

PAUL DALE

# AQUAPONICS:

## 10 QUICK & ESSENTIAL FACTS TO GET STARTED



**AQUAPONIC SYSTEM  
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## How is Aquaponics Different From Hydroponics?

For many years, there has been a general debate about the efficiency of aquaponic systems. The traditional supporters of hydroponics believe that hydroponics is sufficient for producing quality vegetables and fruits. I'm not debating the fact that hydroponics has served its purpose well. But as with all agricultural technologies, hydroponics has limitations.

The first limitation is that you continually add nutrients to the water to sustain the hydroponic plants. The second limitation involves the water used in the system itself. One of the downsides of hydroponics is that you have to drain some of the water on a regular basis in order to keep the water clean.

Then we have traditional pond aquaculture. People can harvest fish, but the vegetation growing on top of the pond is mostly inedible. Aquaponics combines the best facets of pond aquaculture and hydroponics to produce something truly unique: a system that produces almost zero waste and utilizes animal waste and food waste to nourish vegetables and fruits.

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Additional filtration systems can be added to an existing aquaponic system to remove excess waste in the water. An aquaponic system can also be expanded again and again to support multiple grow beds.

A single holding tank with about seventy fish can support up to eight individual grow beds with different vegetables planted in the grow bed media. Aquaponics is so efficient that even commercial producers in the United States, Canada, and throughout the world are using this technology to produce both edible fish and fresh plant produce.

## How Does an Aquaponics System Work?

The simplest aquaponic system requires only one tank that will act as both the grow bed and holding tank. Holding tanks contain the water, and the fish, while the grow beds contain the soil-less media and the plants.

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The solar pond is the best example of a simple yet efficient backyard aquaponic system. A large barrel or plastic vessel is filled with de-chlorinated water and fish. The top part of the barrel is covered with a specially designed grow bed. Seedlings and seeds are transplanted into the grow bed.

Slowly, the maturing root systems of the seedlings will reach the surface of the water. The fish, on the other hand, will continue to feed and excrete waste into the water. Beneficial bacteria will break down the feces and the excess fish feed in the water.

The nutrient soup that will result after the bacteria are done with the waste in the water will then nourish the growing plants on top. In this setup, the roots of the plants are continually in contact with the water.

This setup does not require a water pump, because the roots of the plants are always in contact with the source of the nutrients – the water. In a slightly larger setup, an elevated holding tank transfers water to the grow beds through a flooding mechanism. Excess water from the grow bed will then move to a sump pit. A motorized pump will then return the water to the holding tank to begin the cycle once again.

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## How Efficient Is an Aquaponic System?

People often ask me: is an aquaponic setup really worth the time and effort?

Consider these facts and you will see that an aquaponic system is the *closest* we can get to natural farming and that using nature's own biological cycles is really worth one's time and effort:

1. One of the foundations of aquaponics is the idea of producing a *clean* source of protein (fish) and pesticide-free vegetables and fruits. Almost everyone is aware of the kinds of chemicals used in fish farms and regular agricultural farms in the country. If you want to nourish your family with *chemical-free* organic food, then you can do that

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from the comfort of your own backyard with just *one* aquaponic system.

2. A single system that cycles two thousand to three thousand liters of water can easily support one hundred adult freshwater fish. With one hundred fish in just one holding tank, you can support eight to ten growing beds. Each growing bed can then support *multiple types* of vegetables and fruits.
3. In six months' time, a tilapia fingerling can grow from just fifty grams to an enormous five hundred grams. Let the tilapia age a little more and you'll probably harvest one kilogram tilapias in your holding tank.
4. According to studies, aquaponic vegetables grow *four times faster* than counterparts grown in a hydroponic system.
5. Are you willing to dump hundreds of gallons of water into your vegetable garden every few days? If not, an aquaponic system will spare your land from flooding because it doesn't *need* to be emptied out regularly, unlike hydroponic systems.

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## Meet the Three Aquaponic Variants

Some people think that aquaponics is a new invention, but it isn't really that new. The main principles of aquaponics are quite old and can be traced to the study of aquatic animal life and plant life in ponds, creeks, and other small freshwater bodies. However, it wasn't until the early seventies when people consciously started to imitate the setup found in ponds and creeks.

Aquaponics strives to create a balanced system where fish, plants, and beneficial bacteria can co-exist in harmony. Each component of the system benefits from the presence of the other components.

Fish need to eliminate waste, so bacteria are there to break down the waste. However, the water in the holding tank needs to be oxygenated and purified. That's where the plants come in to help. Plants absorb the broken-down nutrients in the water and purify the water in the process.

There are three main variants of aquaponics. The first variant is called the "ranch tank." It's easy to make a ranch tank. All you need is to dig a deep pit

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in the ground, fill that pit with a few thousand liters of water, and throw some fingerlings in. Algae will grow in the water; some fishes eat algae and some don't. You will not be able to harvest any vegetables from this type of setup.

The second variant is the solar pond (which we discussed in a previous lesson). The third variant makes use of a water pump and a flow system to cycle the water. The best setup, according to aquaponics enthusiasts, is the third variant because it provides the biggest yields and is the easiest to maintain over a long period of time.

## **Aquaponic Flow Systems Explained**

For more complex aquaponic systems, there has to be a regular flow system to ensure that water is being continually purified and the aquaponic plants

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are being nourished and oxygenated as well. There are three ways that you can cycle water from the holding tank to the grow beds.

The first method is called the “once hourly” flow system. As the name implies, water is cycled once per hour. This flow system can be used on a variety of aquaponic systems, including the more complex designs that involve ten or more grow beds. With this flow system, water is automatically pumped out to the grow bed by a water pump.

