Waste Management Overview

Presentation for Hawaii WSARE PDP 2019-2022

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Agricultural Waste

- Unwanted material from agricultural activities

Examples of Agricultural Waste

- Animal waste
- Crop waste
- Farm waste
  - Waste water
  - Rinse water-chemicals
  - Plastic mulching
  - Drip tubing


Animal Waste


Crop Waste


Farm Waste

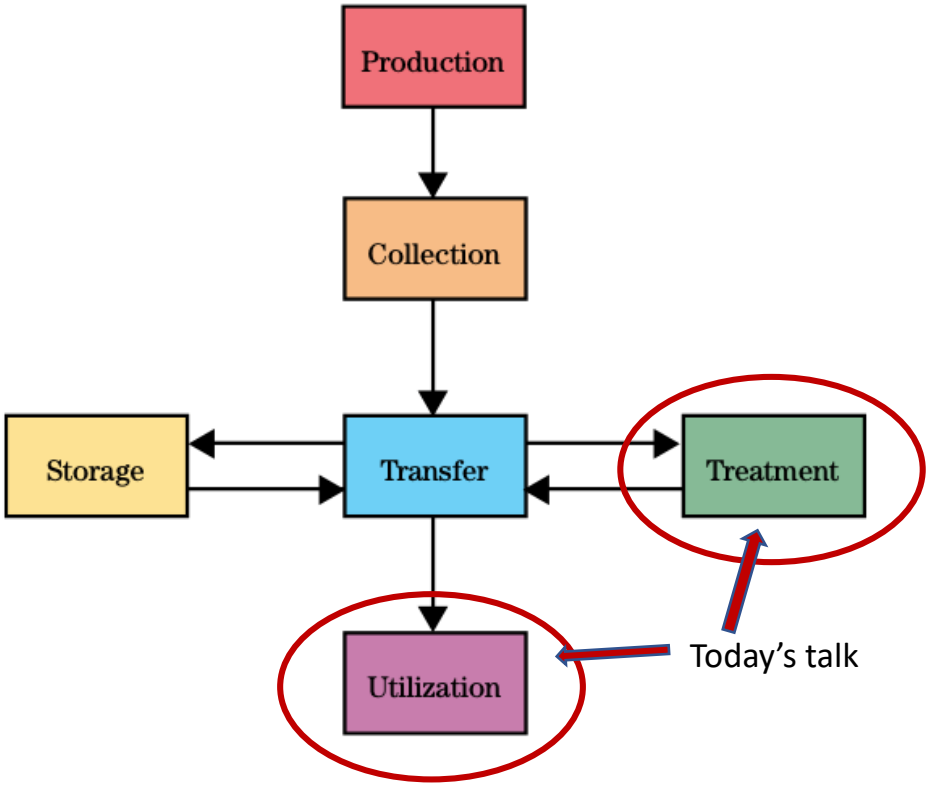
Agricultural Waste Management

- Planned system
- Utilization of all waste in agricultural operations
- Reduce and reuse by products of production
- Practices that improve or sustain the quality of air, water, soil, plant, animal, and energy resources.

Source: USDA NRCS

Components of Waste Management

Figure 9–2 Waste management functions



6 Main Functions

- Production
- Collection
- Transfer
- Storage
- Treatment
- Utilization

Source: USDA NRCS


Minimize disposal

Agricultural Waste Concerns

- Stockpiling
- Odors
  - Ammonia
  - Methane
  - Hydrogen sulphide
- Run Off
  - Algae bloom in ocean
- Water contamination
- Pests
  - Flies, etc.


Stockpiling- Manure

Stockpiling


Odors


Run off

Pest Issues

Source: USDA ARS

Treatment of Waste Products

A function to reduce the pollution potential or alter the physical state of waste.

- Recycling
  - Ex. Composting
- Burial
- Burning


Composting

Composting


Burial


Burning

Burning

Source: UH Hilo

Utilization of Waste

The ways that the waste can be cycled back and used

- Energy
- Land application
  - Mulch
  - Organic matter
  - Plant nutrients

Mulching


Organic matter


Biochar-burning


Land application

Compost Tea for Plants

Recipe:

1. 1-10 to 1:100: Compost to Water
2. Place compost in a mesh bag
3. Aerate tea for 12-24 hours
4. Strain, if needed
5. Apply to plants

Fill bucket with 10 to 100 parts water

Aerate tea for 12-24 hours

Per communication with Dr. Amjad Ahmad (2020). PC: A. Ahmad


Rubbermaid Commercial Products BRUTE

Compost Tea

1. Farm cultivated compost
2. 1:100 compost to water
3. 300 gallons per acre rate of application
4. Crop-pak choi
5. 5 weeks of application

