



GROW FOOD? USE GAPs!



**Good Agricultural Practices
Farm Food Safety Coaching
@ UHM-CTAHR**

**Because that's someone's
dinner you are growing.**

Luisa Castro
Good Agricultural Practices Coach
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Caveat and recording

- I apologize if any of this fact-based information causes you any distress.
- As commercial food producers, it is important that you be informed on the changes in your “industry”.
- Please do not audio or video record this presentation – thank you.



What will be covered in this talk

- Good Agricultural Practices – summary.
- Where aquaponics and GAPs conflict (for now).



What's the best way(s) to *reduce*
the incidence of food-borne
illness coming from the food you
are growing?

Use GAPs!



Basic Good Agricultural Practices (GAPs)

1. Human health and hygiene (toilets, hand washing, not work when sick – risk are pathogens)
2. Water quality (irrigation and wash – risk are pathogens)
3. Fertilizer safety (inorganic and organic – risk are pathogens & dangerous additives)
4. Wild and domestic animal control – risk are pathogens
5. Pest control (rats, cockroaches, rat lungworm) – risk are pathogens
6. Pesticide use (inorganic and organic) – risk is to human health – applicators, workers, and consumers
7. Harvesting practices – risk are pathogens
8. Tracing product back to farm – risk is can't find the offending farm fast enough

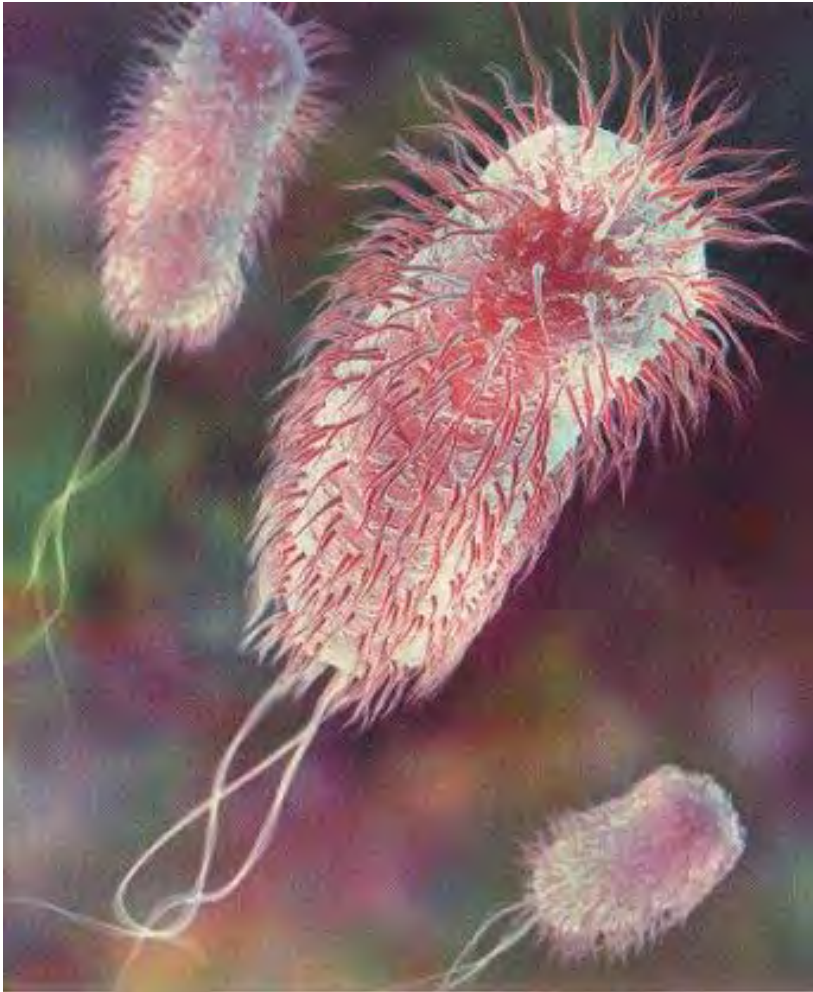


The biggest concern for commercial food producers – of ANY size, who want to keep their customers safe, is pathogens.

