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IFPTI Fellowship Cohort VII: Research Presentation

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The Knowledge, Practices and Perceptions of Produce Safety by Commercial Aquaponic Growers of Fresh Fruits and Vegetables in Hawaii

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Background

What is Aquaponics?

- The integration of hydroponics and aquaculture to simultaneously produce plant and animal products.



Background

What Occurred on February 26, 2018?

- HAR Chapter 11, Sanitation, §11-11-8, the effect on food vegetable production

§11-11-8 Vegetables. (a) Fertilizer. It shall be unlawful to use human body discharges, whether in liquid or solid form, as a fertilizer for plants raised for human consumption.

(1) Sludge from sewage treatment or waste waters from recycling plants shall not be used for fertilizing vegetables.

(b) Washing. Vegetables offered or intended for sale for human consumption shall be washed only in water from an approved public water system.

(c) Vegetables, raw. It shall be unlawful to offer for sale or to sell for human consumption watercress, lettuce, and other vegetables ordinarily eaten raw which are grown in areas subjected to contamination from water used in irrigation or from animals. [Eff. DEC 26, 1981]
(Auth: HRS §§321-10, 321-11) (Imp: HRS §321-11)

Background

How Does the FSMA Produce Safety Rule Affect Aquaponics?

The screenshot shows the Federal Register page for the FSMA Produce Safety Rule. The header includes the National Archives logo, the text "FEDERAL REGISTER The Daily Journal of the United States Government", and the Seal of the Department of Health and Human Services. A blue banner with a registered trademark symbol and the word "Rule" is present. The title "Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption" is displayed in bold. Below the title, it says "A Rule by the Food and Drug Administration on 11/27/2015". The page is divided into sections: "PUBLISHED DOCUMENT" with a "Start Printed Page 74354" link, "AGENCY:" (Food and Drug Administration, HHS.), "ACTION:" (Final rule.), and "SUMMARY:" (To minimize the risk of serious adverse health consequences or death from consumption of contaminated produce, the Food and Drug Administration (FDA or we) is establishing science-based minimum standards for the safe growing, harvesting, packing, and holding of produce, meaning fruits and vegetables). A "DOCUMENT DETAILS" sidebar on the right lists "Printed version: PDF", "Publication Date: 11/27/2015", "Agencies: Food and Drug Administration", and "Dates: This rule is published September 1, 2015. The effective date of Sec. 507.12(a)(1)(i), 507.105(c), (80 FR 55908), is January 26, 2016." A yellow callout bubble points to the summary section.

FEDERAL REGISTER
The Daily Journal of the United States Government

Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption

A Rule by the Food and Drug Administration on 11/27/2015

PUBLISHED DOCUMENT

Start Printed Page 74354

AGENCY:
Food and Drug Administration, HHS.

ACTION:
Final rule.

SUMMARY:
To minimize the risk of serious adverse health consequences or death from consumption of contaminated produce, the Food and Drug Administration (FDA or we) is establishing science-based minimum standards for the safe growing, harvesting, packing, and holding of produce, meaning fruits and vegetables

DOCUMENT DETAILS

Printed version:
PDF

Publication Date:
11/27/2015

Agencies:
Food and Drug Administration

Dates:
This rule is published September 1, 2015. The effective date of Sec. 507.12(a)(1)(i), 507.105(c), (80 FR 55908), is January 26, 2016.

We do not intend to prohibit using aquaponic farming systems to grow covered produce.

Background

Who are the Aquaponic Growers in Hawaii?



Problem Statement

Little research has addressed the produce safety knowledge, perception, and practices used by aquaponic growers selling produce commercially in Hawai'i.

Research Questions

1. What is the food safety knowledge and perceptions among commercial aquaponic growers in the State of Hawaii?
2. How does commercial aquaponic growers' knowledge and perceptions toward food safety influence their food safety practices?
3. What are the preferred learning modes and information resources on food safety by commercial aquaponic growers in the State of Hawaii?

