Aquaponics Update

R. Charlie Shultz

Aquaculture Boot Camp 2
OSU South Center
March 11, 2017

Environmental Pollution





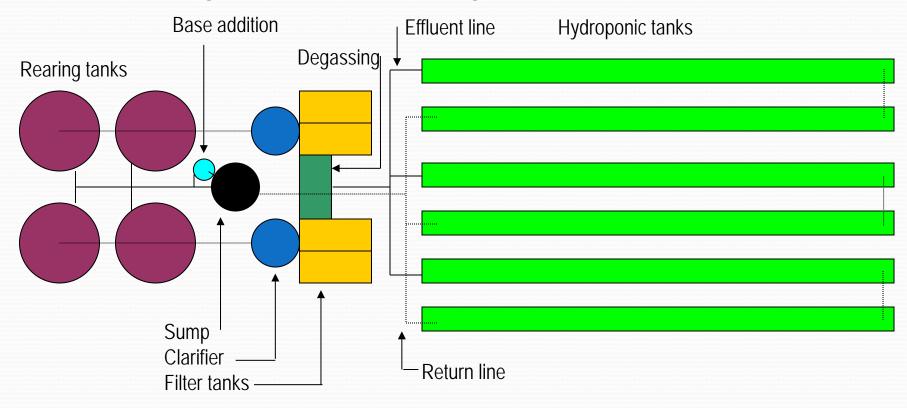
Recirculating Aquaculture



University of the Virgin Islands



UVI System Layout



Total water volume - 29,000 gallons Land area - 1/8 acre 2,300 ft2 plant area

SRAC 454

Recirculating Aquaculture Tank Production Systems: Aquaponics—Integrating Fish and Plant Culture

James E. Rakocy, Michael P. Masser and Thomas M. Losordo 2006 Revised

Kentucky Aquaponics





Kentucky State University

2013. Tidwell, Comford, Pomper, Tope, Dasgupta, Shultz, Wynne, Tiu. Evaluation and Development of Aquaponics as a Potential Source of Fresh and Safe Vegetables and Fish for Urban Minority Populations. 1890 Institution Teaching Research and Extension Capacity Building Grants Program.

Lethbridge College



2015. Funicelli, Shultz, Savidov, Olsen,
Derksen. Advancing Commercial Food
Production Through Integrated Plant and Fish
Systems to Meet the Needs of Industry and
Community. National Science and Engineering
Research Council of Canada (NSERC) 5 year
CCI.

EU Aquaponics Hub: Realising Sustainable Integrated Fish and Vegetable Production for the EU

COST Action FA1305

LilyPad Farm San Marcos, TX



Economic Analysis of Commercial Aquaponic Production Systems

Kevin Heidemann and Dr. Tim Woods University of Kentucky

Travis County Correctional Facility

• http://www.twcnews.com/tx/austin/news/2015/07/15/
travis-county-inmates-learn-new-way-to-grow-food-for-jail.html

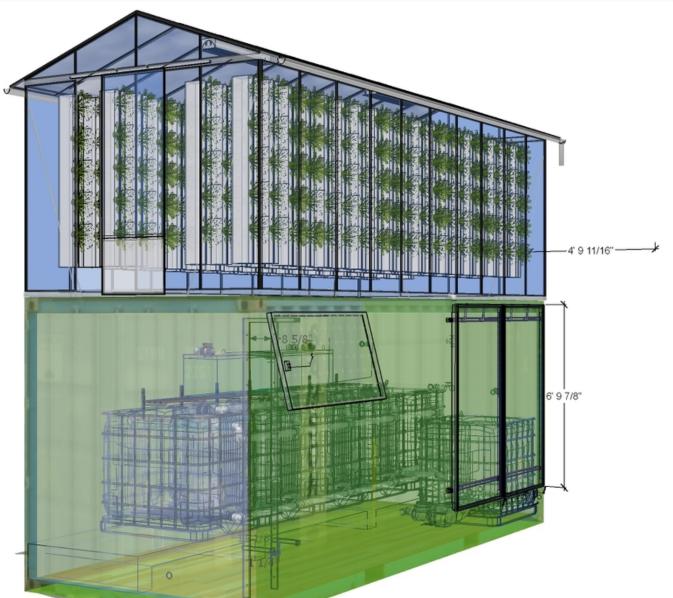
Santa Fe Community College



Greenhouse Expansion @ SFCC



Farm In A Pod



What is Aquaponics?

- Not Just Hydroponics plus Aquaculture
- Balanced or De-Coupled
- Commercial or Smaller
- Don't ask the Regulators or Inspectors! Educate them.
- Associations
- Certification
- Is it Organic?

