



Aquaponics 101 – Style and Types

The technology of aquaponics has grown immensely over the past 30 years. In the ten years I have been actively involved in aquaponics, there has been a sharp increase in the interest and availability of information. What was once the domain of backyard and patio hobbyist is now a commercially viable concept that is getting the respect and study it deserves. Several major university agriculture extension services now have full-time aquaponics research facilities and staff. The University of the Virgin Islands offers a degree course and there are any number of private companies supplying everything from ready-made parts to full-blown design and installation service for large commercial operations. Aquaponics has come of age.

Understanding the scope of Aquaponics Systems

While the hobbyist is the focus of our efforts here, it is worthwhile to have an understanding of the wider picture. Knowledge of how aquaponics can be scaled to commercial operation size and the difference between a home hobby installation and a commercial operation gives insight into the possibilities of aquaponics.

Flood and Drain Systems

Most hobbyists start with a simple flood and drain system. These can be as simple and as small as a 10-gallon aquarium with a plastic dish on top to hold the grow media. These lend themselves well to apartments and schools and can provide a means for the hobbyist to grow herbs and small greens year round.



IBC Tote Systems

Probably the most popular system build for the hobbyist is a system constructed from an IBC tote, usually the 275-gallon type. These are the plastic tanks with a metal cage supporting the plastic lining that you see almost everywhere. They are used to move bulk liquids for commercial use and can often be sourced for a minimal investment.

The metal supporting cage makes these ideal for constructing a self-supporting stand-alone aquaponics system. Their size lends them to the home environment and the construction of the metal cage makes repurposing the tank simple and quick. We will spend more time later on the details of constructing a system from an IBC tote.



Other alternatives

Almost anything can be used to construct an IBC tote. The limits are your own imagination and the time you wished to spend on the internet doing little research. There are hundreds if not thousands of ideas on building home hobby systems. Many are constructed using plastic 55-gallon barrels. If space is a limitation, consider building a small system using an aquarium and plastic tubs. The possibilities are unlimited.



RAFT Systems

RAFT systems, otherwise known as Deep Water Culture systems, are the most popular commercial systems in use today. Raft systems get this nickname because of the way the plants are handled during the growing period. The systems are usually configured as long troughs 12 to 24 inches deep. These troughs can be huge. Some commercial operations use troughs a hundred feet long. High-density foam “rafts” with holes cut to fit net pots are floated on the water and the plant's roots extend through the net pots into the water below. The water is pumped as a continuous stream flowing through the grow bed. An installation of this type can have thousands of plants at a time growing in a densely populated area.

The Commercial Choice

Raft Systems are extremely efficient, which makes them attractive to commercial growers. The use of the rafts, typically 4 feet by 4 feet or 4 ft by 8 ft, allow a single trough to hold plants at different stages of growth enabling growers to maintain a constant harvest.



NFT (Nutrient Film Technology) Systems

NFT systems are a carryover from hydroponics. Typically tubes or shallow troughs with holes into which net pots are inserted, a thin film of water is pumped continuously through the tubes or troughs. The roots of the plants are continuously bathed in the nutrient-filled water film and grow into the tubes or troughs. These systems are popular in hydroponics, but not so much in aquaponics. The tubes and troughs tend to clog with roots and other organic material. If the flow of water is lost, the plants instantly begin to stress as there is no reserve of water in the tubes. A mishap with a pump or piping that goes unnoticed for more than a few minutes can have disastrous consequences.





Drip Towers

Drip towers are a unique form of aquaponics. Originally the towers, some as tall as 8 foot, were constructed from PVS pipe or related material and filled with grow media. Holes are cut along the pipe which are hung vertically, and the nutrient water is pumped to the top and allowed to drip down through the grow media to the bottom where it is collected and recirculated. Planting is done through the holes in the sides of the pipe. This method has proved quite successful. The systems allow maximum use of greenhouse space. They are not particularly suited to large or vining plants, but for greens or herbs they can be very efficient.

Cons

On the downside, because they need a constant flow of water they are susceptible to mechanical failures and drip emitters used to feed the nutrient solution at the top of the towers are prone to clogging unless sophisticated filtration systems are used. However, despite these downsides, there are a number of commercial operations successfully using drip towers.

These have proved popular to the extent that several companies are now selling systems engineered for this purpose. The design varies, but the basic premise is the same.



Aeroponics



Aeroponics is the newest innovation in aquaponics growing. These systems do away with media of any kind, and instead of flowing water, the nutrient solution is sprayed in a fine mist onto the roots of the plants. Most aeroponics systems utilize large tubular grow systems which look much like drip towers with the plants being inserted into holes in the sides of the tubes. However, the tubes are much larger in diameter and do not contain any kind of grow media. Instead, a series of misting

nozzles are located inside the tube, and nutrient solution under pressure is pumped to them. These misters produce a very fine mist that keeps the atmosphere inside the grow tubes at 100%.

Cons

Aeroponic systems are very water efficient. However, a break down in the delivery system will cause the plants to begin to stress in seconds. It demands a constant supply of water all the time. They are also extremely dependent on the quality of the water being delivered to the misters. The smallest debris will cause the mist heads to clog and stop the flow of nutrient solution. For this reason, they



need very efficient filtration systems and constant maintenance. This all means added cost to the initial installation and ongoing overhead for the operator.

Flood and Drain Systems

Flood and Drain systems are the most popular among hobby aquaponists. Their ease of construction, reliability, and adaptability are the perfect learning platform. They are easily built from locally obtainable supplies and can be expanded to almost commercial levels of production. It is easy to produce enough vegetables from a relatively modest installation to feed a family of four fresh vegetables regularly.



The Key

The key to flood and drain systems is the mechanics used to operate the flood and drain cycle. Typically, these systems use a growbed filled with specialized grow media. Media can range from perlite to manmade clay media created specifically for this application. We have operated a system like this with cheap locally sources gravel, lava rock, and the commercially available grow media. All have performed well for us.

The Water Cycle

The heart of a flood and drain system is the ability to fill and then drain the growbed alternately. We will discuss the science and mechanics of these systems in later articles. There are several options to manage this cyclic flow of water, the simplest being a siphon arrangement. As the water fills and drains, it alternately bathes the plant roots in a nutrient solution, and then the water level drops, drawing oxygen into the grow media. The use of growing media allows almost any kind of vegetable or ornamental plant to be grown, including vining and tall plants.

Our Focus

Since this is the most popular style of system for the home hobbyist, our future articles will concentrate on the flood and drain style of aquaponics system. There are variations on all of these, some of which are being successfully used by home aquaponic operators. As you begin your own aquaponics adventure, you will begin to get the itch to experiment. That is the great thing about home hobby aquaponics. Some of the best information and ideas are still coming from small operators who experiment.

Coming Next

In the next article, we will begin to look at each of these styles and types of systems in depth. Our first will be the most popular with home system operators, the basic flood and drain system.

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