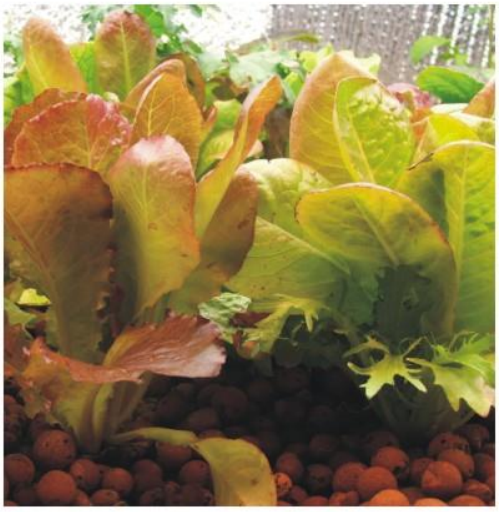
THE Aquaponic SOURCE™
Growing Fish and Plants Together

WHAT IS AQUAPONICS?

AQUA + **PONICS**

Aquaculture – Raising fish in a controlled environment

Ponics – Is Latin *"to work"*, Growing in soil-less media



Fish eat and produce ammonia
Beneficial bacteria convert ammonia into nutrients
Plants absorb the natural fertilizer
Water is continuously recirculated through the system

What is Aquaponics?

Many definitions of aquaponics recognize the 'ponics' part of this word for hydroponics which is growing plants in water with a soil-less media. Hydroponics is its own growing method with pros and cons (discussed later).

Literally speaking, Aquaponics is putting fish to work. It just so happens that the work those fish do (eating and producing waste), is the perfect fertilizer for growing plants. And man, fish can grow a lot of plants when they get to work!

One of the coolest things about Aquaponics is that it mimics a natural ecosystem. Aquaponics represents the relationship between water, aquatic life, bacteria, nutrient dynamics, and plants which grow together in

waterways all over the world. Taking cues from nature, aquaponics harnesses the power of bio-integrating these individual components: Exchanging the waste by-product from the fish as a food for the bacteria, to be converted into a perfect fertilizer for the plants, to return the water in a clean and safe form to the fish. Just like mother nature does in every aquatic ecosystem.

In combining aquaculture and hydroponic systems, aquaponics capitalizes on their benefits and eliminates the drawbacks of each.

Let's consider the other forms of growing plants and fish and see how they compare with aquaponics.

Traditional Soil Gardening

Soil can be a wonderful natural resource, or a very time-consuming element to manage when you are trying to grow plants.

- Some soils have robust fertile live soil-web ecosystems. However, many soil structures that are heavy in clay or sand have challenges related to water, nutrient availability and texture for planting. Many locations lack soil access because they have concrete, asphalt or rock to contend with.
- Along with water runoff, erosion, wind and other soil depleting events, soil loses fertility with each crop. To grow plants in soil, it is necessary to reapply compost or some other fertilizer each growing season. Fertilizers with only N – P – K (Nitrogen, Phosphorus and Potassium), means that the plants grown will absorb these nutrients, but could be depleted of other micro-nutrients such as calcium, boron, copper, iron, zinc, and many others. Applying too much synthetic fertilizer or uncomposted manure can create salinity issues rendering the soil "too hot" to grow crops.
- Managing weeds, pests, insects and diseases takes a significant amount of the gardener or farmers time. Weeds crowd plants, taking water and nutrients, not to mention all the time wasted killing or pulling them out. Pesticides, herbicides and other chemicals can also kill precious soil microbes and can be dangerous to bees, butterflies, birds, other animals, and humans.
- In large scale industrial farming, agrochemicals (fertilizers, pesticides, and herbicides) along with Genetically Modified Organisms (GMOs) are of concern when choosing vegetables, fruits, and herbs. Organically grown crops do not allow GMOs but do have a wide variety of products used for pesticides.