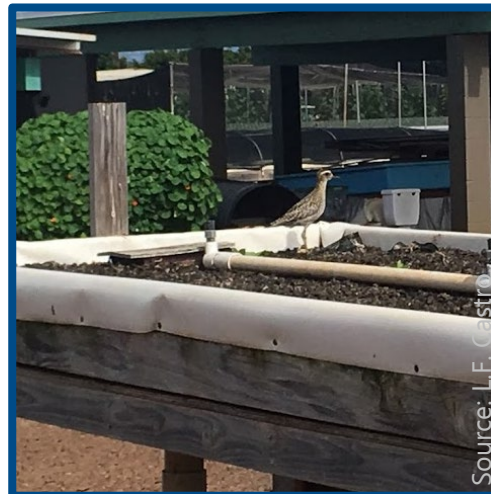
Methodology

Administered Interviews

Which type of aquaponic system are you using?

- ☐ Media filled beds
- ☐ Nutrient film technique (water passes the roots in a shallow stream inside channel)
- ☐ Deep water culture (DWC)
 - ☐ Fish are living under the crops in the same tanks
 - ☐ Fish are kept in tanks separate from the crops
- ☐ Other

Are any of your buyers requiring you to be food safety certified? YES NO



Methodology

- Telephone interview consent
- 42 closed and open-ended questions
 - 8 general farm questions
 - 3 questions on knowledge about food safety
 - 25 questions on GAP practices
 - 6 questions on perceptions and preferences
- Qualitative and quantitative data analysis
- Audio recorded interviews

Data Analysis: Characteristics



LOCATION OF OPERATION

- 5 Oahu
- 2 Hawaii
- 2 Maui

YEARS IN OPERATION

- between 5 and 9 years

TYPE OF SYSTEM

- deep water culture
- nutrient film technique
- media filled beds

Data Analysis: Characteristics



FOOD SAFETY CERTIFIED

- majority NO

BUYERS

- retail
- restaurants
- farmers markets
- public schools
- wholesalers/distributors

CROPS

- lettuce
- green onion
- herbs
- cucumbers
- tomatoes
- watercress
- fish

Data Analysis: Practices



Source: L.F. Castro



Source: L. Yonashiro



Source: L.F. Castro

WATER SOURCE

- 7 municipal
- 1 rainwater catchment
- 1 well system

IN/OUTDOORS

- 8 growing outdoors
- 1 combination

WILDLIFE/PEST CONTROL

- rat traps
- fencing
- netting
- slug and snail repellant

Data Analysis: Practices



WATER SAMPLING

- 5 growers sending water samples to be tested on a regular basis



SOLIDS FILTER

- gravity clarifier
- swirl settler
- radial flow
- microscreen



HARVESTING

- 5 in place
- 3 raft moved
- 1 mechanized

Data Analysis: Perceptions

"I didn't do anything that was unrealistic in regards to food safety. But there's always going to be things that don't translate to real life."