Development of a Mature Ecosystem

Aquaponics vs. hydroponics Yield 2003 Aquaponics Hydroponics 80 70 60 Yield, kg/m² **50** 40 30 20 10 0

Cucumbers

Tomatoes

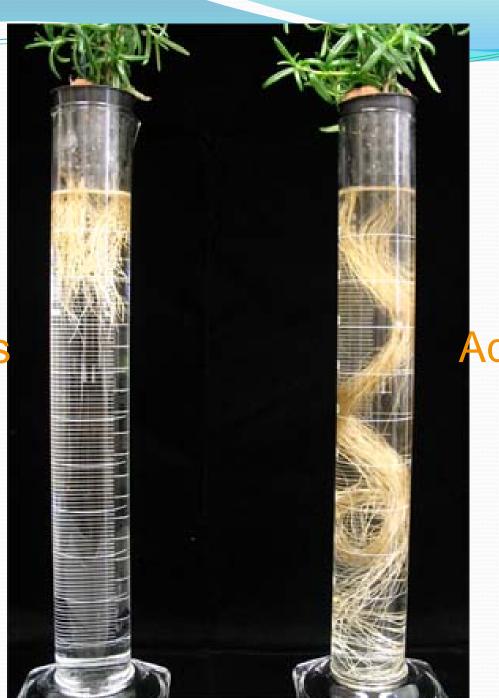
Aquaponics vs. hydroponics Yield 2004 Aquaponics Hydroponics 80 70 60 Yield, kg/m² **50** 40 30 20 10 0

Tomatoes

Cucumbers

Rosemary roots

Hydroponics

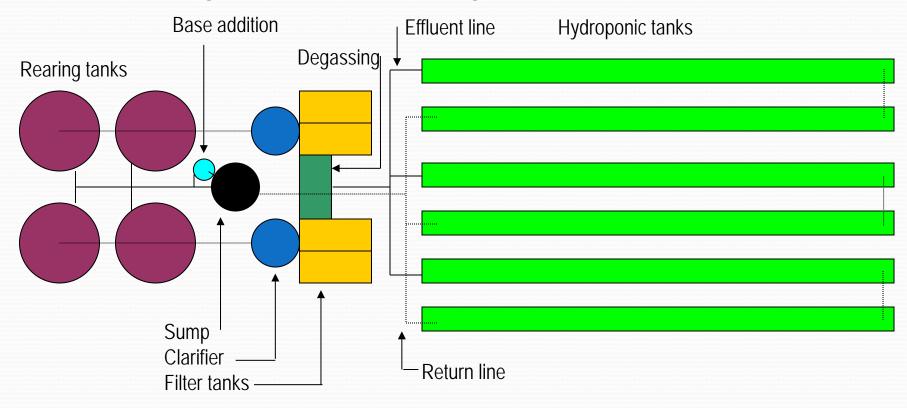


Aquaponics

Balanced Aquaponic Systems

(the key is consistency)

UVI System Layout



Total water volume - 29,000 gallons Land area - 1/8 acre 2,300 ft2 plant area



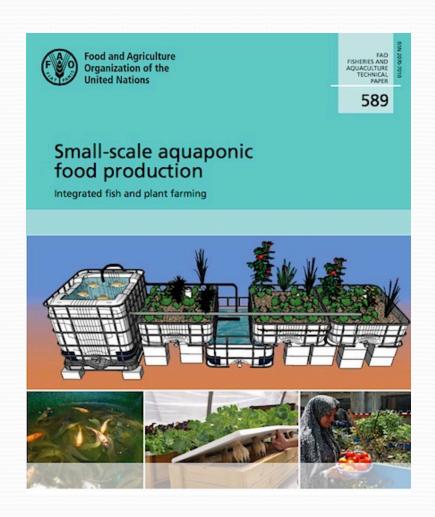
The Biofilter that make money for you!

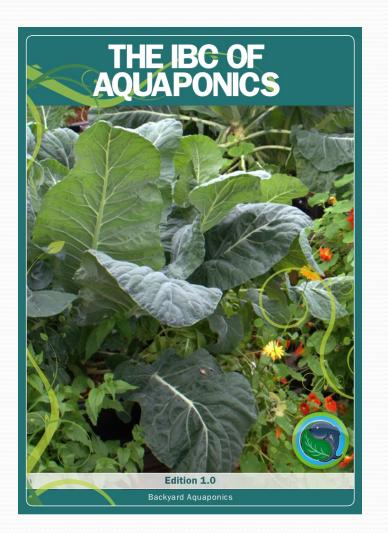
Media Based Systems





IBC-Ponics





Keep Feed Input Relatively Constant

- Provides a constant level of nutrients for plant growth
- Two methods:
- (1) Multiple rearing tanks and staggered production Example: UVI system, 4 rearing tanks, 24-week production cycle, one tank harvested every 6 weeks, feed input decreases ~80% in harvested tank, feed input to system decreases 25-30% at harvest