- Soil can be very difficult to water correctly. Overwatering can result in flooding, evaporation, runoff, soil compaction, prevent air to get to the roots and kill plants with saturation. Alternatively, too little water, hot dry climates, drought and water shortages can wreak havoc on plant growth and can easily result in plant death as well.
- Gardening can be an enjoyable past-time but also demands a certain amount of digging, bending, and physical labor
- While gardens can be located in your backyard. Industrial farms are often thousands of miles from where their food is consumed. This requires extensive transportation, refrigeration, and packaging to get the food from farm to table.

Traditional Hydroponics

Hydroponics Solves Many Soil Based Issues, However, It Also Offers Its Own Problems

- Traditional hydroponic systems rely on the careful application of expensive, man-made nutrients made from mixing together a concoction of chemicals, salts and trace elements. In aquaponics, you merely feed your fish inexpensive fish feed, food scraps, and food you grow yourself.
- The strength of this hydroponic mixture needs to be carefully monitored, along with pH and total dissolved solids (TDS). In aquaponics you carefully monitor your system during the first month, but once your system is established you only need to check pH and ammonia levels weekly or if your plants or fish seem stressed.
- Water in hydroponic systems needs to be discharged periodically, as the salts and chemicals build up in the water, becoming toxic to the plants. This is both inconvenient and problematic as the disposal location of this wastewater needs to be carefully considered. In aquaponics, you do not need to replace your water; you only top it off as it evaporates.
- Hydroponic systems are prone to a disease called “Pythium” or root rot. This disease is virtually non-existent in aquaponics.

Recirculating Aquaculture

Most mainland fisheries are Recirculating Aquaculture Systems, or RAS, which tries to filter and re-use fish tank water. While RAS does attempt to address water conservation, it also brings it's own issues

- The tank water becomes polluted with fish effluent, giving off high concentrations of ammonia. Water has to be discharged at a rate of 10-20% of the total volume in the tank daily. This uses a tremendous amount of water. *Again, in an aquaponics system, you never need to discharge your water*
- This water is often pumped into open streams where it pollutes and destroys waterways.
- Because of this unhealthy environment fish are prone to disease and are often treated with medicines, including antibiotics. *Fish disease is rare in an aquaponics system.*

Aquaponics

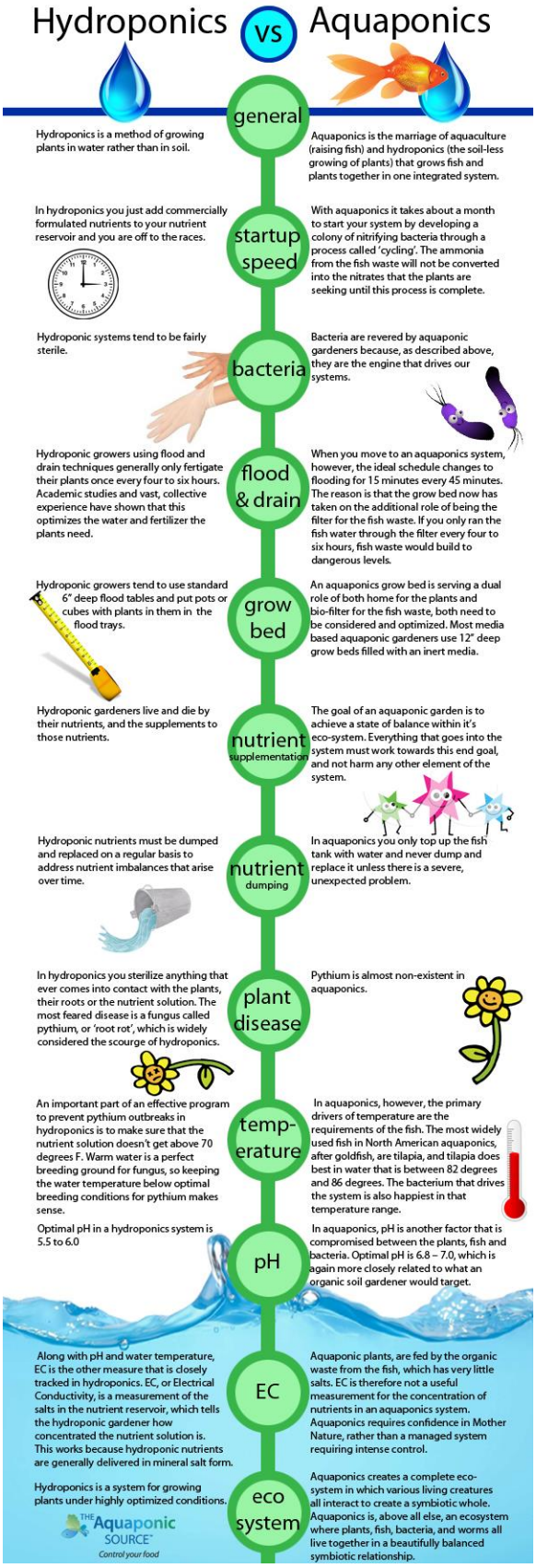
Aquaponics uses the best of all the growing techniques, utilizing the waste of one element to benefit another mimicking a natural ecosystem. It's a game changer

