THE ULTIMATE GUIDE TO
Home
AQUAPONICS SYSTEM

“How To Build Your Own
Aquaponics System In Less Than
A Week - Like The Pros”

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The Ultimate Guide To Home Aquaponics System
# Table of Contents

How To Use This Book 4

**Part 1: Introduction**

Why Try Aquaponics? 7

Aquaponics Quick Facts 11

Small But Efficient: The Solar Pond 13

Variant Aquaponic Systems 15

Experimenting With Water Flow 18

Primary Considerations When Using Plastic for Aquaponics 20

Essential & Optional Components of an Aquaponic System 22

**Part 2: Setting Up an Aquaponic System**

Setup for a Home-Sized Aquaponic System 27
\textbf{How to Use This Book}

\textit{The Ultimate Guide To Home Aquaponics System} was designed for the backyard hobbyist and for curious individuals who wish to know how to create their very own aquaponic system \textit{at home} with the least amount of hassle. This book has been divided into two parts.

\textit{Part 1: Introduction} contains the basic principles of an aquaponic system. The section “Why Try Aquaponics?” contains an overview of what aquaponics technology is. It also delineates the differences between aquaponics and regular pond aquaculture and hydroponics.

You’ll find a simple breakdown of how an aquaponics system works in the section “Why Try Aquaponics?” For a quick guide to the intricacies of aquaponics, check out the section “Aquaponics Quick Facts.”

A description of how a small aquaponic system, the solar pond, works can be found in the section “Small But Efficient: The Solar Pond.” An explanation of the most common variations of aquaponic systems can be found in “Variant Aquaponic Systems.”

For a quick guide to flow systems, read the section “Experimenting With Water Flow.” A definitive explanation of the role of plastic containers in aquaponic systems can also be found in “Primary Considerations When Using Plastic For Aquaponics.”
When you’re ready to build your own aquaponic system, jump over to Part 2: Setting Up An Aquaponic System. The section “Setup for a Home-Sized Aquaponic System” contains all the steps for creating a real aquaponic system in your own backyard.

Have questions? Head over to the section “Frequently Asked Questions (FAQ) About Aquaponics” for some definitive answers. If you are having problems with an established aquaponic system, read the section “Aquaponic System Troubleshooting” for some quick answers.
Part 1: Introduction

Many years ago, a friend of mine introduced to me the concept of aquaponics. At first, the idea seemed a bit crazy – take care of fish, and let vegetables/fresh produce grow with the help of the nutrients present in the fish tank. Let me be honest with you: I have no green thumb. I’m no farmer, and I am certainly no fish expert.

And yet, something about aquaponics caught my fancy. It was the idea of true self-sufficiency that made me try it. I imagined myself being able to grow a clean protein source (fish) and a steady source of vitamins, minerals, and fiber (vegetables). It was really the stuff of dreams. Who hasn’t dreamed of being able to pick clean and tasty food from their own yard?

And then there I was – looking at a simple blueprint for a backyard aquaponic system. My friend told me that he didn’t have the time to experiment in his own yard and he thought about me when he was about to throw away the blueprint.

I took the blueprint, thanked my friend, and embarked on my own personal backyard adventure. I never looked back. Now my own aquaponic system is steadily producing tilapia and other edible fish, and I have fresh vegetables to harvest every few months. You can do this, too!
Why Try Aquaponics?

Aquaponics is an efficient answer to the most basic requirement of modern living: a clean and sustainable source of food. Traditional aquaculture and farming are out of reach for the majority of individuals in the country. Not everyone has a large space that can be dedicated to a conventional vegetable garden.

Shortage of usable space prevents people from even trying farming their own food. Aquaponics eliminates these problems because this type of system does not require a lot of space. What is aquaponics, anyway?

Aquaponics is simply a hybrid of aquaculture (farming of fish) and hydroponics (vegetable farming with the use of a water-based medium). Aquaponics combines the best of both systems. This translates to more advantages for the aquaponics farmer. How does an aquaponic system work?
Here’s a simple breakdown of what happens in an aquaponic system:

1. Freshwater fish like tilapia are placed in holding tanks. The holding tanks have simple aeration systems to help oxygenate the water.