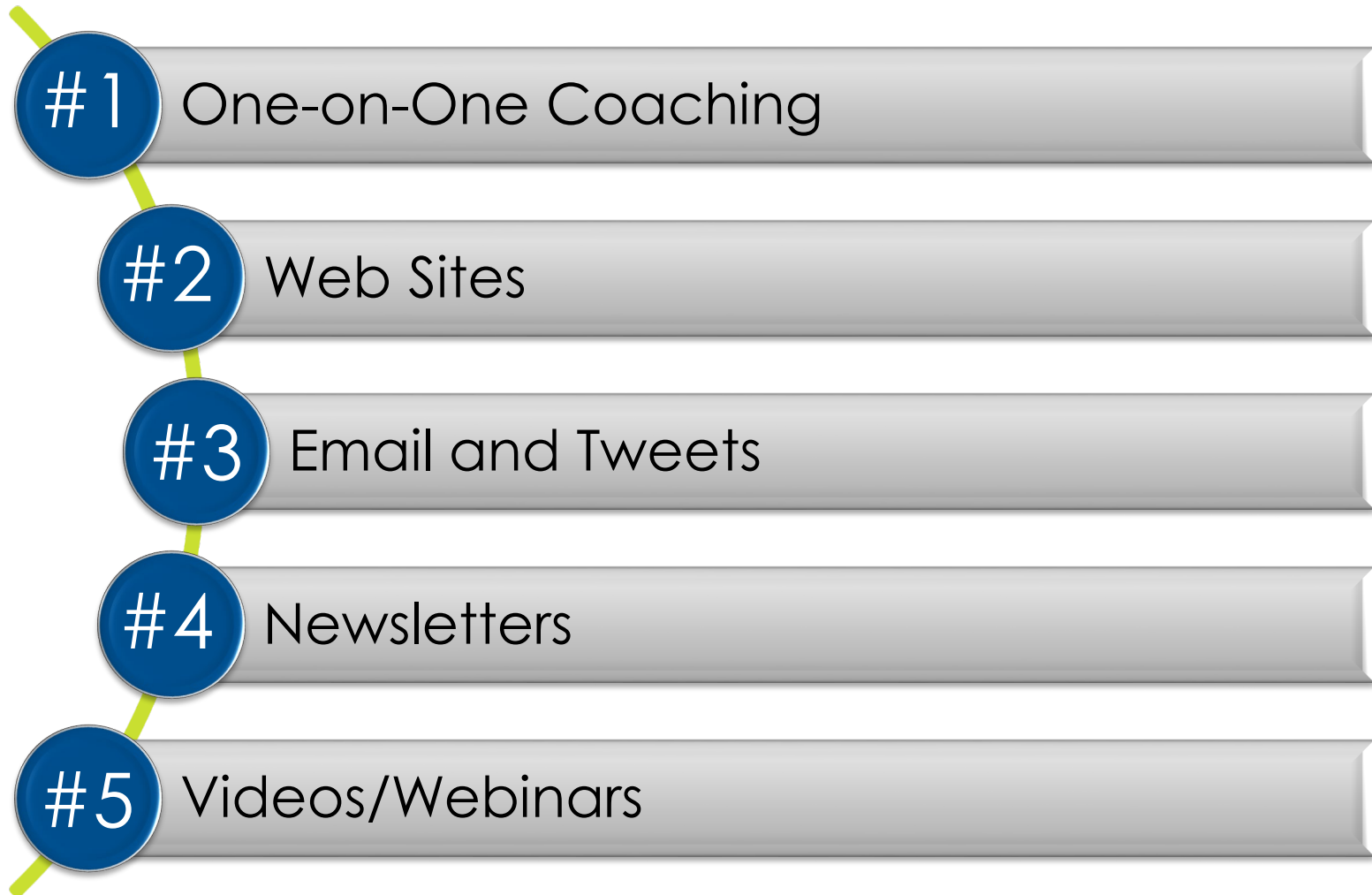
"More effort has to be spent on educating farmers on how to be food safe, rather than inspecting them. It's already hard enough."

"It's extremely necessary because we are responsible for the health of the community we are providing food for."

"I think food safety is one million percent essential and necessary. Food safety should start from planting the seed."

"I'm totally unaware. I only know what we do and the only problem is getting people to wash their hands."

Data Analysis: Perceptions



Conclusions

- Half of the participants reported varying levels of awareness of sources of contamination and practices to prevent or control these sources.
- Most do not feel adequately educated about the PSR and receive barriers to adopting many of the prevention practices.
- Want one-on-one coaching to both support their goals of growing in aquaponic system and their adoption of produce safety.

Recommendations

1. A larger, more rigorous study.
2. One-on-one training programs and outreach.
3. Outreach.

Acknowledgements

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- IFPTI educators, subject matter expert Dr. Paul Dezendorf, and especially my mentor, Katherine Fedder.
- Participants who trusted me in gathering their knowledge, practices, and perceptions as part of this research.
- All of the Fellows in Cohort VII for making this such an exceptional experience.