Once the grow beds are flooded by the nutrient-rich water, the water is slowly drained so that it can be returned to the holding tank once again. The second variant is called the NFT or the “nutrient film technique.” In this flow system, a water pump *continually* cycles the water through the grow beds and back to the holding tank.

This system is not suitable for some plants because with this type of flow system, the roots of the plants will always be submerged in water. Continuous submersion in water is known to cause root rot.

The third variant involves draining the holding tank. Usually, water is drained when there is an overflow. The excess water will then be directed

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into the grow beds. Water is then collected in a third tank before being returned to the holding tank.

## What Type of Material Is Best for Holding Tanks?

As with every DIY (do-it-yourself) endeavor, aquaponics gives you the freedom to be as creative and resourceful as possible with the materials and equipment you are going to use to create the backyard system of your dreams. However, I must point out that you must be very careful when selecting the vessels that will hold your fish and plants.

I normally encourage people to use recycled materials, but you have to be careful with barrels and other large containers that may have been used to

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store chemicals. You must always insist on getting only food-grade plastic when you are buying barrels.

Food-grade plastics are the best choice for holding tanks and grow beds because this type of plastic is sturdy enough to support gallons and gallons of water. Thinner plastic vessels can crack and bow, but food-grade plastic won't, as long as proper bases and supports are constructed.

You may have seen some people use trash cans as holding tanks. I do not recommend this, although you can use a vessel that resembles a trash can if it is made of a tough metallic alloy that will not rust easily (i.e. stainless steel). Avoid adding any copper to an aquaponic system because copper can leak into the water and can cause problems later on.

If in doubt, apply a liner to the barrels to prevent chemicals from the surface of the barrel from leaking into the water.

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## The Essential Components of an Aquaponic System

There are no hard-and-fast rules when it comes to building an aquaponic system, but there are essential components that *must not* be omitted from your “to do” or “to buy” list:

1. **Holding tank** – Without the holding tank, there won't be any place to put the fish fingerlings and the water. Holding tanks can be made from metal or food-grade plastic. To stabilize and strengthen food-grade plastic barrels, you can construct wooden braces to support the base of the holding tank. It's easier to work with plastic because you can drill holes anywhere on the barrel when you have to install the inlet and outlet pipes.
2. **Grow beds** – Grow beds can be as simple as plastic barrels that have been cut lengthwise. You then have to add the media (such as gravel or pebbles) before transplanting the seedlings to the grow beds. When

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an aquaponic set up has a motor, the grow bed is often elevated so that water can drain back to the holding tank. In other setups, the grow bed is placed directly on top of the holding tank so that the plant roots can come into contact with the water's surface.

3. **Water pump** – If you want a large enough system to support a hundred fish or more, you need a water pump. Water pumps can help improve the clarity of the water by continually cycling the water through the system. Small solar ponds do not require pumps because the amount of water in the holding tank is low compared to more modern aquaponic setups.

## Aquaponic Systems Are Flexible

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Not everyone is open to the idea of raising their own fish. That's completely fine, and that doesn't mean you can't use the wonders of aquaponics to cultivate rich-tasting vegetables and fruits. Here's the thing: you can still use an aquaponic system even if you have no intention of taking care of edible fish.

You have two options. The first option is to take care of ornamental fish instead of edible freshwater fish. There are literally dozens of choices when it comes to ornamental fish. Pond fish like koi and large goldfish can be used. That way you still have some fish in the holding tank. The fish will produce the waste material needed to nourish your aquaponic plants.

Now if you really don't like the idea of taking care of fish, you don't have to. Just set up an aquaponic system in your backyard and use manure tea to add nutrients to the water. Some people say that this is just reverting back to hydroponics, but it isn't.

With hydroponics, you have to dispose of water every day. With an aquaponic setup, you don't have to. The holding tank may be empty, but the bacteria are still there to break down the manure tea. The gravel or whatever grow bed media you have will still help filter the water. In the end, you will

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have fresh veggies for the whole family – all with the help of your backyard aquaponic system.

## The Simplest Design Is the Best for Home Systems

When people ask me about the *best* system for beginning aquaponic engineers/enthusiasts, I always recommend the CHIFT system, or “constant water height in the fish/holding tank.” I recommend the CHIFT system because it’s easy to set up and requires virtually no maintenance. So how does a CHIFT system work?

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1. The highest point in a CHIFT aquaponic system is the holding tank. The holding tank must be elevated so that any overflowing water from this part of the system will automatically flow down to the grow beds.

A pipe is installed at a particular height in the holding tank so that when water reaches this maximal point, water is automatically drained. This prevents unnecessary flooding of the surrounding area and is also an extra efficient way to introduce the nutritious water to the grow beds, where all the plants are.

2. When water floods the grow beds, the media absorbs some of the water. The plants get their fill of moisture, oxygen, and nutrients as the media absorbs the water. Excess water from the grow beds is drained unto a third tank –the sump pit.
3. The sump pit is a low-sitting yet high-capacity tank that can handle twice or thrice the actual capacity of the holding tank. It has to be lower than the grow beds so water can naturally drain from the grow beds. A motorized pump transports water from the sump pit *back* to the holding tank. This begins the cycle anew.

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## Freshwater Fishes for Your Aquaponic Tank

There is no shortage of freshwater fish to choose from when you want to stock a newly constructed aquaponic holding tank. You're free to experiment with your favorites. But if you are at a loss as to what type of fish would do exceedingly well in an aquaponic setup, here are some tips:

1. **Tilapia** – This mildly-flavored freshwater fish is the number one choice of many enthusiasts because it grows quickly and can withstand high population densities. Fifty-gram tilapia fingerlings can grow to half a kilogram in just six months! The only downside to tilapia is that it may be considered a 'pest species' in your state. If in doubt, consult with an expert before purchasing tilapia fingerlings.

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