2. The fish are fed with pellets or organic/natural fish food.

3. The fish eat the food and produce waste. The waste from the fish mixes with the water. Detritus and unused fish food also accumulate in the holding tank.

4. Some of the water from the holding tank is pumped out – to the growing beds.

5. Vegetables are planted on the growing beds. The plants make use of the nutrients present in the water from the holding tanks and also purify the water.

6. Purified and oxygenated water from the growing beds is transported back to the holding tanks.

7. The fish benefit from the purified and oxygenated water and the cycle is repeated *ad infinitum*. Because of the nutrient-rich water, vegetables grow continuously. An aquaponic system can also be expanded – all you have to do is add more holding tanks (or increase the capacity of an existing system) and make larger growing beds.
An aquaponic system thrives because of three main components:

**Edible fish + bacteria in the water + plants**

Of course, there is also sunlight, which makes it possible for vegetables and other plants to grow. It’s a beautiful and simple system that produces almost **no waste** because the waste itself is used up by plants.

At the outset, you have the fish and the plants. Where would the bacteria come from? The bacteria will come soon enough. Once the fish in the tank start expelling waste, two types of bacteria will start to grow in the water.

The bacteria present in the water will help break down fish waste and chemicals such as ammonia. The chemical breakdown of waste material in the water will make increase the amount of usable nutrients available for the vegetables that are planted in the growing beds.

Now let’s compare **this** type of system with a conventional aquaculture system that houses freshwater fish. A typical aquaculture system can get dirty **really quickly**. If a holding tank has two thousand liters of water, about two hundred liters of water has to be removed **daily** to keep the system clean.

Do you see the big contrast between an aquaponic system and a conventional aquaculture system?

With a conventional aquaculture system, the waste products in the water have no place to go, but with an **aquaponic** system, the waste is utilized immediately by the plants. The
more waste the fish tank produces, the more nutrients available for plants.

A single holding tank with two thousand liters of water can support up to four large growing beds. In six months’ time, this particular system can produce more than seventy kilograms of fresh vegetables and more than forty kilograms of adult fish.

If you have two systems of the same size, that translates to more than one hundred forty kilograms of vegetables and one hundred plus kilograms of fish every six months. Some of you might be thinking: can’t we pump the water from a conventional aquaculture system to a vegetable garden? Well, sure you can.

But are you really willing to pump out two hundred liters of water every day so you can water your vegetable garden? Even seasoned farmers will tell you that two hundred liters (or even one hundred liters of water) is too much for a regular vegetable garden.
**Aquaponics Quick Facts**

1. If you want your system to provide food for a regular family (say, three to four members) you need a holding tank that can support at least two thousand liters of water. Three thousand liters is ideal.

2. A holding tank with 2,000-3,000 liters of water can easily support more than one hundred freshwater fish like tilapia. You can combine different fishes or you can choose to farm just one species.

3. In six months’ time, a fingerling weighing fifty grams can grow up to five hundred grams or more – depending on the species and the amount and type of feed given.

4. It is imperative that you raise growing beds to avoid invasions from common garden inhabitants like snails. Remember -- you will have fresh, juicy vegetables growing in your growing beds, and pests just love fresh vegetables.

   You have to protect your produce from these incredibly persistent garden dwellers. If you can protect your produce without biocides or pesticides, that is so much better because that way your produce will be 100% organic and safe for your family.

5. If you have a bit of extra time and some room in your budget, you can also try installing a *solar panel* to take care of the power needs of your first aquaponic system.
A sixty-five watt panel is sufficient in most cases. Some people might complain that solar panels are a bit on the expensive side, but trust me – over time, your solar panel setup will pay for itself and you’ll be running a completely self-sufficient aquaponic system that harnesses not only natural biological cycles, but also the cleanest source of power in the world: sunlight.

6. Aquaponics encourages creativity and resourcefulness on all levels. You don’t have to spend a lot of cash having specially crafted tanks delivered to your home.

If you can find a large tub that can has no cracks and can handle at least two thousand liters of water, you can start your aquaponics project at home. Some people even use large metal plastic barrels and other large containers to house their fish. Just make sure that you use food-grade plastic if you are going to use plastic.