Questions?

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PSR and How it Pertains to Aquaponics

Subpart E of the PSR, which deals with agricultural water, applies to aquaponics only if the water used is intended to or likely to contact harvestable portions of produce. If aquaponic water contacts harvestable produce portions, Subpart E standards apply, including relevant microbial quality requirements and relevant water testing requirements.



PSR and How it Pertains to Aquaponics

Subpart F, which deals with biological soil amendments of animal origin and human waste (e.g., raw manure), FDA does not consider liquid-only matrices to be growth media. Growth media consist of solid or semi-solid matrices.



PSR and How it Pertains to Aquaponics

Subpart I, which deals with Domestic and Wild Animals, minimizing potential for biological hazards from animal poop deposited on covered produce.

Subpart I does not apply to fish used in aquaponic operations.



PSR and How it Pertains to Aquaponics

Aquaponic operations are subject to the harvesting section in **Subpart K**.



Fish and Plant Pathogens

- Types vary based on type of plant or fish
- Can be inhibited by normal microbiota of plants and diverse microbes in the system
- Strict biosecurity measures can limit introduction
 - Source and quality of seed/plants
 - Source and quality of fish
 - Limit access

Examples of Fish Pathogens

- Parasite
 - “Ich”, monogenean and digenean flukes, Trichodina
- Bacteria
 - “Fno”, *Aeromonas hydrophila**, *Columnaris flavobacterium*, *Streptococcus iniae**, *Mycobacterium* spp.*
- Fungi
 - *Saprolegnia*, *Exophiala*
- Viruses
 - Tilapia lake virus



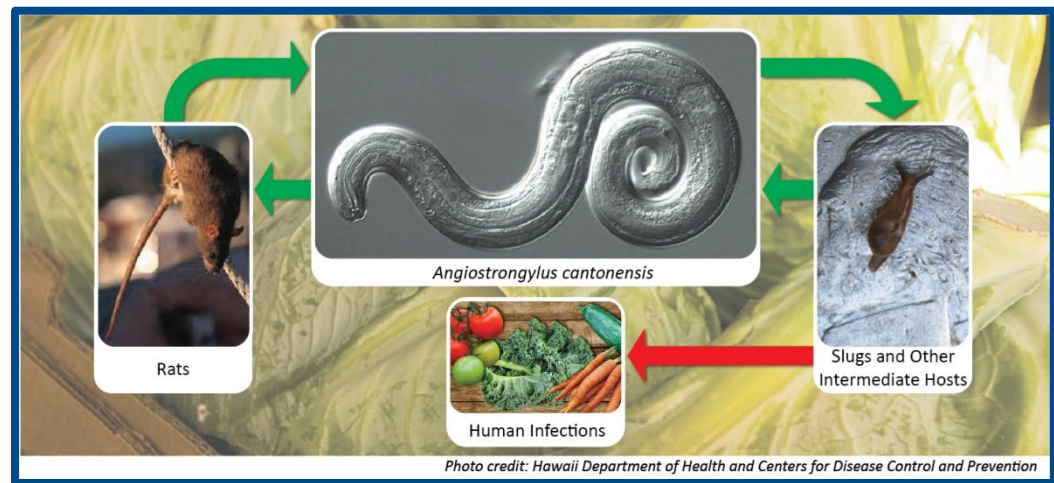
Aquatic Zoonotic Diseases

- Bacteria

- *Aeromonas hydrophila*
- *Streptococcus iniae*
- *Vibrio* spp.
- *Mycobacterium* spp.
- *Salmonella* spp.
- *Listeria* spp.
- *Leptospirosis*

- Parasite

- *Angiostrongylus cantonensis*



The Nitrogen Cycle

Feed Fish



Ammonia



Nitrites

Nitrates



Grow Plants