Advantages: saves labor, good control of stock Disadvantages: wasted space, higher capital cost



Keep Feed Input Relatively Constant

 (2) A single rearing tank with multiple size groups of fish (sequential rearing):

Example: 6-month production cycle, 6 size groups, monthly harvest of large fish with grader, restock equal number of fingerlings

Advantage: conserves space, reduces capital costs

Disadvantage: increases labor costs, increases mortality, disrupts feeding, stunted fish accumulate



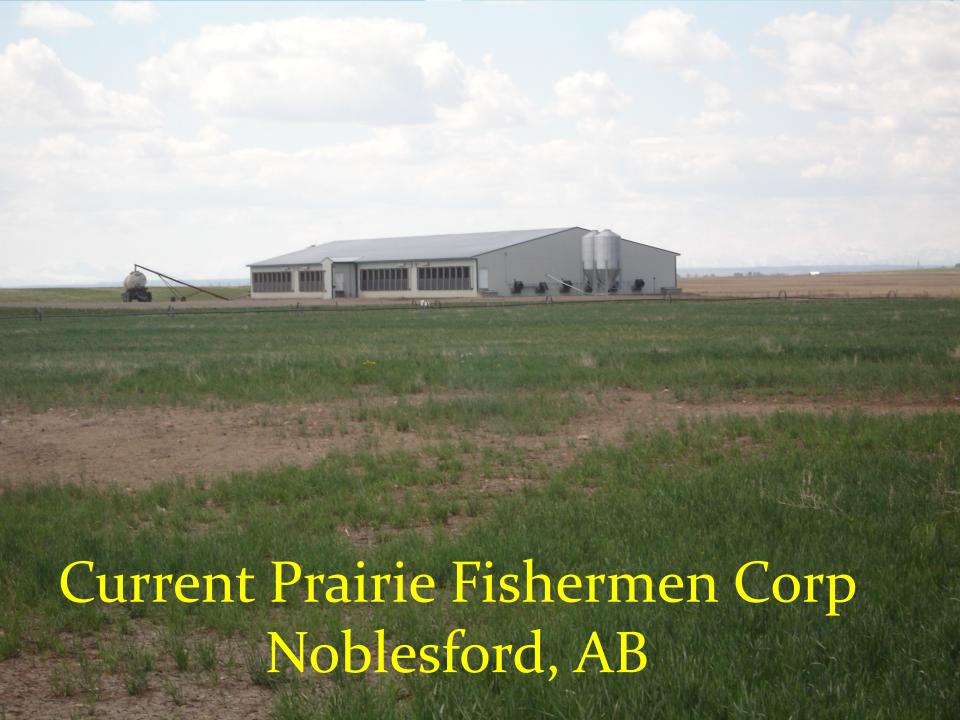


De-coupled Aquaponic Systems

Lethbridge College



Alberta, Canada

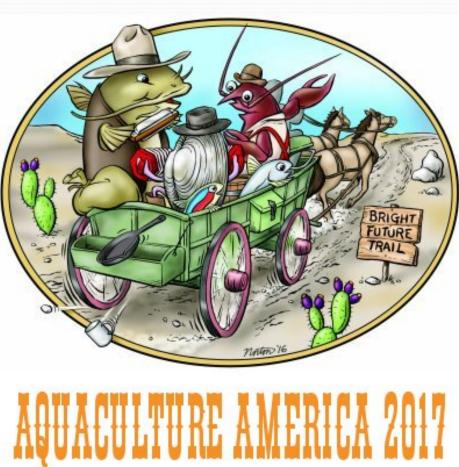


Education

- Conferences
- Specialized Courses
- Internet Social Media
 - FB UVI AP, Decoupled/Dual Loop Aquaponics, Aquaponic Professionals, Mainstream Aquaponics
- Books
- Extension specialists
- Internships
- University

Meetings





Marketing the Story

- Tell the Positive Attributes
- Ecotourism
- Niche Crop Mix
- Do Your Market Homework First!

It's a Great Story!





Which species of fish?





Tilapia! Why Not!!



Tilapia has a terrible reputation. Does it deserve it?

Washington Post
Oct 2016

Sturgeon



"Dirty water is for Fish....Clean water is for Fish Farmers"...J. Henry

KoiPonics



Cabrillo Community College





Plant Potential Production

Variety	Density (plants/m²)	Area planted (m²)	Yield (ea.)	Cases (24/case)
Sierra leaf	20	26.7	535	22.3
Parris Island romaine	16	26.7	428	17.8
Total		53.5	963	40.1

- Production of both varieties was superior in cool winter months
- Production declined when water temperatures were warm and *Pythium* killed roots which suppressed plant growth.