Crops which received compost tea had higher dry weight yields at harvest

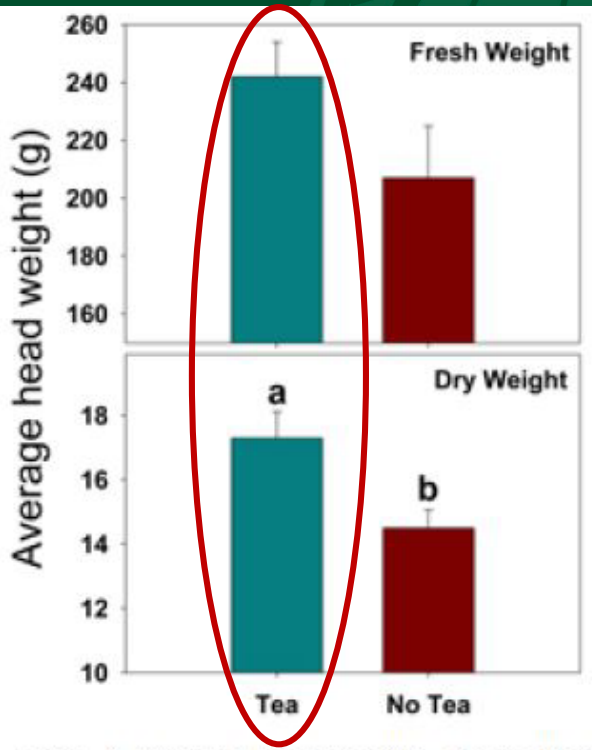


Figure A. Average head weights of pak choi grown with and without weekly applications of compost tea. Values are means of 5 replications . Error bars are standard errors. Different letters indicate significant differences between mean at $P<0.05$..

Radovich and Arancon. 2011. Tea Time in the Tropics.
Source: https://www.sare.org/content/download/66749/944806/Compost_Tea_Manual.pdf

Vermicompost Tea

1. Freshly harvested or cured vermicompost
2. 1:10 vermicompost to water
3. Extract 12-24 hours with aeration
4. OR, 7-10 days with no aerations

Crops which received vermicompost tea had higher dry weight in cabbage

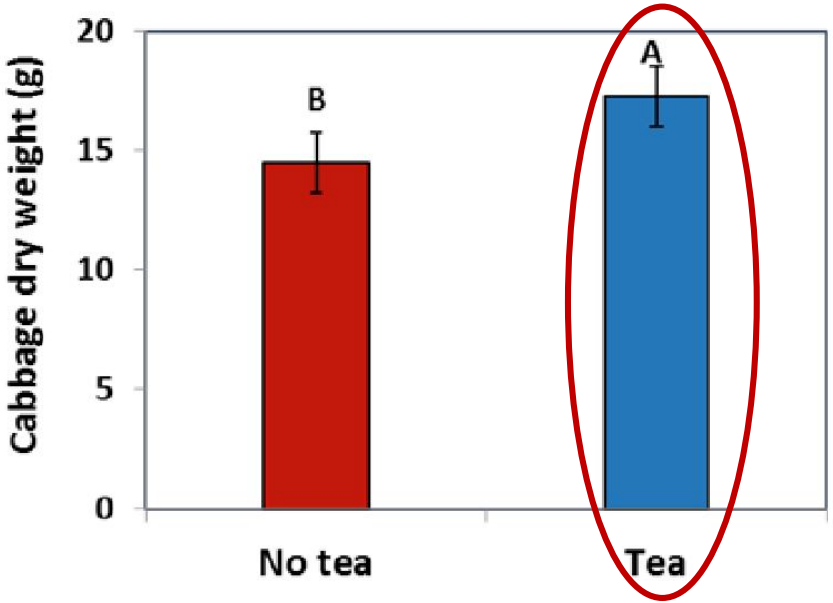
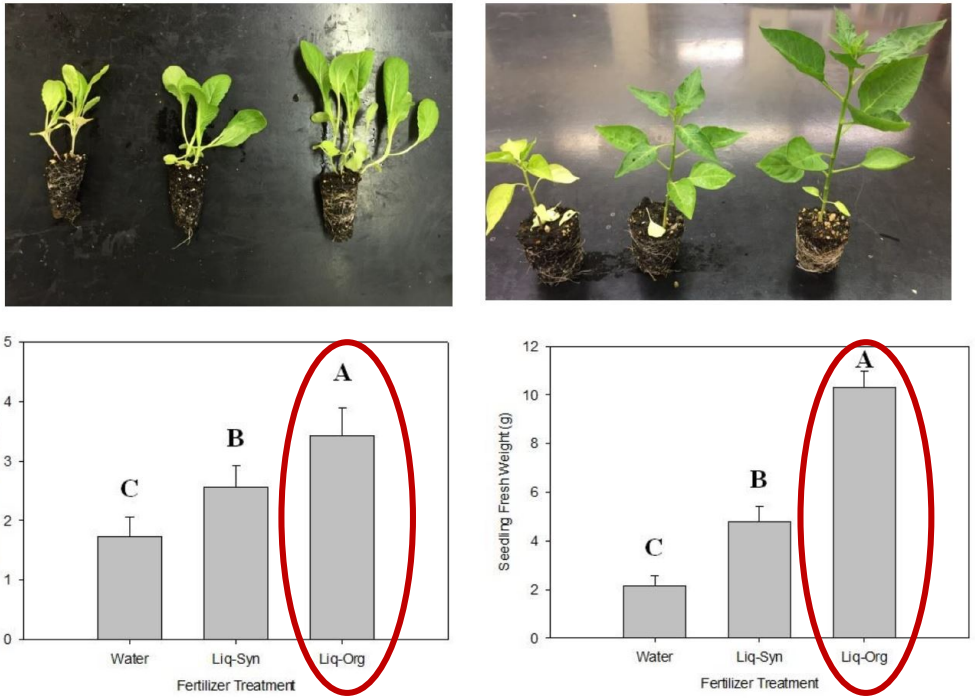


