Considerations for Choosing & Maintaining Your Aquaponic System

May 25, 2013

About Hapa Farms

- Commercial Hatchery
- Kahalu`u, O`ahu
- www.hapafarmshawaii.com/aquaculture
- Custom hybrid tilapia breeding
  - Tested FNO free
  - Color
  - Fast-growing
  - Disease resistant
  - All male

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Kahalu’u Red

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Kahalu’u Black

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Blue Tilapia

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Koilapia

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Purple Tilapia

- All male
- Fast growing

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Aquaponics

- Build systems
- Provide training in building, maintenance, planting, harvesting, breeding

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Aquaponics in Education

- Working with schools to design, implement, and build self-sustaining aquaponic programs

isisHawaii
the power of one plus one...

College of Tropical Agriculture and Human Resources (CTAHR)

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Keep it simple

People think aquaponics is complicated because

- Combines a lot of skill sets
  - -Aquaculture
  - -Hydroponics
  - -Construction
  - -Mechanical
  - -Horticulture
  - -Plumbing

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Getting Started

- Choosing your system:
  - Focus on fish production, plant production, or balance?
  - Type of fish you want to raise
  - Types of plants you want to grow
  - Size of site
  - Budget
- Choosing your site:
  - No overhanging roofs or trees
  - Access to power and potable water
  - Security

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Hydroponic Components

- All modern intensive integrated aquatic agriculture is based off of hydroponic techniques
  - Deep Water Culture
  - Nutrient Film Technique
  - Ebb & Flow

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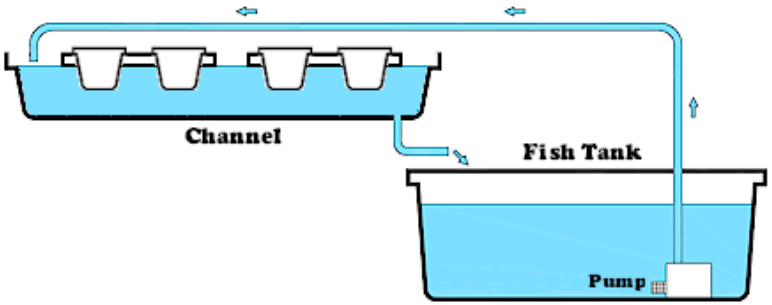
Deep Water Culture

- Continuous flow of water with plants suspended at surface
- Developed in 1936 for hydroponics
  - Dr William Frederick Gericke (UC Davis)
- Integrated into large scale aquaponics by Dr. James Rakocy (UVI) in 1997



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Deep Water Culture - Pros

- Large volume of water buffers temperature/pH
- Easy harvest
- Potentially profitable model (lettuce)
- Can add guppies, etc in grow bed to diversify aquaculture component

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Deep Water Culture - Cons

- Good raft materials are hard to find as most common (plywood or Styrofoam) are not food safe
- Slower growth than ebb & flow
- Limited types of plants
- Sludge
- Lots of maintenance
- Need an additional filter (mechanical or biological)

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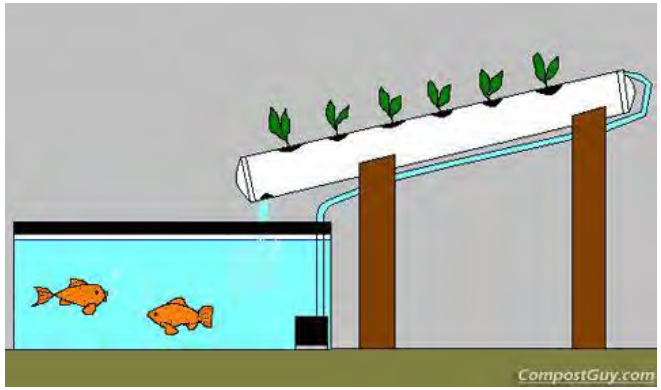
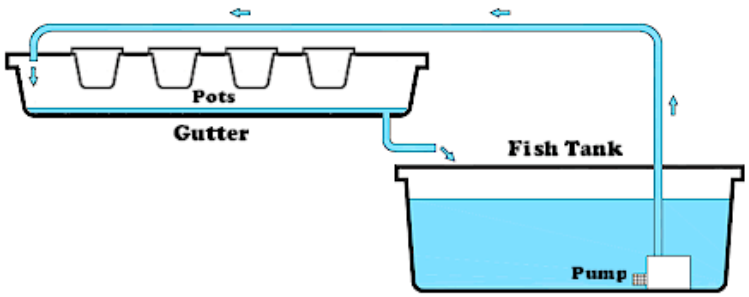
Nutrient Film Technique

- Shallow stream of water circulates through plant roots in channels
- Developed in late 1960s for hydroponics
  - Dr. Allan Cooper
  - Glasshouse Crops Research Institute (U.K.)





