WASHINGTON STATE UNIVERSITY

World Class. Face to Face.

Making and Using Compost Teas

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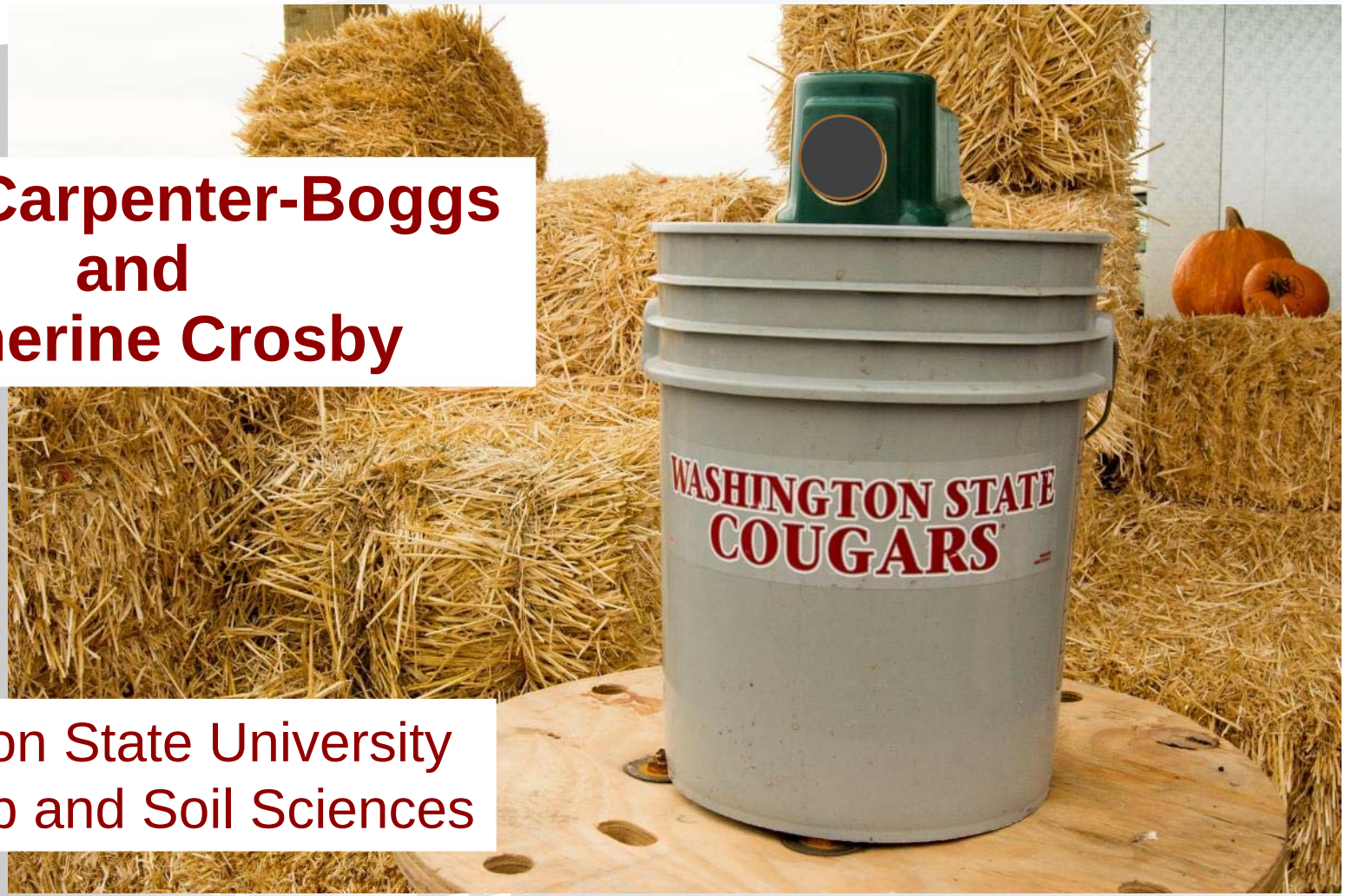


Presentation Overview

- What is compost tea?
  - Definitions
  - Ingredients
  - Uses
- Compost Tea as a fertilizer
  - Overview
  - Application methods
- Compost Tea as a Disease Suppressant
  - Regulations
  - Mechanisms
- Take Home Messages on Compost Tea
  - Quality of materials
  - Why use it
  - How to use it

Note: Any brand names mentioned or seen in this slide set are used for information and example only, and are not endorsements of any given product.

Presentation Overview

- What is compost tea?
  - Definitions
  - Ingredients
  - Uses

Compost Tea

- 1 part compost : 1 - 100 parts water
- May also contain
  - Inoculants
  - Sugars, microbe food
  - Plant nutrients, rock powder
- Aerated or static fermentation 1hr-1wk
  - Extracts soluble nutrients & humics
  - Dislodges and grows microorganisms

Passive Steeping
Compost Extract or Non-aerated Compost Tea

- Low cost
- Potential for anaerobic conditions

(photo L. Carpenter-Boggs)

Brewing with Aerator
Aerated Compost Tea

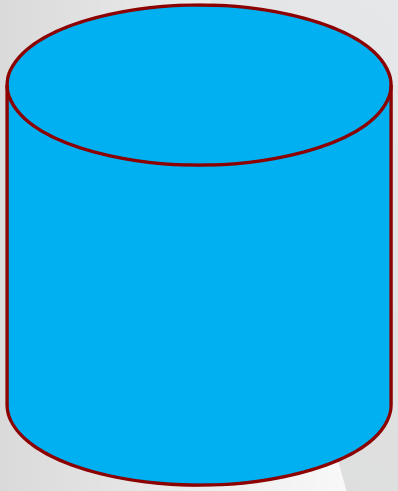
- Consistent aeration

(photo L.M. Lege)