7. Believe it or not, you only need to inspect an aquaponic system a few minutes each day. Once the system is in place, everything works so smoothly that you only need to intervene when it’s time to clean the pipes, tanks, etc.
Small But Efficient: The Solar Pond

The curved gray line represents the plastic mesh that prevents the fish from eating the roots of the floating lettuce.

Aquaponics isn’t really a new invention. In fact, as early as the seventies, people were already experimenting with the idea of combining aquaculture with hydroponics.

The solar pond is a compact version of a typical aquaponic system. It was designed for households that did not have a lot space to spare. The solar pond is so compact that it only requires one fish tank. So are the two systems similar? Yes.
Are the two systems identical? In some respects, yes. But if we were to make a one-to-one comparison of all the components of the two systems, then the answer is no. You see, the solar pond was meant to support only a small volume of fish and plants.

Lettuce was the usual choice. The plants are placed directly above the tank (the grow bed is the cover of the tank). A mesh is placed between the fish and the plants to prevent the fish from snacking on the roots of the hydroponic lettuce.

In the beginning, the hydroponic lettuce is placed in the center of the tank on a specially designed circular grow bed that allows the lettuce to literally float in the water.

As the lettuces grow, the larger ones are transplanted near the rim of the tank to give way to smaller lettuces. Hardy fish like tilapia and catfish are best for small solar ponds. Like in a larger aquaponic system, the plants on top of the solar pond are there to purify and oxygenate the water.
Variant Aquaponic Systems

Aquaponics has three major variants. The following variants are listed from the simplest type of system to the most complex (and priciest) variant:

1. A large hole is dug into the ground and is filled with water and fish fingerlings. Nothing else is added to this system.

2. Aquarium or solar pond (home-scale production of fish and edible aquaponic plants like lettuce and tomatoes).

3. Fish are placed in a dedicated holding tank. Water from the holding tank flows toward a separating mechanism so that solids are removed. Diluted water from the holding tank reaches the aquaponic plants. Water is purified by the aquaponic plants before the water flows back to the holding tank.
A common ranch tank – the green dots on the dark blue line signifies the presence of algal growth on the surface of the water. This is a closed system that depends largely on natural processes for maintenance (i.e. oxygenation, etc.).

The first system in our list is a simple make-shift pond setup that is usually placed in ranches on regular farm land. A single make-shift pond can handle more than three thousand liters of water.

However, because of the inherent limitations of this type of system, not too many fish fingerlings can be placed in the pond. There are no pumps, aeration mechanisms, or filtration systems.

The water in the pond is periodically oxygenated when it rains. In time, normal biological cycles allow algae to grow on the surface of the water. Some pond fish can feed on the algae that grow on the surface of the pond.
People who use this type of system are more interested in periodically harvesting adult fish because plant life on the surface of the pond is usually inedible. It would be very difficult to place a stable ‘floating’ grow bed on top of the make-shift pond set-up.

The second aquaponic variant makes use of a single, closed setup with aquaponic plants on top. The solar pond is a good example of the second variant. People can create this variant with tubs, barrels, or just about any large vessel that can contain a few thousand liters of water.

Aquaponic plants can float on top of the water because they are placed on a buoyant medium such as Styrofoam. Only the aquaponic plants’ roots are in direct contact with the water; the rest of the plants’ surfaces are fully exposed to natural sunlight. This is called the raft method and is the simplest way to cultivate aquaponic plants.

The third kind of aquaponic system makes use of three distinct components: the holding tank, the filter, and the growing bed. What’s unique about this system is that you really have full control of the entire system, from the amount of water that goes into the holding tanks to how much water is removed from the holding tanks on a regular basis.
Experimenting With Water Flow

There are several methods of adjusting water flow in the third variant system so that aquaponic plants are at least periodically in contact with the water from the holding tanks.

1. **Once hourly** – A water pump can be installed in the holding tank so that a pre-set amount of water is removed from the holding tank and transported to the elevated grow beds once every sixty minutes.

   Water that is transported to the grow beds are slowly drained back to the holding tanks via drain holes. The drain holes under the grow beds are never closed, which allows this intermittent system to work uninterrupted, 24 hours a day.

2. **Continuous** – This method makes use of a regular water pump that continuously cycles water from the tank to the grow beds. As one can imagine, there is constant movement of water when this method is used.