Production Value

Variety	Density (plants/m ²)	Growth Period (weeks)	Value (\$/head)	Value (\$/m²)	Value (\$/m²/week)
Parris Island romaine	16	4	2.00	32.00	8.00
Sierra leaf	20	4	1.50	30.00	7.50
Boston Bibb	30	3	1.00	30.00	10.00

 High density and frequent harvests has higher value even when individual value is low.

Other greens

Variety	Density (plants/m ²)	Growth Period (weeks)	Yield (kg/m²)	Value (\$/kg)	Value (\$/m²)	Value (\$/m²/we ek)
Pak choi	30	3	8.00	3.30	26.40	8.8o
Kale	30	3	0.89	6.59	5.86	1.95
Collards	30	3	0.45	6.59	2.96	1.48
Swiss Chard	30	3	1.44	6.59	9.49	3.16
Basil	16	4	1.80	22.05	39.60	9.90

 Leafy green crops take advantage of abundant nitrogen in the system and easy nutrient management.

Cornell Hydroponic Lettuce Handbook

An Overview of Aquaponic Systems: Hydroponic Components

D. Allen Pattillo Iowa State University, pattillo@iastate.edu

Testing Water and Plants



Plant Analysis Handbook III A Guide to Sampling, Preparation, Analysis and Interpretation for Agronomic and Horticultural Crops

Gretchen M. Brysoni Haery A. Villis David N. Sasseville J. Benton Jones, Jr. Allen V. Barker

Niche Markets

Medicinal or Recreational



System Design

- NFT
- Media
- Deep Water Culture
- Aeroponics
- Hybrid

Nutrient Film Technique (NFT)





Media Based Systems





Nutrient Film Technique



Deep Water Raft Culture (DWT)





Sludge Management

Discharge it

Mineralize it (zero-discharge)





Controlled Environment Options





Urban Aquaponics

Aquagrowers (Livonia, MI) Foodchain (Lexington, KY)





Brewery Waste to Fish Feed





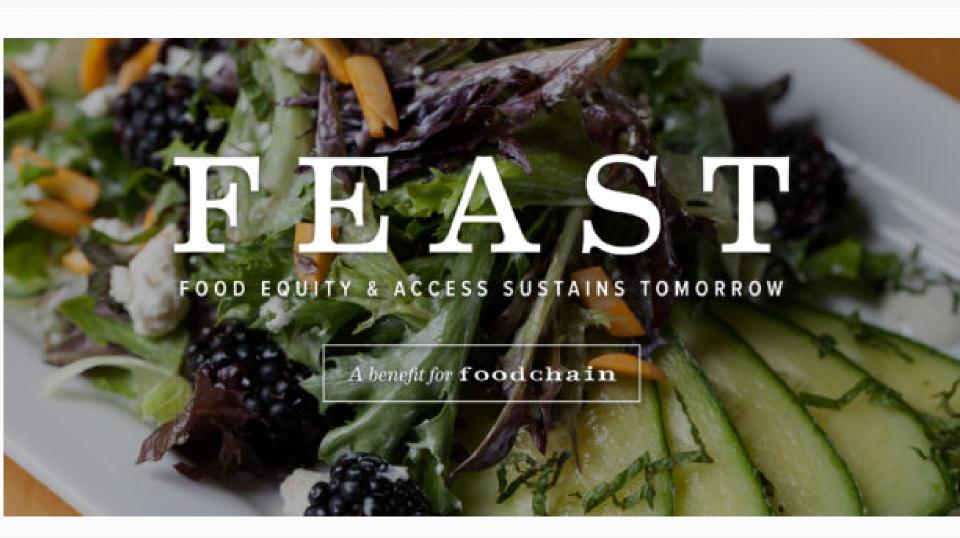
FoodChain





SMITHTOWN BEE

Tuesday March 14, 2017



Are You Making Money?

- Economies of Scale
- Analyze Financial Statements
- Do an Energy Audit
- You Don't Make Money Growing Fish and Plants...
 You Make Money SELLING them!

"Farming looks mighty easy when your plough is a pencil" D.D. Eisenhower

Aquaponics Business Plan Users Guide

epa.gov

Panel Discussion Topics

Fish and Plant Varieties Greenhouse Design Heating and Ventilation

Lighting

Pest Control

Fish Nutrition

Water Quality

Food Safety

Marketing and Business Management Certified Organic and Other Certifications

Thank you again, Ohio!



Charlie Shultz

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