Compost

Water

time

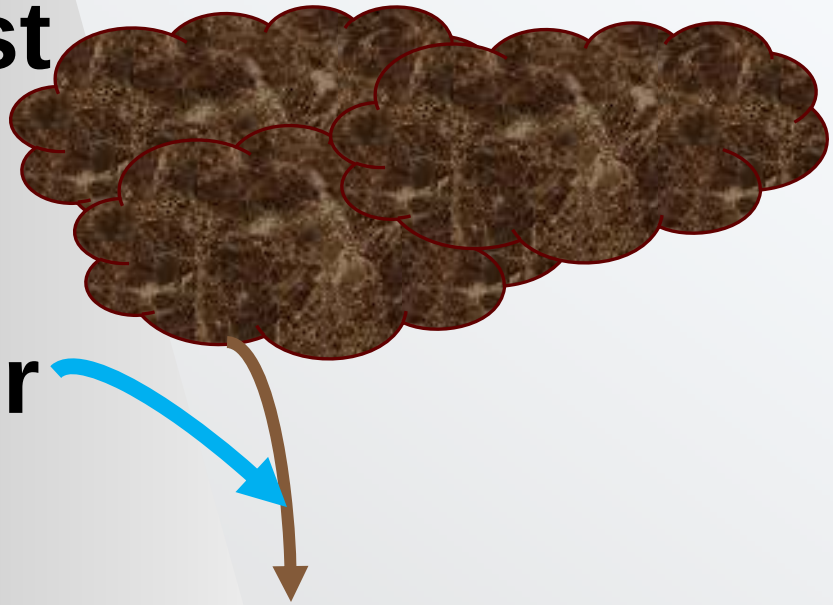


Tea with water-soluble nutrients and dislodged microbes

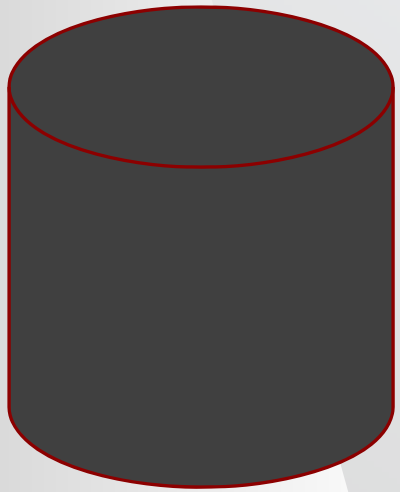
How can we make different kinds of tea?

- Change the:
  - Compost
  - Aeration
  - Temperature
  - Additives

More
Compost



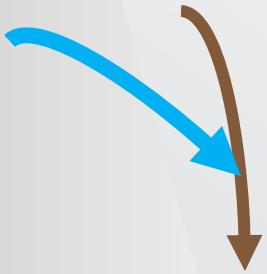
Water

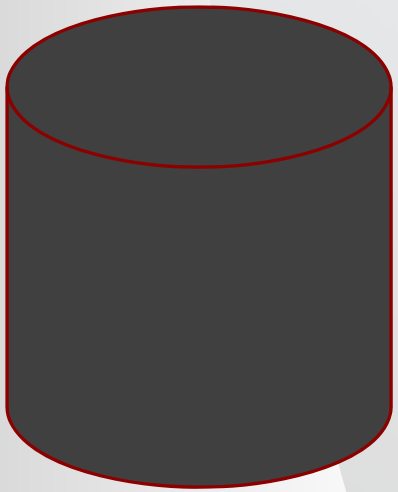


Tea with More water-soluble nutrients and dislodged microbes

Different
Compost

Water





Tea with Different water-soluble nutrients and dislodged microbes

What are compost tea additives?

- Kelp extracts
- Humic acids
- Rock dust
- Molasses *
- Whey powder
- Dried herbs
- Commercial blends

Photo credit: L. M. Lege

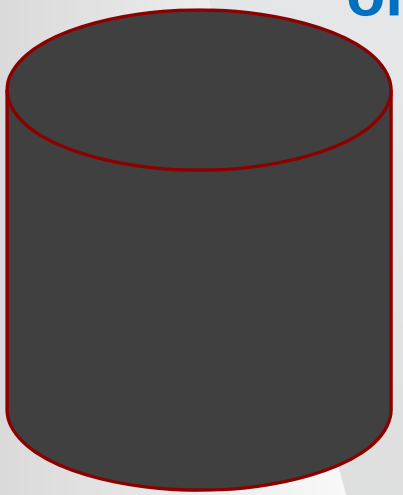
*Addition of sugars can increase growth of *E. coli* and human pathogens

Compost

Water

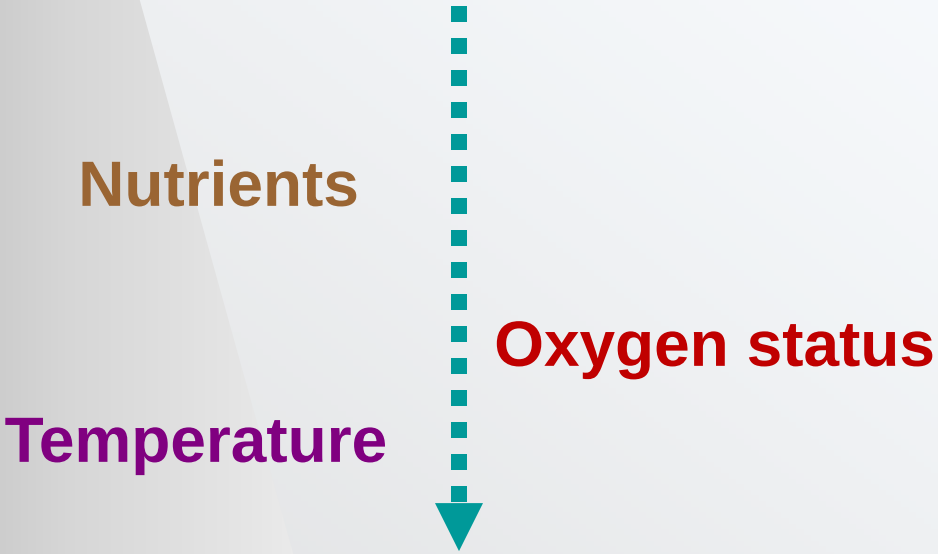
Added ingredients

We cannot create elements.
Nutrients come from ingredients
or N fixation (not shown in teas)



