



Aquaponics: A Sustainable Food Production System

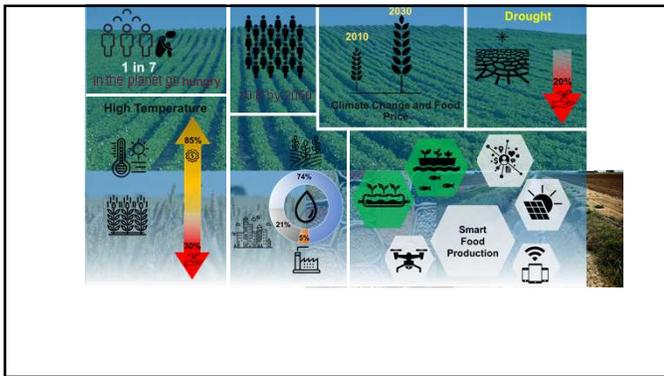
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Outline

- ✓ How Aquaponics Work?
- ✓ Benefits of Aquaponic System
- ✓ Aquaponic System Types
- ✓ Aquaponics Food Safety
- ✓ Concerns in Organic Aquaponics

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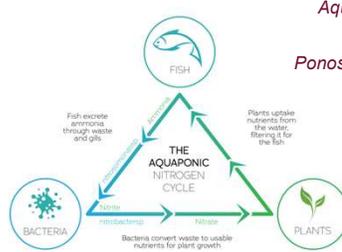


1 in 7 in the world go hungry
3.4 billion
2030
2010
Drought 20%
High Temperature 85%
74%
21%
3%
Smart Food Production

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How Aquaponics Work?

Aquaculture- Growing fish in RAS
Ponos- growing plants with/without media



THE AQUAPONIC NITROGEN CYCLE

Fish excrete ammonia through waste and gills
Bacteria convert waste to usable nutrients for plant growth
Plants uptake nutrients from the water, filtering it for the fish

<https://intmarfarms.com/about/>

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Why Aquaponics?

- Two food products together (protein, produce)
- No soil-borne diseases, no weeds
- High fish stocking density, high crop yield
- No waste
- No pesticides or herbicides
- Food security
- Better ergonomics for workers
- Works in draught or places with poor soil quality
- More efficient
 - Less water used than in conventional farming
 - Higher yields with less land
 - Faster growth – more efficient delivery of nutrients directly to plants

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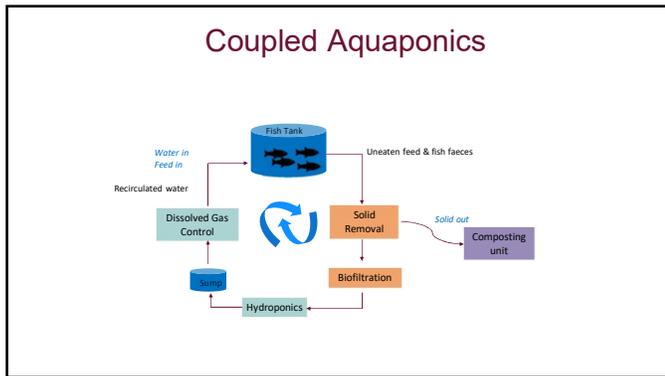
Aquaponic System Types

a. Coupled (Single-Loop) Aquaponics

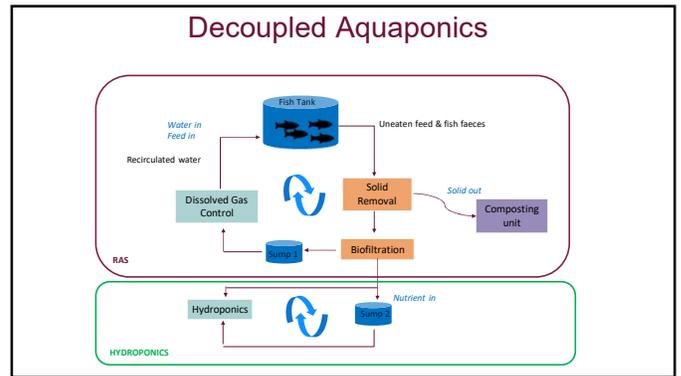
b. Decoupled Aquaponics (Separate loops for fish and plant)



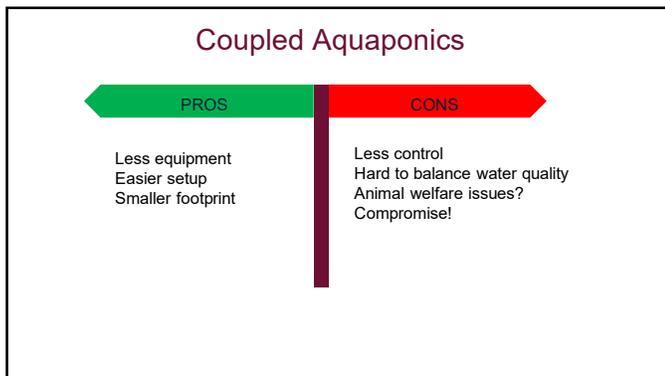
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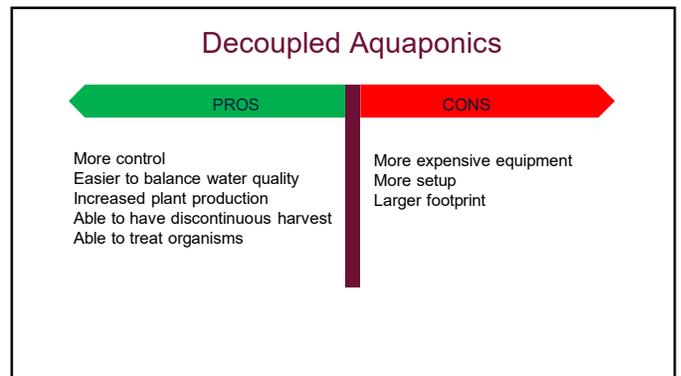
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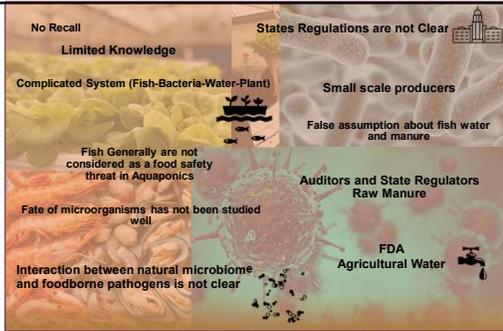
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Aquaponics Food Safety

