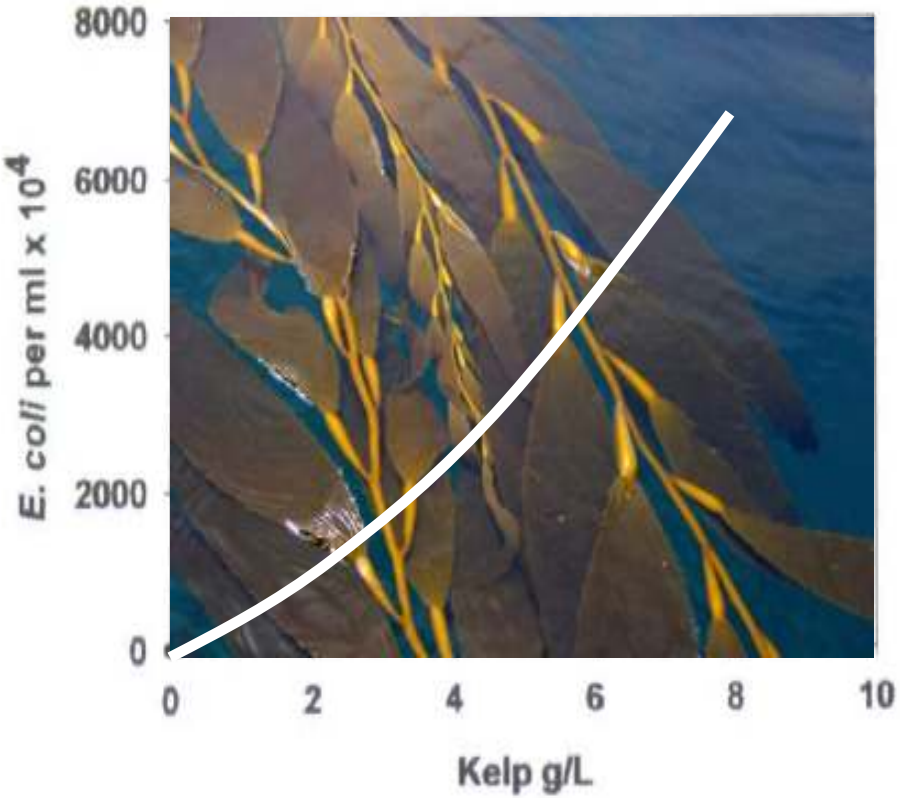




Duffy et al. 2004. Effect of Molasses on Regrowth of *E. coli* O157:H7 and *Salmonella* in Compost Teas. *Compost Science and Utilization* 12: 96-93