   This method is also called NFM, or Nutrient Film Method. At the outset, it may appear that this technique is better than all the other techniques because it produces constant water flow and you won’t have to install timers and other devices to make the system work.

   In reality, this technique is only good if you want to cultivate hardy aquaponic plants like lettuce. Not all plants can tolerate constant water flow; many regular plants suffer from root rot because the constant
movement of water reduces the amount of available oxygen for the roots of the plants.

3. **Draining** – This method is similar to the first method because it involves the use of a drain system that will eventually return the water from the holding tank. The draining method requires that additional water be added to the holding tank so that the extra water will literally *flood* the grow beds for a short period.

After the grow beds are flooded, water is drained and returned to the holding tank. Before the next flooding, it is imperative that you wait for the roots of the aquaponic plants to dry just a little bit so you can minimize the occurrence of root rot.
Primary Considerations When Using Plastic for Aquaponics

*Always* use food-grade plastic if you wish to use hard plastic barrels or similar vessels. Any container or vessel that comes in direct contact with your fish or plants *must* be food grade.

Any plastic vessel that is *not* food grade may pose a health risk because chemicals may eventually leak out of the vessel. Remember: both fish and plants are capable of absorbing and storing chemicals. As backyard aquaponic farmers, we want to produce only the cleanest food for our families. Investing in food grade plastic is the *only* way to go.

Metals like cast iron are *not* recommended for aquaponic systems because these metals will eventually rust and release undesirable elements into the water.

 Metallic water is *not* ideal for raising edible fish. If you really want to use metal, consider getting stainless steel or similar alloys that are resistant to corrosion and rusting. Use an approved liner for aquaculture when rust-proofing any metal parts in your system.

Now I’m all for using recycled parts when possible, but when it comes to health safety, I’m very wary of recycled plastic. Use recycled plastic *only* when you know full well that the barrel or vessel was only used for neutral contents like sugar or sucrose.
If you don’t know how the vessel was used in the first place, don’t use it. It may have been loaded with toxic chemicals. Even with the actual contents gone, the lining of the plastic vessel will still have trace residues.

These residues will eventually mix with the water – and the fish will absorb some of it. Trace amounts of harsh chemicals are found in fish meat. This is one particular fact that you should also keep in mind when buying used barrels for hydroponics and aquaculture.

If you can’t find a brand new plastic vessel for your holding tank, you can still use recycled barrels but you must apply an appropriate liner to prevent any chemicals from the plastic from mixing with the water.

Applying a protective layer inside and outside the holding tank will also protect the vessel from accelerated degradation due to the environment (i.e. excessive heat, cold, etc.).
Essential & Optional Components Of an Aquaponic System

Below are components that you can add to an existing aquaponic setup. Choose items that you think will enhance the efficiency of your own aquaponic system.

Not all of these items are essential to an aquaponic system. (Remember: you can make an aquaponic system with just one barrel and some hydroponic lettuce on top!)

1. **Automatic feeding mechanism** – Of course, not everyone can stay at home to feed their fish regularly. When everyone’s away, your fish must not suffer.

   That’s why you must install an automatic feeding mechanism in the holding tank. Koi feeders are a good idea. Feeding mechanisms such as regular koi feeders are relatively inexpensive and are easy to install. These are also perfect for an aquaponic setup!

2. **Automatic siphoning system** – Siphoning water from the holding tank when the water level reaches a particular height is another way of cycling water from the holding tank to the grow beds. Unfortunately, automatic siphoning systems for holding tanks are not mass produced and can only be made from scratch.

3. **Bacteria** – An aquaponic system needs beneficial bacteria in order to thrive. It’s a good thing that beneficial bacteria are free and self-propagating. You just need to cycle your new holding tank so the bacteria can colonize the water. It may take a few days, but the bacteria will multiply.
Now if you want to give your holding tank a much-needed bacterial boost, all you need to do is take some water from a river or pond and add the water to your own holding tank. Note that heavily chlorinated water can reduce or even kill all beneficial bacteria in a holding tank.

You can also visit a pet store to see if the store has a stock of aquarium bacteria. (Yes, people actually sell bacteria!)