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Nutrient Film Technique - Pros

- Cheapest to build
- Use of vertical space
- One of the most common hydroponic growing system used in Hawaii
- Easy to harvest
- Most common in leafy green hydroponic production

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Nutrient Film Technique - Cons

- Sludge catches in root balls – lots of maintenance required
- Need filter
- Food safety – sludge on leaves
- Limited types of plants
- Low volume of water so major temperature, pH fluctuations

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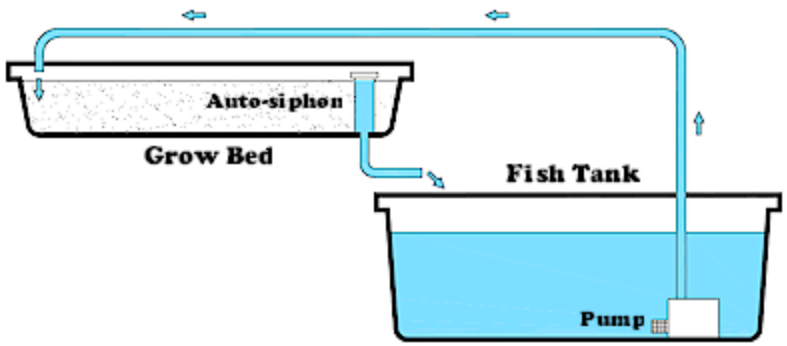
Ebb & Flow

- Water fills grow bed containing solid media then drains
- Developed in 1940s for hydroponics for US Army
  - Robert and Alice Withrow (Purdue)
- Aquaponics transfer
  - Mark McMurtry et al (NCSU)
  - Travis Hughey



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Ebb & Flow - Pros

- Shown to have highest yield (plant biomass) when compared to other aquaponic techniques – faster growth
- Most versatile
- Acts as biofilter

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Ebb & Flow - Cons

- Expensive to build (materials)
- Day-to-day maintenance
- Build-up of biological materials

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Food Safety

- For backyard farmers, the most at-risk are your family and friends, children and elderly
- Food safety is your personal responsibility

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Some Good Agricultural Practices

- Avoid contamination from feces of warm-blooded animals
  - No overhang over systems
  - No clutter near systems
- Avoid contamination from slugs
  - No plants touching ground (i.e. no path for slug between ground and system)
- Water from system shouldn't touch plants
- Always use potable water to fill system
- Sink designated for hand washing only
- Signs of rules
- *Educate everyone in contact with system of food safety rules*

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Resources for Food Safety

- CTAHR Good Agricultural Practices website
- http://manoa.hawaii.edu/ctahr/farmfoodsafety/
- Food safety for aquaponics:
- http://www.ctahr.hawaii.edu/oc/freepubs/pdf/FST-38.pdf

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3 Components of Food Safety

- Biological
- Chemical
- Physical

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Building Materials

- Ensure food safety of any materials that touch the water in your system
  - Grow beds, tanks, liners, pipes, airline, wood, submersible pumps
- General rule: if original purpose was not for food/water storage, probably not food-safe
- Always check with the FDA about material safety before growing food in a container

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Plastics

	**PETE**	Polyethylene terephthalate - can leach dioxins, carcinogens, hormone-disrupting phthalates with long-term use
	**HDPE**	High-density polyethylene – durable in sun, *mostly* food safe
	**V**	Vinyl/polyvinyl chloride (PVC) – may not be food safe. Schedule 40 PVC pipe *is* food safe.
	**LDPEA**	Low-density polythylene – not known to leach toxic chemicals
	**PP**	Polypropylene – not known to leach toxic chemicals
	**PS**	Polystyrene – *some* types are food safe
	**OTHER**	Combination of any kind of plastic, may contain BPA
	**9/ABS**	Acrylonitrile butadiene styrene – leaches toxic chemicals

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Building Materials

- Plastic IBC – intermediate bulk containers
  - IBCs are popular for their efficient use of space and their corrosion/chemical resistance
  - Commonly used for shipping/storing:
    - Some foods, water
    - Soaps, glues, detergents, solvents
    - Cosmetic/pharmaceutical additives
    - Corrosive chemicals and hazardous liquids

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Building Materials cont'd

- IBCs cont'd
  - Companies specialize in repurposing IBC containers so you might not know entire history of IBC
  - Even if materials are food grade, may have held liquids that make it unsafe
  - If held food, might have used a food-grade liner, not necessarily safe
  - Always buy new or request full written records of history

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Building Materials cont'd

- Cement
  - Sealant must be food grade, many are not
- Liners
  - Look for NSF 61 (safe for potable water)
  - "Fish safe" does not necessarily mean food safe

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Building Materials cont'd

- Pipes
  - Schedule 40 PVC is food safe
  - ABS pipes (black) are not safe
- Airline
  - Vinyl tubing not always food safe
- Garden hose
  - Not all garden hoses are made of safe materials

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Building Materials cont'd

- Wood
  - Bare wood should never be touching the water in your system
  - If wood touches the water in your system:
    - Sealant must be food grade
    - Wood should not be treated for termites

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Things you can grow…

…with the right system.








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Some of the things we've grown

- Banana
- Artichoke
- Basil
- Parsley
- Ginger
- Okra
- Eggplant
- Cucumber
- Tomatoes
- Avocado
- Pineapple
- Papaya
- Blood orange
- Lemon
- Kale
- Mint
- Peppers
- Marigold
- Corn
- `awa
- Mamaki
- Sweet potato
- Sugar cane
- Kalo
- Leafy greens
- Dill
- Mountain apple
- Ginger
- Strawberry
- Okinawan spinach
- Nasturtium
- Garlic chives
- Spearmint
- And more…

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Keep it simple

- Although the concept of aquaponics has been around for thousands of years, commercial aquaponics is less than 10 years old
- It's not necessary to over-complicate aquaponics
- Selecting the right materials & grow system is easy to do and can substantially increase your success rate

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