Tea with Added water-soluble nutrients and potentially different microbes

Initial Compost Microbes



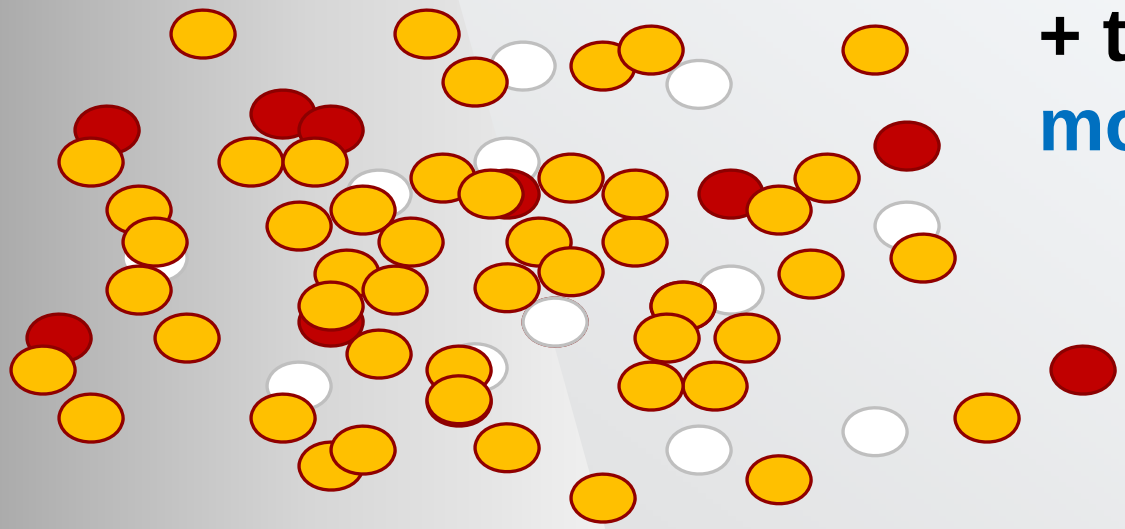
Compost Tea Microbes

Good bugs in → good bugs out

Bad bugs in → bad bugs out

Danger in using poorly processed composts, esp. animal-based

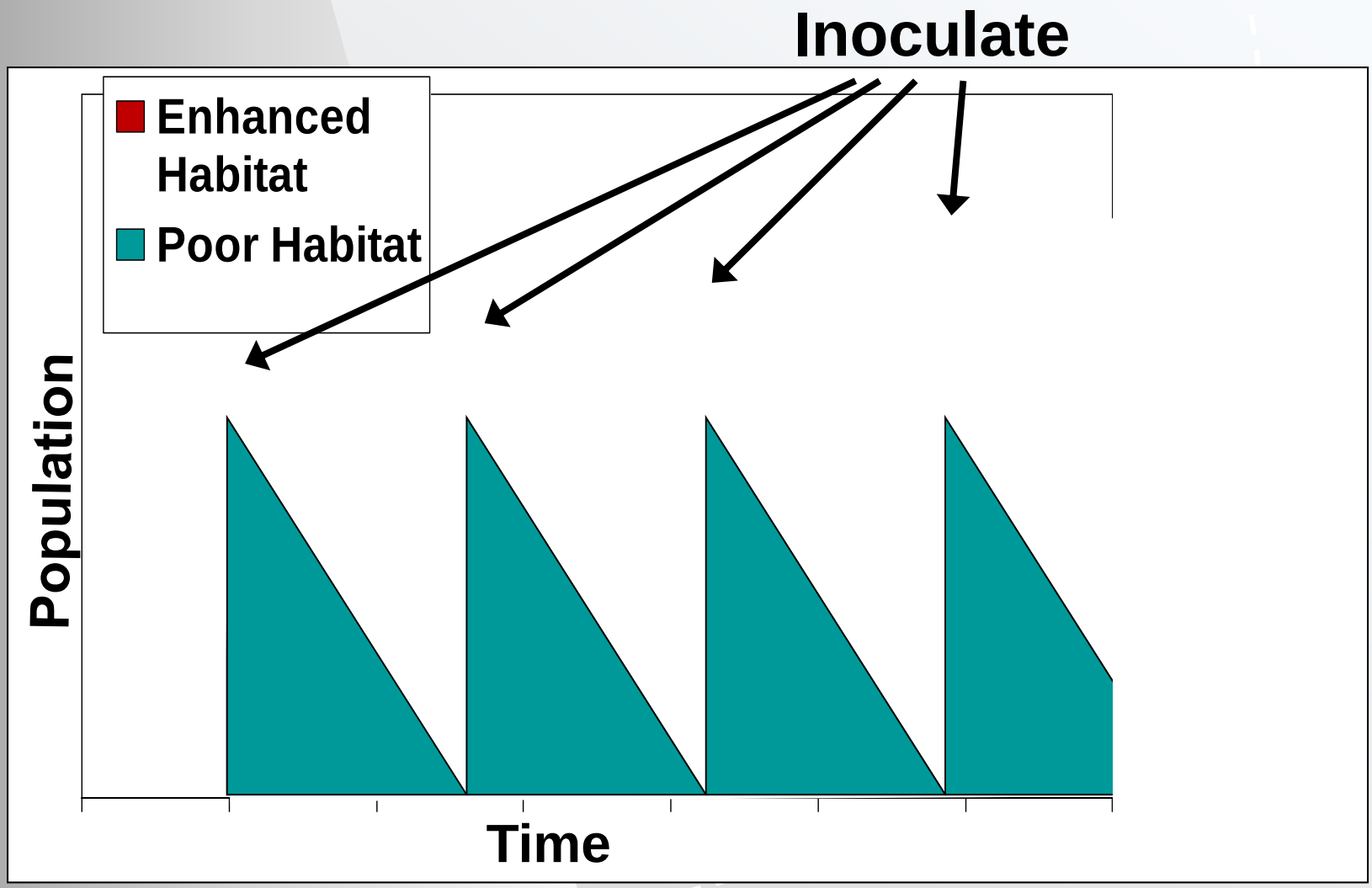
We can grow and change the microbial community.



