Adventures in

Sustainable Agriculture, Aquaponics

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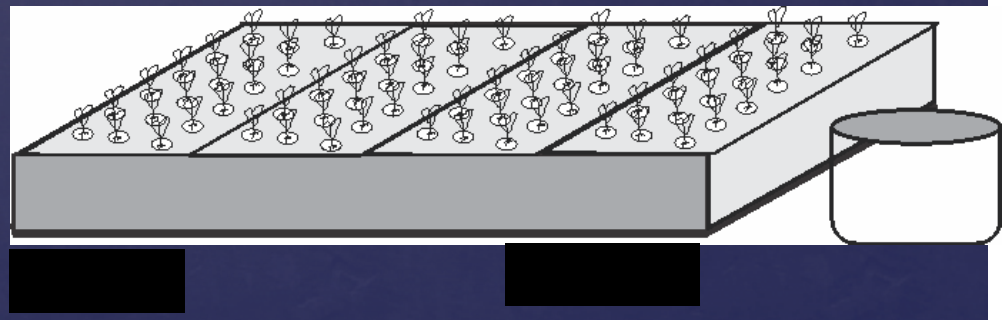
- I have been teaching and hold a National Teaching Award. My students are successful all around the state. One organized this workshop. I became a world leader in my field and yadda yadda (UH stuff).
- So I thought why not go for the whole 9 yards.
- Objectives.
  - Create aquaponics businesses.
  - Create jobs in aquaponics.We all give lipservice to helping industry.

Assisting in starting farms

Aquaponics

- Symbiotic production of fish and vegetables. Grow trays and fish tank.
- 3-6 X more productive per unit area of space than traditional.
- Uses 2% of the water as traditional.
- Environmentally friendly, no effluent.
- Very much suitable for islands.

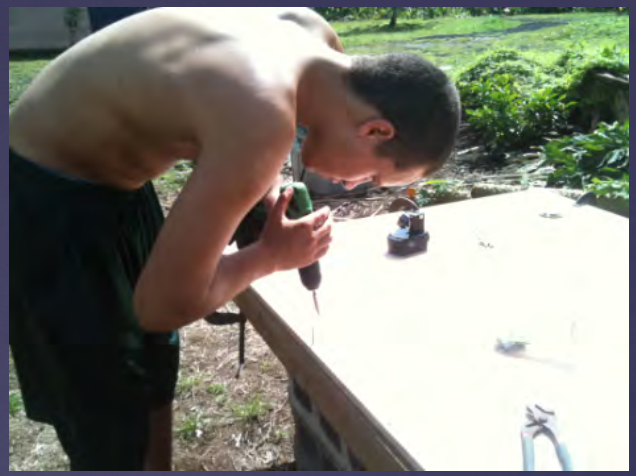
- Picture a schematic of a research unit. Growbox, plant holders, fish tank, bricks.



- James Rakocy invented aquaponics. He deserves credit for it. His systems are not good enough for commercial production.
- UH has
  - Decreased capital expenses (6X)
  - Developed management schemes and made them economical

Where did we start from?

- Samoa
- There is little food security. All fruits and vegetables are air-flown from New Zealand. **They are very expensive**
- Construction is intimidating. When someone works along side, it is easy.
- We constructed 3 systems.
- We worked with them on marketing



Interesting issues when attempting to help new farms

We (David Walfish) won a business plan contest with the Harvard business school. Social entrepreneurship.

We stayed one crop cycle

- Watercress production.
- A crop with an upside market.
- Franchising now

Fred Lum, a 20 year history working on recirculation aquaculture. Shows that aquaculture skills are the most important.

Fish raceway under roof. No sun to grow algae which use up vegetable nutrients

However, started with a small aquarium air pump. Low DO meant denitrification and vegetables starving for nitrate fertilizer. This was a problem which we solved. Also had to help learn how much to feed according to the nutrient flux hypothesis.

Whereever we go we see traces of Kai Fox and Clyde Tamaru. The help is good. They did gravel biofilter.

Mari's Garden

- Good production
- Good prices because organic and unique taste
- 28 raceways
- 4,000 lbs/month, six new jobs

Mari's Garden

Ed Otsuji, king of the CSAs

- Was going to build a one plywood sized, pre-made system. Price was the same as this six plywood system shown here.
- Learning from Samoa, we took only half a day to teach him how to build.
- Had a nutrient flux problem. More fish.
- Had a shading problem for fish. Covered.
- Gets very good prices for watercress. Likes farmers' markets.
- Each farmer has a unique system.

- Just starting.
- Needed help with starter
- fish.
- Needed instruction in the nutrient flux hypothesis.
- Needed engineering specifications for construction .etc.
- If it didn't make sense smart people wouldn't do it.

Iliili Farms. A construction company who thinks aquaponics is interesting.

Summary

- It was good to create new businesses in Hawaii
- It was good to create new jobs for STEM students in Hawaii
- And then a goal would be to train students to fill those job slots
- Some farmers succeeded in part due to experience and intuition. Among students success or failure depended on STEM skills. This is a new world. Fractions. 2% bodyweight feeding. Pump sizes.

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- Lowering capital and operating costs
- Nutrient Flux Hypothesis to balance fish/plant/feed ratio
- Denitrification and its prevention
- Economical solids removal
- Economical aeration
- We approached it as a STEM problem. Students are molecular biosciences majors

Research was needed.

Philosophy on hoped for impacts

- It would be good to create new businesses in Hawaii
- It would be good if someone created new jobs for students in Hawaii
- And then a goal would be to train students to fill those job slots