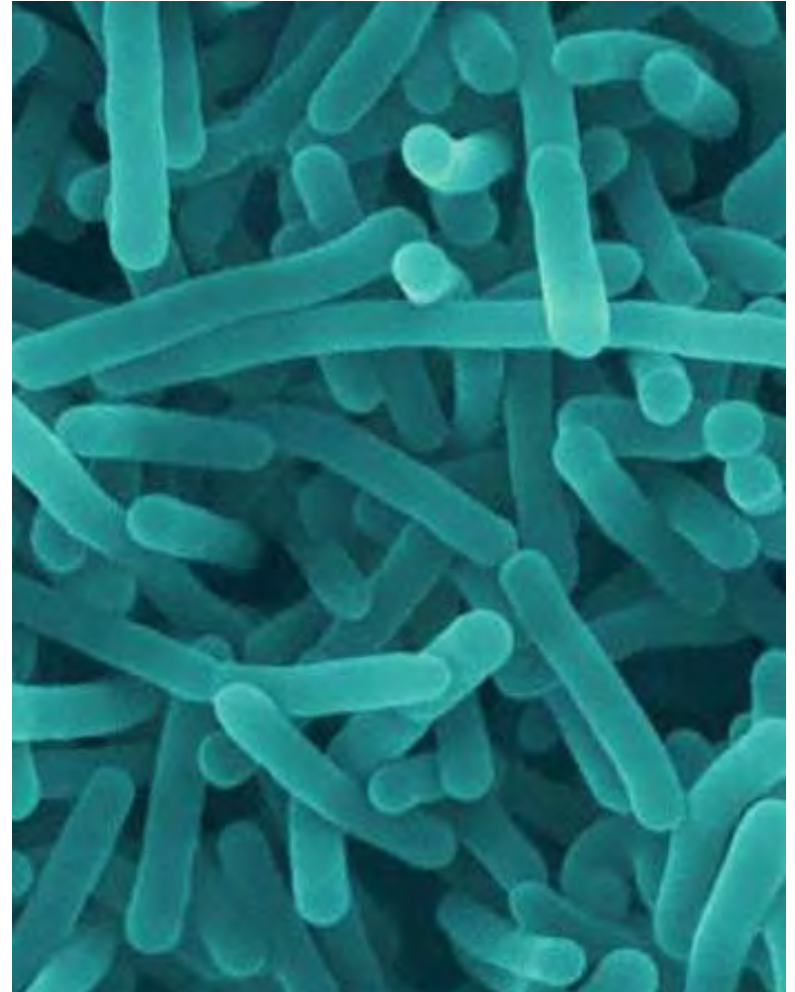
But, there are also chemical and physical “adulteration” risks as well.



Pathogens (tiny bacteria or viruses)



E. coli



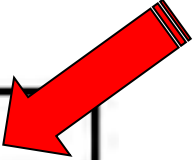
Listeria



Where do you think pathogens
can be found on a farm or in a
garden environment?



Pathogens are held in many animal species



Agent	Cases	Reservoir
Norwalk-like viruses	9,200,000	Human
<i>Campylobacter</i> spp	1,963,141	Poultry
<i>Salmonella</i> , Non-typhoidal	1,341,873	Animal
<i>Clostridium perfringens</i>	248,520	Soil, human, animal
<i>Giardia lamblia</i>	200,000	Human, animal
<i>Staphylococcal</i>	185,060	Human
<i>Toxoplasma gondii</i>	112,500	Cat
<i>Shigella</i> spp	89,648	Human
<i>Yersinia enterocolitica</i>	86,731	Pig
<i>Escherichia coli</i> O157:H7	62,458	Cow

Mead, et al, *Emerging Infectious Diseases* 1999: 5(5); 607-625



How do workers pose a risk?

- Humans carry a variety of bacteria and viruses. Greatest risk is human feces.
- Even if somebody is not sick, they may still be able to contaminate produce and others.
- Farm workers are sometimes the last/only people to handle the produce before the consumer.



How does water pose a risk?