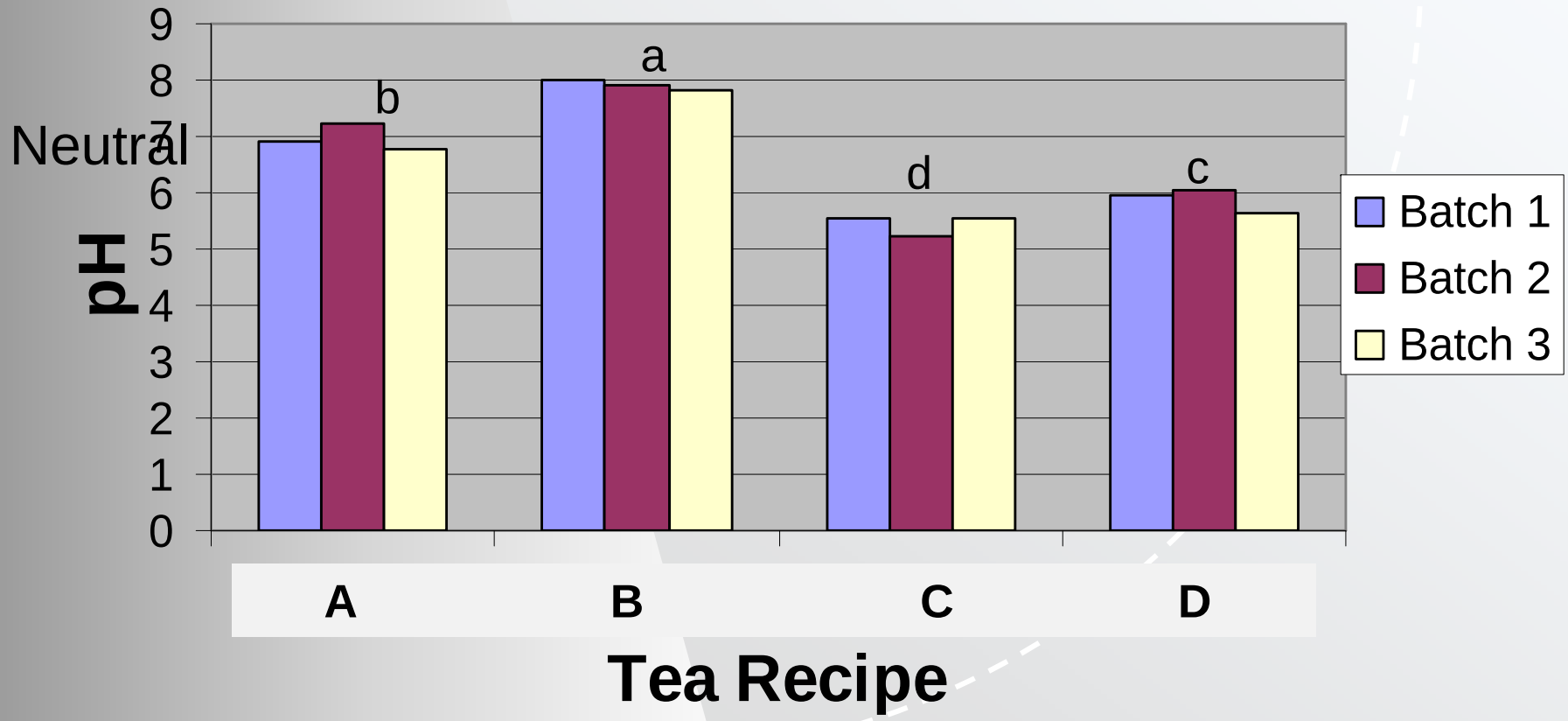
In general,
Food + warmth
+ time grows
more microbes

But microbes are diverse. Some foods and conditions will favor some microbes more than others
= dramatic community shift is possible

