Ebb and Flow Methods in Aquaponics

Commonly used methods and arrangements

"Time and Tide waits on no man"

Rex Byrns
1206 Salem Road
Victoria, TX 77901
361-655-4987 (cell)
rex@megansgardens.com
www.facebook.com/megansgardens

MEGAN'S GARDENS
Locally Grown Aquaponic Produce

Growing Methods

- DWC – Deep water culture
  - See papers from UVI
  - Most authentic research of any method in aquaponics
- Ebb and Flow in a Grow Media
- NFT – Nutrient Film Technique
- Continuous Flow
- Wicking Beds
- Hybrid Systems

The Cycle

- Fish excrete Ammonia
- Bacteria convert the Ammonia to Nitrite (poisonous to fish)
- A second group of bacteria convert the Nitrite to Nitrate (Feeds the Plants)
- Water is safe for fish

Fishless Cycling

Fishless cycling is my preferred method. It is simple but requires patience.

The first thing to learn is that only ACE Hardware carries pure Ammonia. All others that I found had added surfactants, perfumes or other..

Urea, Chicken Manure, P, and fish food are alternatives to ammonia but not recommended on a first attempt.

Cycling tends to take two weeks minimum, no matter what you do to try to do to help it.

Steps in Cycling

- Build your system
- Fill with water and run for a couple of days to take care of leaks and such
- Get some plants in the system
- Add liquid seaweed with iron to give them something to eat until your fish start working for you.
- Get pure ammonia from ACE hardware
- Get yourself an API Master water test kit that includes High and Low PH, Nitrite, Ammonia, and Nitrate test solutions. (Note: some kits do not have the Nitrate and have water hardness instead)
- Add ammonia to your system until you read a 10 to 20 ppm. Track how much you added to get to that point.
- Test every day until you start seeing Nitrites. Every other day add Ammonia to keep the level that you started at.
- When you are adding the same amount every other day that you used to start, you should start testing for Nitrate.
- You are cycled when Ammonia daily reads almost zero, Nitrite reads zero, and Nitrates are climbing.
- Stop adding ammonia for a day. Confirm the absence of ammonia and nitrites with the presence of Nitrites.
- Add fish and get to gardening. Bring over neighbors, tell everyone who will listen and pay attention to signs of extreme addiction.

What is Happening?

- Think about basic plant needs
  - Water and Nutrients
  - Air/Oxygen
- Remember that Growth occurs in aerobic conditions. Unless your water is HIGHLY oxygenated, you are in an anaerobic condition while flooded.
- Ebb and Flow provides a method to make sure that your plants get all that they need. All the Water AND All the Air that they NEED!

Pros of Ebb and Flow

- Very reliable
- Most inexpensive
- Simple
- More Efficient
- Flexible if Planned well
- Lower evaporation losses
- Provides a great atmosphere
- Has a couple of hidden benefits

Cons of Ebb and Flow

- Can be VERY frustrating when things go wrong
- Almost always requires a sump tank
- Limited by sump volume
- Modification can be difficult
- Special considerations must be considered in large systems
- Again in larger systems it is not preferred if hydroponics is used alternately.

Definition

Also known by the more descriptive name "Flood and Drain".

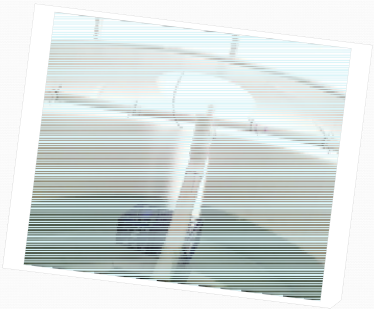
The typical system will use a water tight grow bed filled with an inert media that provides support for the roots. The media is flooded with water to a specified level – sometimes held for a time – then drained to a specified level. The process repeats over and over at sometimes specific intervals.

System Design Considerations

- How much and of what do you want to grow?
  - Maximum fish AND plants
  - Maximum Plants
- Year round?
  - Winter only?
  - Summer only?
- Indoors – Outdoors – Hybrid?