- Waist-high aquaponic gardening eliminates weeds, back strain, and small animal access to your garden.
- Aquaponics relies on the recycling of nutrient-rich water continuously. In aquaponics, there is no toxic run-off from either hydroponics or aquaculture.
- Aquaponics uses 1/10th of the water of soil-based gardening and even less water than hydroponics or recirculating aquaculture.
- No harmful petrochemicals, pesticides or herbicides can be used. It's a natural ecosystem.
- Gardening chores are cut down dramatically or eliminated. The aquaponics grower is able to focus on the enjoyable tasks of feeding the fish and tending to and harvesting the plants.
- Aquaponic systems can be put anywhere, use them outside, in a greenhouse, in your basement, or in your living room. By using grow-lighting, and space can become a productive garden.
- Aquaponic systems are scalable. They can fit most sizes and budgets, from small countertop herb systems to backyard gardens, to full-scale farms, aquaponics can do it all.
- And the best part – You get to harvest both plants and fish from your garden. Truly raise your entire meal in your backyard
- Instead of using dirt or toxic chemical solutions to grow plants, aquaponics uses highly nutritious fish effluent that contains all the required nutrients for optimum plant growth. Instead of discharging water, aquaponics uses the plants, naturally occurring bacteria, and the media in which they grow in to clean and purify the water, after which it is returned to the fish tank. This water can be reused indefinitely and will only need to be topped-off when it is lost through transpiration from the plants and evaporation.

There are a few primary methods of aquaponic growing widely in use today:

- **Deep water culture** (DWC) or *raft based* growing uses a foam raft that is floating in a channel filled with fish effluent water that has been filtered to remove solid wastes. Plants are placed in holes in the raft and the roots dangle freely in the water. This method is most appropriate for growing salad greens and other fast-growing, relatively low-nutrient plants. It is also most commonly used in larger commercial-scale systems.
- **Media-based Aquaponics** Media growing involves growing plants in inert planting media such as expanded clay pellets or shale. The media provides both the biological filtration (conversion of ammonia to nitrates) and mechanical filtration (removal of solid wastes) in the same system. Media-based systems are great for home and hobby scale systems so you can grow a wide variety of crops. In particular, large fruiting plants do really well in addition to leafy greens, herbs and other varieties. Examples of media-based systems are the Harmony (pictured), the AquaUrban 60 gallon system, and the AquaBundance system
- **Nutrient Film Technique** (NFT) NFT systems work by flowing nutrient-rich water through a narrow trough, such as a PVC pipe. Plants are placed in holes drilled in this pipe, and the roots dangle freely in this stream of water. This method of growing works very well for plants that need little support, such as strawberries (pictured) and other herbs. NFT is also a great way to utilize unused space because they can be hung from ceilings above other growing areas.
- **Vertical Aquaponics** One of the greatest aspects of aquaponics is its ability to grow an incredible amount of food in a very small area. No method does this better than vertical aquaponics. Plants are stacked on top of each other in tower systems such as the AquaVertica. Water flows in through the top of the tower, and flows through a wicking material that the plants roots absorb water and nutrients from. The water then falls into a trough or directly into the fish tank. This form of agriculture makes the most of each square foot of space, and works very well with leafy greens, strawberries, and other crops that do not require support to grow.