General Effects of Inoculants

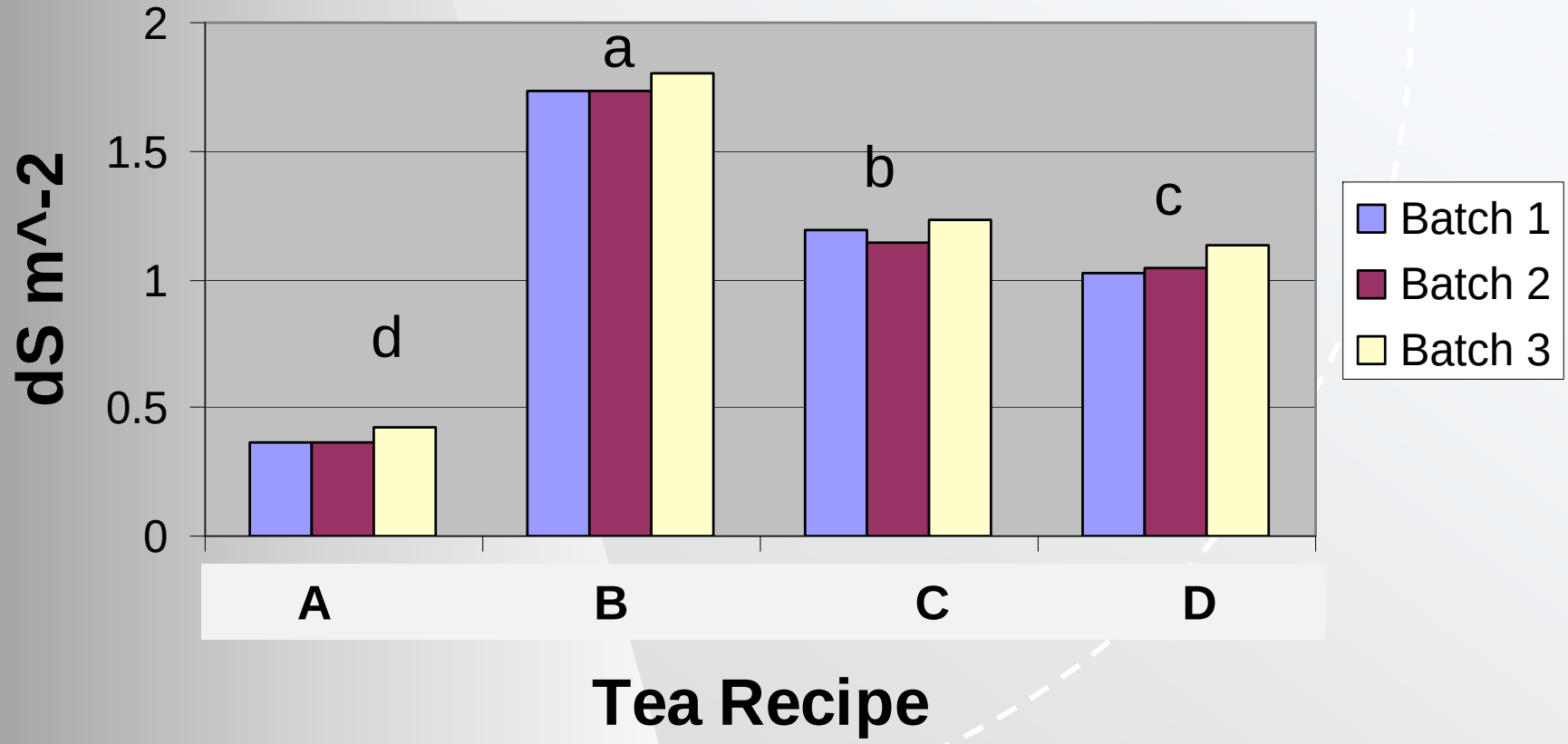


We can make different teas from the same compost



We can make different teas from the same compost

Electrical Conductivity



Why do we care about brewing different teas?

Designing teas for specific uses

- **Macronutrients and Micronutrients**
- **pH**
- **Microbial community**

Why use compost tea?

- **Compost tea is gaining interest for its perceived ability to:**
  - **enhance plant health**
  - **suppress plant disease**
  - **provide plant nutrients**
  - **reduce fungicide and fertilizer requirements**

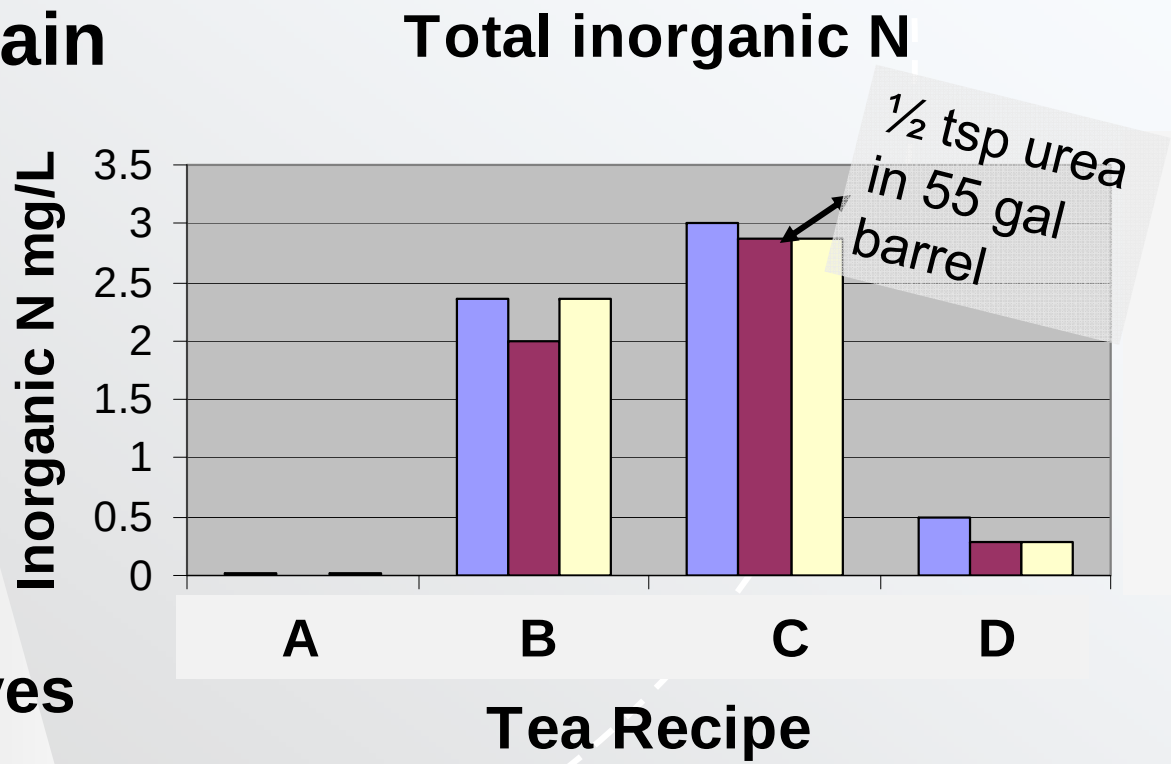
Research efforts to test these and other effects are expanding.