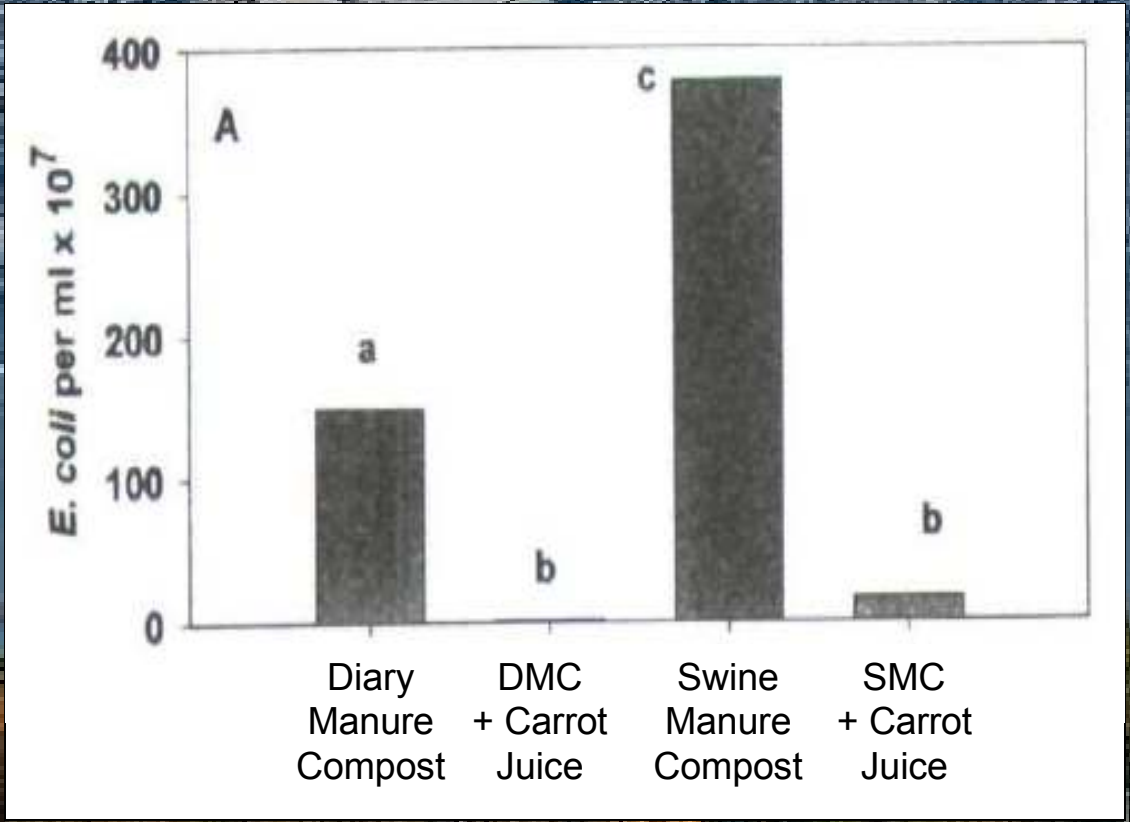
Molasses and Kelp Increase *E. coli* Concentration in Compost Tea





Kannangara et al. 2006. Effects of Aeration, Molasses, Kelp, Compost Type, and Carrot Juice on the Growth of *Escherichia Coli* in Compost Teas. *Compost Science and Utilization* 14: 40-47.

Carrot Juice Inhibits *E. coli*



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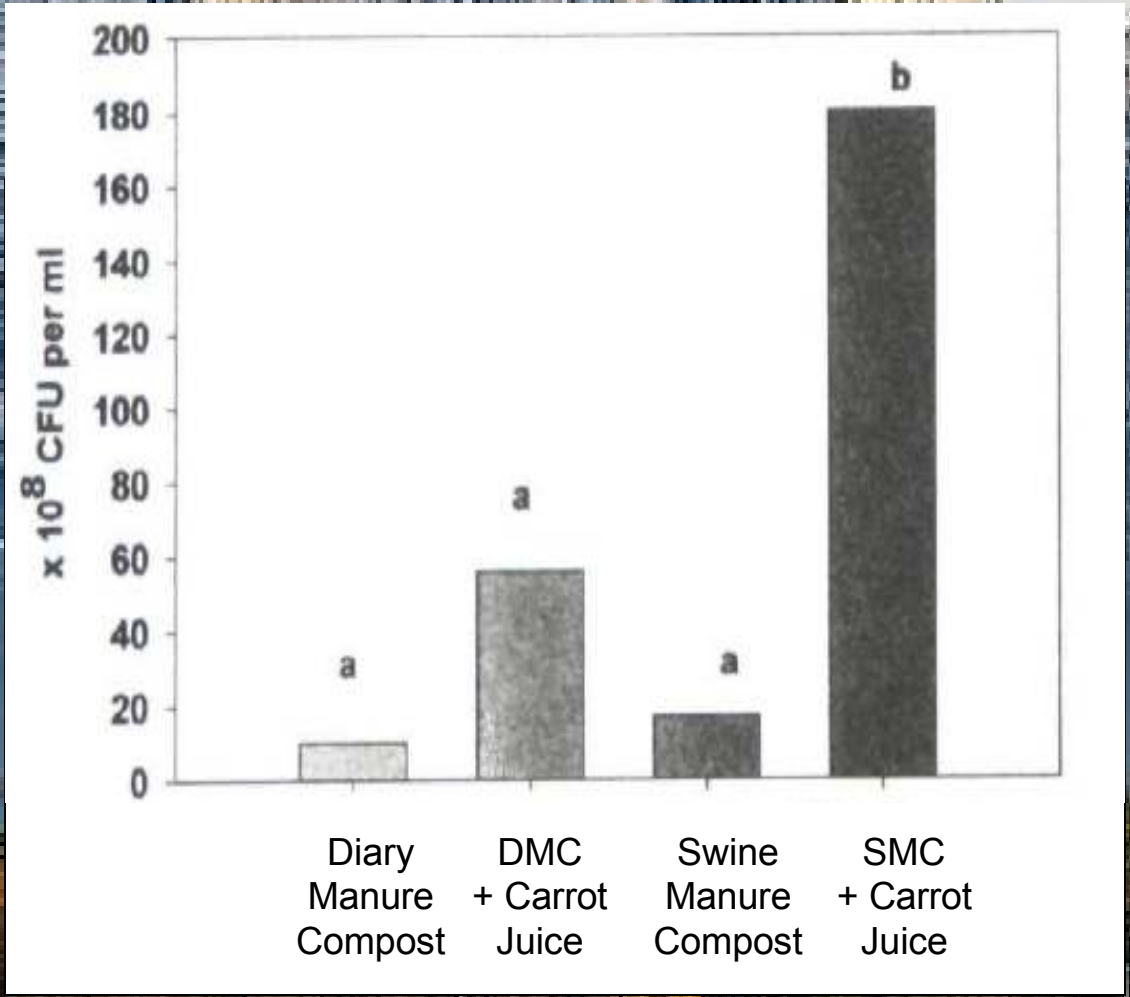
Carrot Juice *Does Not* Inhibit Other Bacteria