Ensure water sources are designed and maintained in a manner that prevents contamination



How does wildlife pose a risk?

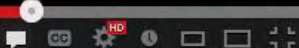


Keeping domestic animals out

Aquaponic Lettuce In 5 Weeks?



1:04 / 1:15



How does harvesting pose a risk



How do pesticides pose a risk?

- If the crop is not on the label
- If not using rate (or less) as on the label
- If not wearing Personal Protective Equipment (P.P.E.) as on the label
- If not following Restricted Entry Interval (R.E.I.) as on the label
- If not following PreHarvest Interval (P.H.I.) as on the label.



You cannot make your own pesticides that will be sprayed on crops you sell – why?



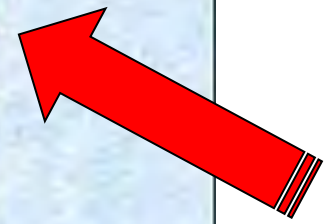
Parts of a pesticide label



ACTIVE INGREDIENTS:	
Pyrethrins	0.02%
Piperonyl Butoxide, Technical .	0.20%
Clarified Hydrophobic Extract of Neem Oil	0.90%
OTHER INGREDIENTS	98.88%
Total	100.00%

KEEP OUT OF REACH OF CHILDREN
CAUTION See Booklet For Additional
Precautionary Statements.

Net Contents 24 FL OZ (710 ml)



Active ingredient

- Toxic material that kills the pest
- Use to identify the pesticide
- The same active ingredients are often sold under various trade names
- Use it to research toxicity



Is there any problem with these ingredients in home-made plant enhancers or pesticides?



Butter Clams
Saxidomus nutalli



Dungeness Crab
Cancer magister



Pacific Littleneck Clams
Protothaca staminea



Pacific Oysters
Crassostrea gigas



Pacific Spot Prawn
Penaeus setiferus



Pacific Sea Scallops
Pecten novaezelandiae



FOOD ALLERGY AWARENESS!

WHAT TO KNOW!

A food allergy is an abnormal response to a food triggered by the body's immune system. Once exposed to the allergen, the allergic individual can suffer a mild to life-threatening reaction. The only control is avoidance of the food. Despite taking precautions, allergic people may be unknowingly exposed to an allergen.

Approximately 11 million Americans suffer from true food allergies. Be prepared to protect your customers. Know the eight major food allergens and the symptoms of an allergic reaction.

THE EIGHT MAJOR FOOD ALLERGENS

MILK



EGG



FISH



CRUSTACEAN SHELLFISH



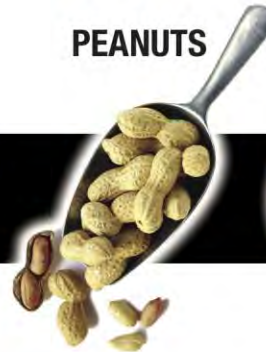
WHEAT



SOYBEANS



PEANUTS



TREE NUTS



Now on to aquaponics!
(thanks for your patience)



Aquaponics and food safety

- Everything that has just been said applies to aquaponic farms – everything.
- But, when aquaponic farms are audited by “third-party” auditors, there is a problem .
- . .



05.04	Is untreated animal manure used? If No, go to 5.05. NOTE: Special attention to commodity specific guidelines rules (e.g., Californian Leafy Green Commodity Specific Guidelines) which ban the use of untreated animal manures . See 5.04d	15
05.04a	Is untreated animal manure incorporated into the soil prior to planting or bud burst for tree crops and not applied during the growing season?	20
05.04b	Are there untreated animal manure records available for each growing area including application records which shows that the interval between application and harvest was not less than 120 days (unless more stringent laws or guidelines exist)?	15
05.04c	Are there Certificate(s) of Analysis (COA), specification or some other document available for review provided by the untreated animal manure supplier stating the components of the material?	20
05.04d	Are untreated animal manures being applied to crops where the country regulations/guidelines ban the use such materials (e.g., Californian Leafy Green Commodity Specific Guidelines)? If this question is answered Yes, automatic failure of this audit will result.	20

08.07	Is there evidence of fecal contamination in proximity to the growing area or any storage areas? (This refer to a single account of human or domestic animal fecal matter and/or systematic discoveries of wild animal manure) If this question is answered Yes, automatic failure of this audit will result.	20
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Here is what we know and have
been telling other scientists



Table 1. Comparison of the relative food safety risks on a soil-based farm and an elevated, soilless aquaponics farm.