Presentation Overview

- **Compost Tea as a fertilizer**
  - **Overview**
  - **Application methods**

Compost Tea as Fertilizer

- Compost teas contain
  - Nitrogen
  - Carbon
  - Phosphorus
  - Sulfur
  - Potassium
  - Micronutrients
    - depends on additives
  - etc.
  - … just not much



Compost Tea as Fertilizer

- **Pak choi (4)**
  - **Significantly improved**
    - **Leaf size**
    - **Above ground biomass – by 20%**
      - **Compared to chicken manure compost**
      - **Not significantly different than soluble fertilizer**
    - **Nutritional status**
- **Strawberry (2)**
  - **Non-aerated teas provided same level of micronutrients as compost and fertilizer**

Foliar or soil application

Use full-strength or diluted up to 1:100

Compost Teas

Watch out for osmotic stress

Directly onto crops to increase growth, supply nutrients, reduce pests & diseases.*

Soil is more forgiving

Applied to soil to improve chemistry, nutrients, and biota

**Compost tea is considered an experimental pesticide!*

Compost tea application

- Dilute tea up to 1:100 with water
  - Check electrical conductivity (suggest under 0.5 dS/m)
- Use low pressure sprayer
  - If concerned about damaging microbial cells
- Can be applied as a soil drench
  - Through irrigation lines if filtered

Does Foliar Feeding Work?

“A portion of a plant’s nutritional needs can be met by applying soluble fertilizer directly to the foliage. Foliar fertilization can result in rapid nutrient absorption and utilization to correct deficiencies or to merely prevent nutrient shortages during critical periods of growth. However, unlike roots, plant leaves are not adapted to assimilate large amounts of nutrients and meet the bulk of the nutrient requirement.”

“For some crops, foliar nutrition may be the most economical and reliable method of providing some nutrients, especially with micronutrients.”

International Plant Nutrition Institute

https://www.ipni.net/ipniweb/pnt.nsf/5a4b8be72a35cd46852568d9001a18da/688627694f30cb2e8525740c004c6971!OpenDocument

References (non-comprehensive)

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3. Lopez-Espinosa, S. T., A. Moreno-Resendez, P. Cano-Rios, N. Rodriguez-Dimas, V. Robledo-Torres, and C. Marquez-Quiroz, 2013, Organic fertilization: An alternative to produce jalapeno pepper under greenhouse conditions: Emirates Journal of Food and Agriculture, v. 25, p. 666-672.
4. Pant, A. P., T. J. K. Radovich, N. V. Hue, and S. C. Miyasaka, 2012, Pak Choi (Brassica rapa, Chinensis Group) Yield, Phytonutrient Content, and Soil Biological Properties as Affected by Vermicompost-to-water Ratio Used for Extraction: Hortscience, v. 47, p. 395-402.
5. St Martin, C. C. G., W. Dorinvil, R. A. I. Brathwaite, and A. Ramsubhag, 2012, Effects and relationships of compost type, aeration and brewing time on compost tea properties, efficacy against Pythium ultimum, phytotoxicity and potential as a nutrient amendment for seedling production: Biological Agriculture & Horticulture, v. 28, p. 185-205.

Presentation Overview

- **Compost Tea as a Disease Suppressant**
  - **Regulations**
  - **Mechanisms**

Results of Compost Tea Disease Control Studies

- **MIXED !!**
- **Sometimes suppress disease**
- **Sometimes worsen disease**
- **Sometimes enhance plant growth**
- **Sometimes reduce harvestable yield**
- **Sometimes no effect**

Pathogens and Diseases Reduced or Controlled with Compost Teas
(at least 1 published research article)

Common name	Genus
Late blight of potato, tomato	Phytophthora
Gray mold on beans, strawberries	Botrytis
Fusarium wilt	Fusarium
Powdery mildew on cucumbers	Sphaerotheca
Apple scab	Venturia
Bacterial leaf blight on carrots	Xanthomonas
Downy & powdery mildew on grapes	Uncinula, Plasmopara

References (non-comprehensive)

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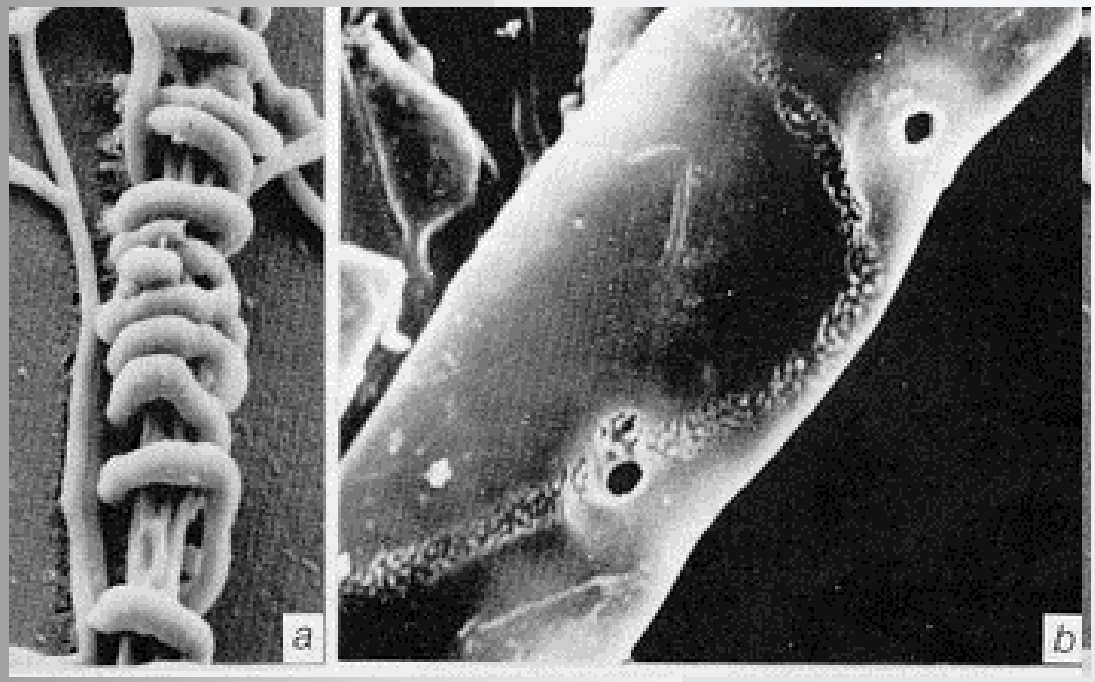
St Martin, C. C. G., W. Dorinvil, R. A. I. Brathwaite, and A. Ramsubhag, 2012, Effects and relationships of compost type, aeration and brewing time on compost tea properties, efficacy against Pythium ultimum, phytotoxicity and potential as a nutrient amendment for seedling production: Biological Agriculture & Horticulture, v. 28, p. 185-205.