Carrot Juice *Does Not* Inhibit Other Bacteria

Toxic carrot juice paralyzes 2 in Toronto

Last Updated: Monday, October 9, 2006 | 1:43 PM ET
CBC News

Two Toronto residents are paralyzed after drinking carrot juice that tested positive for a botulism toxin, according to the city's public health department.

"There are two adults who are severely ill in hospital and they had a history of drinking the exact same juice that's been part of the carrot juice recall," Dr. Elizabeth Rea, an associate medical officer of health, told the Toronto Star on Sunday.

The juice, produced by Bolthouse Farms in Bakersfield, Calif., was ordered off North American store shelves late last month

Bolthouse Farms bottles the three recalled brands, which

RELATED

- Food Safety
- U.S. finds 4th case of botulism linked to carrot juice

VIDEO

- Ron Charles reports for CBC-TV (Runs: 2:47)

play: real »
play: quicktime »
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CANADA FEATURES

NOP Compost Tea Task Force Recommendations

- Compost extract: Compost held in *potable* water for < 1 hr
- Compost tea: Compost held in water for > 1 hr
  - Aerated
    - 1 part compost, 10-50 parts water
    - Air injection or constant circulation for 12-24 hours
    - Often used additives (molasses, yeast extract, algal powder) to increase microbial biomass
  - Non-aerated
    - 1 part compost, 3-10 parts water
    - Occasional stirring
    - 1-3 weeks

Additives increase microbial biomass (both good and bad)

NOP Compost Tea Task Force Recommendations (April, 2004)

- Use drinkable water
- Sanitize equipment before use
- Use NOP-compliant compost (*both plant and manure-based composts*)
- No restriction:
  - Compost tea without additives
  - Compost extract (steeped for < 1 hr)
  - Compost tea with additives IF production system (compost + additives + equipment) makes tea that meets EPA water quality guidelines for E. coli and enterococci in two pre-tests
- 90/120 day pre-harvest restriction:
  - Untested compost tea with additives
  - Soil applications of raw manure extract/tea or compost leachate
- Prohibited:
  - Foliar applications of raw manure extract/tea or compost leachate
  - Use of compost teas for edible sprout production

Task force calls for more science

"The Task Force unanimously urges USDA and its agencies to strongly support additional research on the potential for crop contamination and plant disease/pest control by compost tea.

[…]

Critical issues requiring further data include

- compost quality
- compost tea additives
- temperature and duration of compost tea production, and
- the population dynamics of human pathogens in microbially diverse agro-ecosystems relative to pre-harvest intervals for application of compost tea."

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