If you have an old aquarium at home, you can be sure that the water already has the same bacteria that your freshwater fish need in the holding tank. Take some water from your aquarium and add the water to your holding tank. This will help quicken the cycling process.

4. **Filter media** – Aquaponic farmers usually use gravel and pebbles as filter media. Beneficial bacteria require a lot of usable surface area in order to thrive. Be careful when using filter media such as limestone as these materials can affect the growth rate of plants if the water’s pH level is slightly acidic.

5. **Rechargeable batteries** – If your system has a sump pump or any other water pump installed, check if your equipment supports back up batteries.

Whether you have a “once hourly” flow system or a continuous flow system, it is important that your water pump works uninterrupted, twenty-four hours a day. This applies to aeration mechanisms, too. Fish can begin to die within a few hours if the aeration system stops due to power failure.
6. **Freshwater fish** – Do your research before choosing the species of fish that you will be raising in your holding tanks. Some fish thrive in warmer waters; some fish are fine with cooler conditions in more cramped spaces (i.e. holding tanks). Fish hatcheries are a good place to buy fish fingerlings.

If you have no prior experience in raising fish, don’t buy tilapia and other larger fish just yet. Instead, buy smaller ‘feeder fish’ so you can experiment with your first aquaponic system. The ideal ratio is one-fourth pound of live fish for every gallon of water in your tank. One gallon of water is equivalent to 3.8 liters of water.

If a tilapia fingerling is fifty grams on average that translates to two tilapia fingerlings for every gallon of water. This may seem excessive, but we have to take into consideration that these fish can grow to half a *kilo* in six months’ time. We have to give the fish some space to grow.

Cramped conditions increase fish mortality and can also stunt growth. Since the holding tank is a closed limited system, fish will not be able to swim away to more spacious areas as they do in the wild.

This is why we have to increase the average surface area available for *each* fish to ensure that each fish in your holding tank will reach the largest possible size at harvest time.
7. **Food** – Fish food plays a central role in an aquaponic system. If the fish food is adequate for the fish, the resulting nutrient ‘soup’ in the water will be adequate for your plants as well. You have *many* options when it comes to fish food. You can give your fish wholly organic food such as crickets and mealworms.

You can also raise small ‘feeder fish’ in a separate tank so you have fresh food for your tilapia or catfish all year long. For folks who have no time to fabricate a second system for feeder fish, you can still buy *dog food* (dry pellets only).

Dog food contains a lot of protein, fat, and carbohydrates, which makes it perfect for tilapia and other common edible fish. The mineral and vitamin content of the dog food also helps boost the growth of your plants and fish.

8. **Holding tank** – As we discussed earlier, holding tanks for an aquaponic system should be made from clean, food-grade plastic.

Avoid using regular vessels or tubs that were *not* meant to contain large amounts for long periods of time. These tubs may work for a few weeks, but eventually the weight of the water will strain the material and the plastic will probably crack.

You can increase the durability of thinner plastic barrels by installing a metal framework around the holding tank. Before adding any liners to the holding tank, make sure that the liner is fit for containers that hold *drinking water*. If the liner is *not* approved for drinking water, don’t use it.
If you can choose between different barrels that have the same capacity, choose a barrel that is wider to give your fish a wider swimming surface.

Contrary to common belief, fish do not swim from the bottom of a body of water to the surface. Fish spend their time swimming *in just one level*, moving from one side to the other. So the wider the surface area inside the holding tank, the more space fish has to swim around.
Part 2: Setting Up An Aquaponic System

Setup for a Home-Sized Aquaponic System

Setting up your first home-sized aquaponic system is not difficult. As long as you have the patience to test and adjust the individual components of your system, you’ll find the optimum settings that will work for your goals and everything will be fine. This part of the book will describe how you can create a home-sized system using regular food-grade barrels, some pipes, and a little hard work.

For this setup, you will need the following materials:

- Three food-grade barrels (55-gallon barrels are best, but you can also use 20-gallon barrels if 55-gallon barrels are not available).
- Some wood: eight pieces of 2 x 4 x 8s, six feet of 2 x 10s and six feet of 1 x 8s.
- Eight feet of hose
- Water pump that can pump out a maximum of 800 gallons per hour
- Ten feet of PVC (you will need one-inch PVC pipe for this system)
- Seven “L” shaped pipes
- One “T” shaped pipe
STEP #1:

Cutting the opening of the holding tank

Using a jigsaw or any other available cutting tool, cut an opening to your new fish tank.