How might disease suppression work?



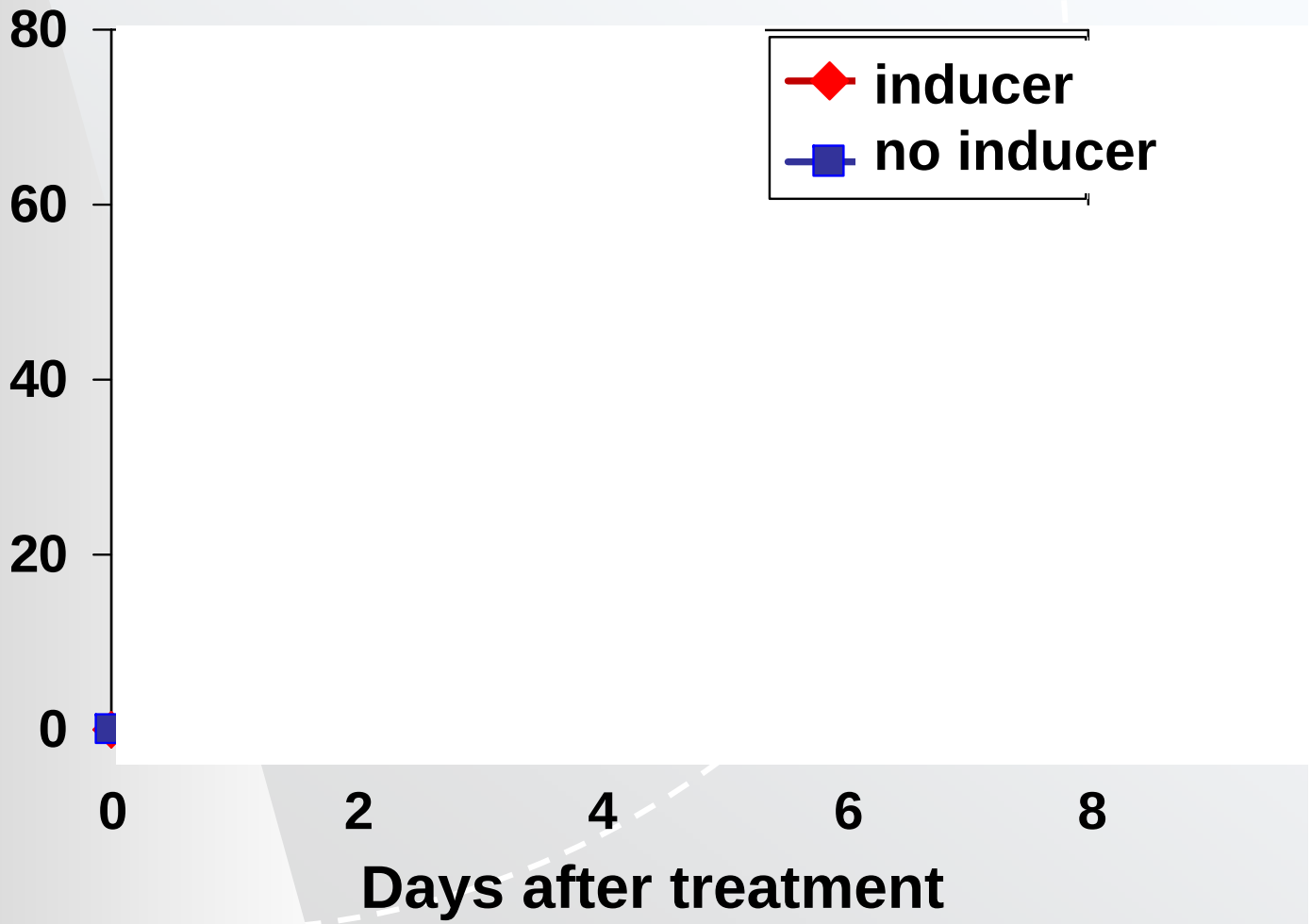
- **Competition for resources**
- **Predation**
- **Antagonism**
- **Stimulation of Plant Responses**
- **Interference with disease lifecycle**

Hyphae of the fungus *Arthrobotrys* coiled around a hypha of a pathogenic fungus *Rhizoctonia* resulting in the death of the latter (1a); the hypha of *Sclerotium* parasitized (revealed by penetration hole) by a parasitic fungus, *Trichoderma* (1b) (Campbell 1989).