- ✓ Fish and edible plants are regulated by the FDA
- ✓ Fish: Seafood HACCP Rule
- ✓ Plants: Produce Safety Rule; FSMA
- ✓ Food safety concern: proximity of fish culture water to edible plant culture




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Food Safety Risks in Aquaponics

- *Listeria monocytogenes*
- *Salmonella spp.*
- *Shiga-toxin E. coli*
- *Vibrio spp.*
- *Aeromonas spp.*
- *Shigella spp.*
- *Campylobacter spp.*
- *Edwardsiella tarda*
- **Norovirus (36% of the outbreaks)**

- Protozoa
 - *Giardia*
 - *Cryptosporidium*
 - *Cyclospora*

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Water Regulations

- If the water used is **intended to or likely to contact** harvestable portion of produce (Subpart E)
- **Domestic and Wild Animals**, only applies to outdoor or partially enclosed production (Subpart I)-Indoor/greenhouse operations do not fall under these regulations
- If water from fish aquaculture unit, is **splashed or dripped** onto edible portion of plants, it is under Subpart K.



Will the water be in contact with the edible portion of plant?
 Water quality should meet standards for irrigation water (21 CFR Part 112).
https://producesafetyalliance.cornell.edu/sites/producesafetyalliance.cornell.edu/files/shared/documents/PSA_FSMA_Reg_Table_2016_edit.pdf

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Reducing Food Safety Risks

Good Agricultural Practices (GAPs)
 Good Manufacturing Practices (GMPs)






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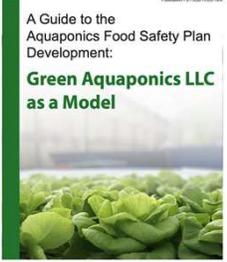
Preventing Control Strategies

- Water sanitation
- Proper handwashing
- Training
- Plant and fish processing
- Using non-edible plants like ornamental plants
- GMPs
- GAPs
- Post-harvest sanitation




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A Guide to the Aquaponics Food Safety Plan Development:
Green Aquaponics LLC as a Model



Virginia Cooperative Extension Sea Grant WCU

A Guide to the Aquaponics Food Safety Plan Development:
Green Aquaponics LLC as a Model



https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt.edu/FST/fs1-302/FST-302.pdf

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Concerns in Organic Aquaponics




Debating since 1995.

- ✓ Organic label should be limited to soil-based.

“An organic plant shall contain provisions designed to foster soil fertility, primarily through the management of the organic content of the soil through proper tillage, crop rotation, and manuring.”

- ✓ Growing in soilless media an alternative, if USDA organic regulations can be met.

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In 2010 the NOSB (National Organic Standards Board), recommended that hydroponic production **not be allowed to be certified organic**, stating "systems of crop production that eliminate soil from the system, such as hydroponics or aeroponics **cannot** be considered as example of acceptable organic farming practices...due to their exclusion of the soil-plant ecology intrinsic to organic farming systems and USDA/NOP regulations governing them.

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(January 2018)
USDA updated the growers that hydroponic, aquaponic, and aeroponic operations can still be certified under USDA organic regulations.

"Certification of hydroponic, aquaponic, and aeroponic operations is allowed under the USDA organic regulations, and has been since the National Organic Program began. For these products to be labeled as organic, the operation must be certified by a USDA-accredited certifying agent, and maintain compliance with the USDA organic regulations".

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A lot of aquaponics operations are not USDA organic certified.

- ✓ Pesticide-free forms of pest management
- ✓ Non-GMO fish feed
- ✓ Treat sick fish without the help of antibiotics

"sustainability" of their growing practices



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Organic industry is not giving hydroponic, aquaponic growers a warm embrace

By Dan Flynn on February 8, 2019
Some fish produce from hydroponic growers has been approved for and is being sold under USDA's organic label, but farmers who grow their organic crops in the soil don't see the competition.

Center for Food Safety filed a rule-making petition with U.S. Department of Agriculture, demanding new regulations prohibiting organic certification of hydroponic agriculture production. The 22-page petition also asks USDA to revoke any existing organic certification previously issued to hydroponic operations.

<https://www.foodforpeace.com/2019/02/organic-industry-is-not-giving-hydroponic-aquaponic-growers-a-warm-embrace/#toc=28833>

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Resources

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<https://www.ams.usda.gov/sites/default/files/media/CSHydroponics.pdf>

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Thank you!

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