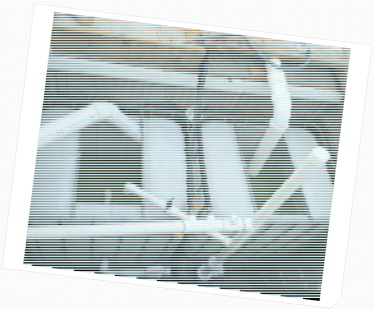
Main Fish Tank

1200 Gallons with a 4 inch SLO (Solids lift orifice) and 2 inch spray bar. The holes are drilled at an angle to cause a strong counter clockwise swirl in the water to keep the bottom as clear as possible



Sump Tank

Two 275 gallon totes are buried with a ¾ horse swimming pool pump with built in filter cup. The pump intake ties both totes together using uni-seals. The 4 inch pipe on the left comes from the fish tank overflow while the 4 inch pipe on the right is the overflow from the hybrid DWC trough. The two inch pipe on the pump output has a bypass return, one inch black poly lines that go to the grow beds while the remainder goes to the fish tank.



Overview of Grow Area

ALL water goes to the grow beds first. The expanded shale works as a filter for solids which are bad in a DWC trough. Because I wanted to make sure that the nutrients were evenly distributed, the trough is fed from the grow beds at four different points.

Hybrid DWC Trough

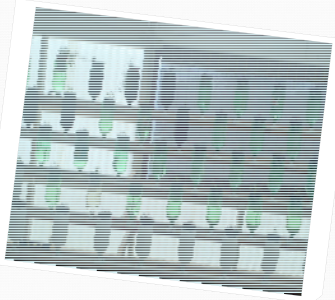
I use corrugated poly sheets reinforced with ½ inch conduit. It is not actually in contact with the water, rather it suspends the net cups above the water. The distance between the two can be easily adjusted. The purpose for this design is to provide a way where some of the roots always get air and some always get water. There are air bubblers every 4 feet.

Clean White Roots

Overall dimensions are 4 foot by 66 feet long. In version 2.0 the raft will be narrower to make it easier to work. Some plants get very heavy. I have 2 inch holes at 7.5 inch spacing. It is a little too close for some things but just right for "baby" crops.

I love Bottles

Another hybrid design of mine. The bottles that are painted white are for a kids project where they can paint a bottle in a contest. When summer arrives the unpainted ones get covered in bubble wrap mylar insulation. They are little radiators, much like zip grow towers and NFT systems.



Various Methods of Flood and Drain

Lessons Learned

- When plumbing a gravity return – use the double and halve rule. Example: if using 1 inch supply line, use a 2 inch return
- Make PH adjustments SLOWLY! Remember a points difference is double or half as much alkalinity or acid.
- Your fish will not instantly die if they skip a meal or two
- Stratification in grow media can happen
- You can use oyster shell to buffer your ph up, but you can't put nails in a system to add iron.
- You don't have to glue your pipes – but in some places you should.
- Shade your fish tank
- Rotate fish water every hour – two hours minimum
- Use Red Wiggler Worms
- Hydrated Lime and Potassium Hydrate (Lime) should be alternated
- Know your Chelated Irons – EDTA, DTPA, HEEDTA and EDDHA
- Not Everything You See on the Internet is Accurate
- A ph of 6.2 is ok
- Keep your color keys out of the sun, they will fade – and you might not notice it.
- Protect your bacteria – Remember that you are farming 3 things
- Adjust your PH if you must with top-off water
- Keep out the dead stuff – Your system is a closed loop – Wash your hands frequently

Good Information

- Bright AgroTech – Dr. Nate Storey
- The Aquaponic Source – Silvia Bernstein
- Brite Ideas – bihydro.com (Austin and San Antonio locations.
- Let your fish be your organic certification committee
- Learn about cloning
- Find doers not wannabes
- Scrounging can save you lots of money.
- Have fun

Questions & Answers

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