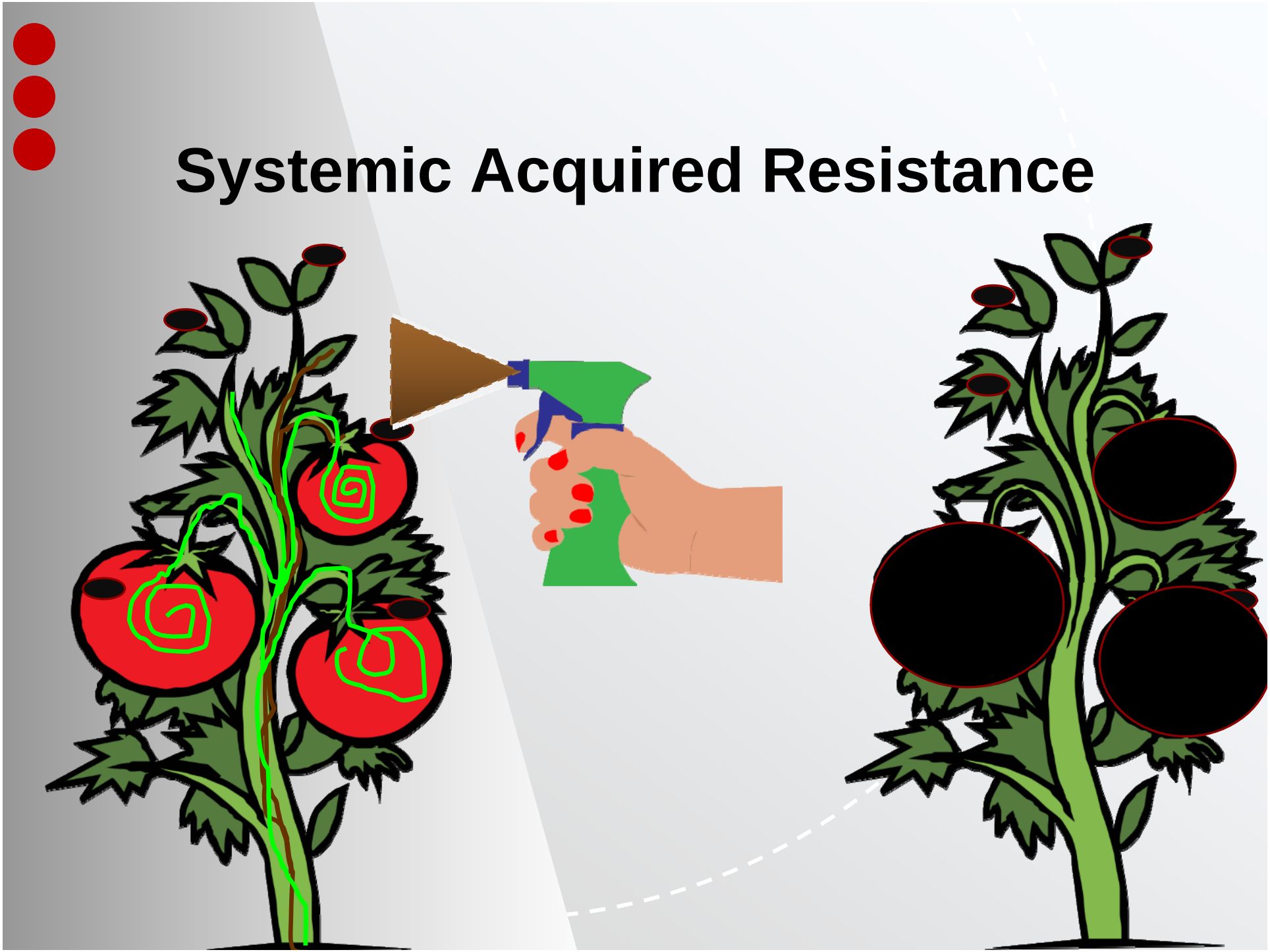
Systemic Acquired Resistance

Plant "vaccination" stimulates plant response *prior to* pathogen attack

Defense compounds:
Phenolics, Peroxidase, Chitinase, etc.



Systemic Acquired Resistance



Presentation Overview

- Take Home Messages on Compost Tea
  - Problems with Tea
  - Quality of materials
  - Legal standing
  - Our Verdict

Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to $7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.

Problems with Compost Teas

- High variability in products and responses
- Some diseases are worsened
- Poor understanding of mechanisms and responses
- Quality Control

Factors you can control

- **Initial compost**
  - **Use high-quality, mature compost from a reliable source**
- **Consistent tea-making, spray conditions**

Photo credit L.M. Lege

Legal standing of compost tea

- **No compost teas are currently registered with EPA as pesticides. It is illegal to sell compost tea as a pesticide.**
- **In research, it is an experimental pesticide.**
- **Can be used to promote plant health, not to treat disease.**
- **Can be used as a nutrition supplement.**

National Organic Standards Board

- **Compost Extract:** Any mixture of compost, water, additives and adjuvants
  - Held for less than 1 hour
  - May be applied without restrictions

- **Compost Tea:** Any mixture of compost, water, additives and adjuvants
  - Held for more than 1 hour
  - Restrictions may apply

National Organic Standards Board

- Compost tea must be made with potable water
- Equipment must be sanitized
- Must use organic compliant compost sources
- Compost tea without additives can be applied without restrictions
- Compost tea with additives can be applied using raw manure restrictions: 90 / 120 day harvest ban
- Compost teas from a single compost source can be tested to show they meet EPA standards for fecal bacterial and (if so) applied without restriction
- New compost batches must each be tested.

OMRI Organic Materials Review Institute

(a nonprofit organization, not a regulatory agency)

- **OMRI lists 23 brand names of compost teas and similar materials.**
  - **These are allowed (with the NOP restrictions and 90/120 day caveat when appropriate) for use as crop fertilizers.**
  - **There are no brand name materials allowed for use as a crop protectant.**

However, OMRI currently states:

- **“Compost tea made on the farm may be used to suppress the spread of disease organisms.”**
- **“Compost tea sold for disease suppression must comply with all pesticide regulations.”**

What is our verdict on Compost Tea?

- Weak but valuable nutritional supplement
- Some contain plant hormones
- Some stimulate plant defense system
- Much more peer-reviewed research needed before specific recommendations are warranted

Take home concepts on compost tea

- Research is showing that compost teas can provide benefits to plant nutrition and health
- EPA rules DO NOT allow use of compost teas to control disease
- Use HIGH QUALITY starting materials
  - “garbage in = garbage out”
- Compost tea with added ingredients should be used like raw manure

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Thank You

Please ask lots of questions!