Fig 3. Plant weight of pak choi grown with and without weekly drenching of vermicompost tea. Columns followed by different letters are signifi-cantly different.

Pant, A. and K.H. Wang. 2014. Recycle Organic Waste Through Vermicomposting
Source: https://www.ctahr.hawaii.edu/uhmg/news/V10-Pant-Wang-benefits-vermicompost.pdf?source=post_page

Tankage & Vermicompost Tea

- Liquid Organic Fertilizer (LOF) (tankage + vermicompost) compared to synthetic liquid fertilizer and water
- Same nitrate content
- Fertigated a week after seed germination on a weekly basis
- Liquid organic fertilizer out did synthetic fertilizer and water treatments in fresh and dry weight for papaya, tomato, kai choy and pepper seedlings.



A. Ahmad, et al. 2017. Improving Seedling Quality with Locally Made Liquid Nutrient Solution. Sustainable and Organic Agriculture Hanai'ai Newsletter. V 29. Source: https://cms.ctahr.hawaii.edu/soap/Hanai-Ai/volume-29-mar-apr-may-2017

From Trash to Treasure:

Utilizing Locally Produced Rendered Meat to Produce High N Content Liquid Fertilizer

Dr. Amjad A. Ahmad

COOPERATIVE EXTENSION
UNIVERSITY OF HAWAI'I AT MĀNOA
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https://vimeo.com/245473495

Compost Heating: Recommendations

- Food Safety Modernization Act (FSMA)
- USDA National Organic Policy (NOP)

FSMA: Compost

- Two scientifically valid composting methods that meet these standards
    - Static composting (131°F, 3 days), curing
    - Turned composting (131°F, 15 days), 5 turnings and curing
- Establish and maintain records of process

[1] FSMA Final Produce Rule. Federal Register. V. 80 no. 228 § 112.54

FSMA: Use of Agricultural Tea

- Water extracts of biological materials are allowable if held for 1 hour prior to application.
  - If compost is **treated** (i.e. static compost temperature 131^{o}F for 3 days)
    - Tea maybe applied with **no restrictions** if water has 0 E.coli and no additives (112.56) and in accordance with requirements:
    - § 112.54 -(a) Treated by a scientifically valid controlled physical, chemical, or biological process, or combination of scientifically valid controlled physical, chemical, and/or biological processes, that has been validated to satisfy the microbial standard in § 112.55(a) for *Listeria monocytogenes* (*L. monocytogenes*), *Salmonella* species, and *E. coli* O157:H7;
    - § 112.55 -(a) Meets the microbial standards for *L. monocytogenes, Salmonella* species, and *E. coli* O157:H7

In consult with J. Silva and K. Tavares (3.17.20)

FSMA Final Produce Rule. Federal Register. V. 80 no. 228 § 112.3(c), [80 FR 74547, Nov. 27, 2015, as amended at 81 FR 26468, May 3, 2016]

FSMA: Use of Agricultural Tea

- Water extracts of biological materials are allowable if held for 1 hour prior to application.
  - If compost is **treated** (i.e. static compost temperature 131^{o}F for 3 days)
    - Tea maybe applied to **soil and foliar** if in accordance with (112.56 (a)) requirements:
    - § 112.54 -(b) Treated by a scientifically valid controlled physical, chemical, or biological process, or combination of scientifically valid controlled physical, chemical, and/or biological processes, that has been validated to satisfy the microbial standard in § 112.55(b) for *Salmonella* species and fecal coliforms
    - § 112.55 -(b) Meets the microbial standards *Salmonella* species