Potential risk factors	Typical soil-based produce farm	Netted, elevated, soilless aquaponic produce farm
Soil	Soil-based risks are plot-by-plot, farm-by-farm. Soil cannot be sanitized.	Soil not used. Growing surface elevated above ground. Potential growing surfaces include gravel and synthetic materials such as Styrofoam and plastic—all can be sanitized as necessary.
Irrigation water	Water source could be river, ditch, well, lake, rooftop, municipal (potable), and/or recycled. Non-municipal water sources could contain pathogens, pesticides and other undesirable factors that could be applied to the edible portion of the crop.	The best practice is to use potable water in fish tanks and never to use open source water from rivers, ditches, lakes, etc.
Warm-blooded animal intrusion	Cattle, deer, swine, birds, rats, etc., may be able to access ground-level growing areas.	The best practice is to net all production systems. Netted, elevated growing systems severely restrict any warm-blooded animal access.
Fish feces (feces from cold-blooded animals)	Fish wastes could be in open-source irrigation water (and/or in fish meal). Could be applied on the edible portion of the crop or on soil via irrigation water.	Fish waste-based nutrients are kept well under the edible portion of the crop and never applied directly to the edible portion of the crop. Fish wastes must first be converted to nitrate, by symbiotic bacteria, for plant uptake and use.
Worker hygiene	Same as for any produce farm.	Same as for any produce farm.
Packing facility safety	Same as for any produce farm.	Same as for any produce farm.



Table 4. A summary of indicator microbes and pathogenic bacteria estimated from system water and raw flesh of freshly harvested tilapia fish originating from both aquaculture and aquaponic tanks in aquaponic research systems at the University of Hawai'i. No *E. coli* O157:H7 or *Salmonella* were detected, even though fecal coliforms and generic *E. coli* were detectable in all system water samples.

Fish Tank	Sample	<i>E. coli</i> CFU/100mL*	Fecal Coliform MF/100mL*	<i>E. coli</i> O157:H7 25 g*	<i>Salmonella</i> 25 g or 25 mL
Source	Water	< 1	< 1	-	Negative
Aquaculture 1	Water	24	29	-	Negative
Aquaculture 2	Water	4	36	-	Negative
Aquaponics 1	Water	>200	340	-	Negative
Aquaponics 2	Water	62	26	-	Negative
Aquaculture 1	Fish Muscle	-	-	Negative	Negative
Aquaculture 1	Fish Muscle	-	-	Negative	Negative
Aquaculture 1	Fish Muscle	-	-	Negative	Negative
Aquaculture 2	Fish Muscle	-	-	Negative	Negative
Aquaculture 2	Fish Muscle	-	-	Negative	Negative
Aquaculture 2	Fish Muscle	-	-	Negative	Negative
Aquaponics 1	Fish Muscle	-	-	Negative	Negative
Aquaponics 1	Fish Muscle	-	-	Negative	Negative
Aquaponics 1	Fish Muscle	-	-	Negative	Negative
Aquaponics 2	Fish Muscle	-	-	Negative	Negative
Aquaponics 2	Fish Muscle	-	-	Negative	Negative
Aquaponics 2	Fish Muscle	-	-	Negative	Negative

* - Indicates that test was not conducted

10 Steps to get underway

1. Take a self-assessment.
2. Do some reading, study, and self-education.
3. Attend a GAP training.
4. Make a formal management commitment to food safety.
5. Develop a food safety plan for you farm.
6. Implement the easiest and most accessible practices.
7. Reach out to your buyers and customers.
8. Identify and build cooperative relationships that can help implement GAP.
9. Continue improving until you're ready for an external audit.
10. Seek out resources and support as needed.



Thank you!



Luisa Castro (luisac@hawaii.edu / 808.244.3242 x232)