AQUAPONICS VS HYDROPONICS



Similar Concept – Yet Very Different Approach and Systems

AQUAPONICS is the combination of aquaculture (raising fish) and hydroponics (the soil-less growing of plants) that grows fish and plants together in one integrated system.

HYDROPONICS is a method of growing plants without using soil (i.e., soil-less). This technique instead uses a mineral nutrient solution in a water solvent, allowing the nutrient uptake process to be more efficient than when using soil. There are several types or variations of hydroponics.

Many new growers are torn between two techniques: aquaponics vs hydroponics. Each technique has its potential; aquaponics draws you in with the allure of living creatures, and hydroponics with its precision and control.

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4 WAYS AQUAPONICS IMPROVES ON HYDROPONICS

1. NUTRIENTS

Expensive Hydroponic nutrients are replaced by less expensive fish feed

NUTRIENTS

You know how much you spend on nutrient solution every year. Now consider this scenario: in our AquaUrban Aquaponic System, a 60-gallon tank powers 7.5 sq ft of growing space. In that space, you can grow 6 – 7 indeterminate tomato plants and about 10 tilapia. The only inputs to the system are ~15 watts of power for the pump (let's say that is equivalent to hydroponics), water to top off the tank (less than in hydroponics because you never discharge and replace the nutrient solution) and fish food.

Tilapia grow from fingerling stage to plate-sized (1.5 lbs) within a year. Tilapia convert feed to body weight at an efficient 1.2 – 1.5 lb of fillets for every 1 lb of feed. This means that you will need (10 * 1.5 * 1.5) = 22.5 lbs of fish feed per year to raise your 10 tilapia. Fish feed costs about $1/lb depending on feed quality, shipping costs, bulk pricing, etc.

So this means you're running a 7.5 square foot grow bed for about $22.50 spent on nutrients per year…AND YOU GET 10 FRESH, DELICIOUS FISH AT THE END OF THAT YEAR!

2. AQUAPONICS MIMICS NATURE

Aquaponics must be organic, by nature

AQUAPONICS MIMICS NATURE

Hydroponics is all about growing in a sterile, man-made environment, tailored specifically to the plant species you're growing. Traditional hydroponic systems rely on the careful application of expensive, mined (often through unsustainable practices) nutrients made from mixing together a concoction of chemicals, salts, and trace elements.

In aquaponics, you are creating a natural ecosystem where you rely on bacteria and composting red worms to convert the ammonia and solid waste from the fish into a complete plant food. It is a necessarily organic process. If pesticides are applied to the plants, the fish will suffer. Conversely, if growth hormones or

antibiotics are given to the fish, the plants will suffer. Aquaponics is the management of a full ecosystem, so one input will inevitably interact with everything in the system.

Aquaponics relies on natural biological processes and is rewarded through better growth, less maintenance, and lower disease rates over time. If you can't beat Mother Nature, you might as well join forces with her.

3. ZERO WASTE

Unlike Hydroponic systems, Aquaponics never requires discharging water.

ZERO WASTE

Water in hydroponic systems needs to be discharged periodically as the salts and chemicals build up in the water which eventually becomes toxic to the plants. This is both inconvenient and problematic as the disposal location of this wastewater needs to be carefully considered. Rather than having these problems with a chemical imbalance, aquaponic systems achieve a natural nitrogen balance that is the hallmark of an established eco-system.

In aquaponics you NEVER replace your water; you only top it off as it evaporates.

4. MORE PRODUCTIVE

Aquaponics (vs Hydroponics) is more productive

MORE PRODUCTIVE

A university study has now shown that after the aquaponic bio-filter is fully established a grower will see faster and better-growing results with aquaponics vs hydroponics. (Click here for a study by Dr. Nick Savidov, of the Crop Diversification Center South, Alberta Agriculture Food, and Rural Development at Brooks, Alberta, Canada report in the Aquaponics Journal, 2nd Quarter, 2005.)

Aquaponics is actually more productive than hydroponics!