In consult with J. Silva and K. Tavares (3.17.20)

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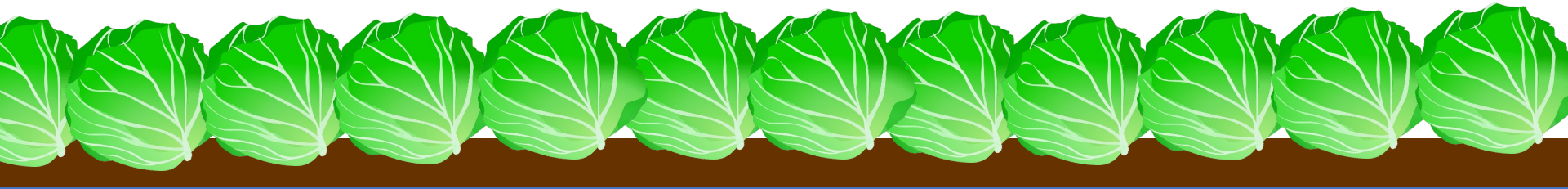
FSMA: Use of Agricultural Tea

- Water extracts of biological materials are allowable if held for 1 hour prior to application.
  - If compost is <u>untreated</u>
    - Tea maybe be applied to the soil and applied in a manner which minimizes the potential for contact with covered produce
    - Harvest should occur 90-120 days after application



Agricultural Tea

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USDA NOP: Composting

- Initial C: N ratio of between 25:1 and 40:1
- For static aerated pile, compost should maintain a temperature of between 131°F (55°C) and 170°F (77°C) for three days.
- For a windrow system, this temperature must be maintained for 15 days and the pile turned a minimum of five times within that time period.
- Accurate temperature records are needed to satisfy the NOP standards.

Source: USDA Organic Regulations for Organic Compost 7 CFR § 205.203(c

USDA NOP Approved Compost Material

- Animal bedding and manure:
  - Must meet requirements for raw manure.
- Crop residues
- Yard wastes
- Fish wastes and by-products
- Seaweed by-products
- Paper (must be newspaper or other recycled paper without glossy surface or colored ink)
- Green waste that has not been exposed to pesticides
- Guano—Bat or Bird (allowed with restrictions):
  - Must be decomposed and dried deposits and must meet requirements for raw manure.
- Other non-synthetic substances

Source: USDA Organic Regulations: § 205.203(c)(1)

USDA NOP: Vermicompost

- Vermicomposting occurs at room temperature using specific earthworms (e.g. Eisenia fetida) and microbial activities.
- Vermicompost systems can be set up indoors, and finished vermicompost usually has a higher nutrient level than typical compost.
- If using vermicompost, the NOP 5021 specifies the following conditions:
  - Vermicompost is made from allowed feedstock materials
  - Aerobic conditions are recorded and maintained by adding thin layers of organic matter at 1- to 3-day intervals
  - Moisture is maintained at 70% to 90%; and
  - The vermicompost must cure for 6 to 12 months for outdoor windrows, 2 to 4 months for indoor container systems, 2 to 4 months for angled wedge systems, or 30 to 60 days for continuous-flow reactors.

USDA NOP: Compost Tea

- The NOP draft guidance on crop materials states that compost tea made from compost not meeting the requirements of § 205.203(c) or NOP 5021 is subject to restrictions of § 205.203(c)(1) for raw animal manure.
- Use only potable water (0 *Ecoli*) to make compost tea or to dilute it.
- Sanitize all of the equipment used to prepare compost tea.
- Make compost tea only from compost that has maintained a temperature of at least 131°F for three days and that has been mixed so all of the pile or windrow has heated up.
- Avoid additives when fermenting compost tea, as these can promote the growth of harmful organisms. In particular, simple sugar sources, like molasses, should be avoided.
- Additives can be used if sample batches of compost tea are tested before using it to make sure it meets the Environmental Protection Agency's (EPA) Recreational Water Quality Criteria (GM= 126, STV=410) with regard to coliform bacteria.
- If compost tea is made with additives but is not tested, or if it doesn't meet water quality guidelines, then food crops may not be harvested until 90 to 120 days after the compost tea has been applied (as with raw manure use on organic farms).

Benefits of Waste Management

- Minimizes off farm transport & storage
  - Landfills
- Minimizes run off and contamination
- Increases on farm organic matter and nutrients

For More information:

Sustainable and Organic Agriculture Program

University of Hawaii at Manoa, College of Tropical Agriculture and Human Resources

https://cms.ctahr.hawaii.edu/soap

Oahu Agriculture & Conservation Association

https://www.oahuaca.org

WSARE

Western Sustainable Agriculture Research and Education

https://www.westernsare.org/

Oahu Agriculture & Conservation Association

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