There are no hard-and-fast rules when it comes to creating an opening in a large barrel. The size of the opening depends on how big your barrel is. Ideally, you should be able to see everything that is taking place in the fish tank and you should also be able to easily reach into the barrel if you have to.

Some of you might be wondering: why is there a strip of plastic in my design? Why not cut open the barrel all the way through? In an ideal environment, the holding tank might be all the way through, but since the aquaponic system will be placed in your backyard, we have to take into
consideration that there might be other animals (like cats) in the surroundings.

The strip of plastic in the middle has two purposes: first, it supports the rest of the sides of the barrel so that the plastic does not bow due to the weight of the water. And second, the strip of plastic is a mounting point for a metal or plastic screen.

You can install a screen later if you think your cat (or other animals) might take an interest in your fish. A screen will also prevent leaves and other trash from accumulating in your holding tank.

STEP #2:

After cutting an opening in your barrel, it’s time to create a steady base. You can use 2 x 10s for the base of the barrel. All you have to do is cut the wood in such a way that it embraces the bottom of the barrel. Use the barrel’s size and shape as a template when you draw a half-circle on the 2 x 10s.

You will need two 2 x 10s for each barrel that you want to use as a holding tank. The bottom of each wooden base must be at least two to three inches in height after the initial cutting. After cutting the base of the barrel, place the 2 x 10s on the barrel and lock down the wood with 2 x 4s. You can use nails or screws to secure the new base of the barrel.
Using the barrel as a template, cut a semi-circle on the 2 x 10s

Add the 2 x 10s to the barrel and lock down the base of the barrel with some 2 x 4s. Voila!
STEP #3:

Cut the barrels lengthwise, as shown here

Create rectangular notches on the 2 x 4s

Now that we’re finished with the holding tank, let’s move on to creating the grow beds. We need to determine the optimal height for the grow beds, so place your holding tank on the ground (with the base, of course) and measure the holding tank from the base to its topmost portion.

Take note of this measurement, because this will be the height of the grow bed. The growing bed must be elevated so that water can later drain back to the holding tank.
Grow beds have two parts: the grow beds and the *stand*. To make grow beds, cut one large, food-grade barrel *length-wise*. Place the two halves of the barrel side by side on the ground. Measure the distance from the leftmost side of the first barrel to the rightmost side of the second barrel.

Add four inches to the total measurement. This will be the width of the grow bed stand. Get your 2 x 4s again and create rectangular notches on either side of each 2 x 4. Cut your 1 x 10s and create a stabilized platform and stand. Combine the notched 2 x 4s with the cut 1 x 10s.

Measure the length of the barrel halves to determine the length of the platform. Add supports to the top of the platform so you can place the barrel halves on top of the newly built platform. You can use tough plywood or even some leftover 1 x 10s for the pyramidal supports for the platform.

Pyramidal supports can be made by placing boards side by side so that a triangular base is achieved. Place three pyramidal (or inverted “V”) supports throughout the platform (one in the center, two on the sides) so that barrels halves are stabilized when you place the barrel halves on top of the platform.
STEP #4:

At this point, you’ll have a fully stabilized holding tank and grow beds ready. At the proper height, everything should work perfectly after you have installed the pipes for the system. Let’s do just that! But before we can install any pipes, we have to create holes first. Using a regular drill, drill two holes in each grow bed.

The holes should be 1.25 inches in size. Be careful when drilling the plastic though – the holes must be exactly 1.25 inches in size or the fittings will become loose and a leak may result. You will need female slip fittings and male threaded PVC for the grow beds.

Add the fittings to the holes and seal the opening in both barrel halves with some silicone sealant. Add generous amounts of sealant to prevent leaks. It would be very difficult to do repairs later on when you have the plants and fish in the grow beds and holding tanks already.
STEP #5:

Cut the remaining 2/3 of the barrel so that three support points will remain.

This is what the duckweed and dump tanks look like after both halves have been joined.
The fifth step is to establish the duckweed tank. This is optional but highly recommended for two reasons.

First, duckweed will help oxygenate and purify the water. Second, duckweed is good fish feed. This way you’ll have lots of extra fish food for your walleyes or tilapia. Like the grow bed and holding tank, the duckweed tank also requires a sturdy base and platform.

Measure the height of the grow bed platform from ground up. This will be the height of the base of the duckweed tank. Next, cut a barrel crosswise. Cut out about one-third of the barrel. Both ends should be closed/sealed. Do not remove the top of the barrel. If the top of the barrel seems loose, find a way to seal the top.

Add silicone sealant to waterproof the edges. Cut the remaining 2/3 of the barrel in such a way that there will be three support points. Place the smaller part of the barrel on top of the larger half and nail the two together.

After nailing together the two parts, seal the holes with silicone sealants to prevent any leaks. Assemble the platform and base by following the principles laid out in Step #4. The only difference is the height and size of the barrel that will be placed on top -- the principles of construction are the same.
STEP #6:

You may want to consult with a plumber before installing the pipe system for the aquaponic system.

Personally, I don’t recommend that you install the piping on your own because the time you will spend trying to figure out the best way to install the pipes can be used for other activities that require your attention, such as purchasing some gravel or other media for your grow beds, etc.

What I’m going to provide is a general schema for the flow system, so that you can tell your plumber what the system needs in order to function.

- The primary water flow for the entire system will come from the holding tank. The water pump should be connected to the holding tank; all the other tanks are dependent on the holding tank.

- A siphon system must be installed so that water that runs from holding tank to the duckweed tank and dump tank will flow back to the grow beds. Excess water from the duckweed tank must flow down to the dump tank, too.

- Two large pipes must be installed so that water from the holding tank ‘floods’ the grow beds.

- A separate pipe will prevent over-flooding of the grow beds. This flood pipe will return excess water from the grow bed back to the holding tank.
- Gravel must be poured after the main lines are installed in the grow beds. After gravel has been poured, the aquaponic plants can be finally planted. Make sure that you wash the gravel before pouring it into the grow beds.

**Operating the Home-Sized Aquaponic System**

Fill the holding tank with water. The water must not be highly chlorinated or bacteria will not be able to colonize the water and the system will not work. As I discussed earlier, you can ‘boost’ the bacteria in the water in the holding tank by adding pond water or river water.

Using a pump with the recommended GPH capacity will ensure that water in the entire system will cycle all four separate tanks (grow beds, dump tank, holding tank, and duckweed tank) at least once every forty minutes. Using gravel is ideal for the “ebb and flow” or flooding technique for aquaponics.

When water reaches the dump tank, check for leaks. If there are leaks, stop the system and fix the leaks. Perform all testing before adding the fish and the plants to the system. You can get duckweed from ponds and creeks.

Under ideal conditions, duckweed can reproduce fairly quickly within twenty-four hours. Again, the presence of duckweed will help purify the water and help feed the fish (because not all fish eat algae and algae can grow pretty much anywhere, even in your holding tank). A system this small will require at least two weeks of bacterial cycling before the plants will begin to grow at a regular rate.
During this time, evaluate your system every day and make adjustments based on your common sense. What I have provided you is a simple schema for a system – it’s up to you to refine and improve the system based on your needs.

That’s the great thing about aquaponics – it gives everyone the freedom to innovate and improve existing schemas. The more you work on your aquaponic system, the more you will learn from it. Believe me – in a few weeks’ time, you will master the whole system and you will begin to troubleshoot on your own.

As for the fish you can add to this particular aquaponic system, you have two options. You can raise edible fish or you can raise ornamental fish if you don’t want to eat the fish. Some people like the idea of using an aquaponic system to cultivate vegetables and fruits, specifically.

Some people don’t like eating fish that were raised in an aquaponic system. In such cases, you can just opt to take care of ornamental freshwater fish like goldfish and koi.

The fish will still produce the waste material needed to keep the system running, and at the same time, you have a large aquarium with lots of pretty fish in it. For folks who want both protein and veggies from their aquaponic system, there are many types of fish that you can raise in a holding tank:

- Tilapia
- Walleyes
- Crappie fish
- Koi fish (koi fish are both ornamental and edible)
- Pacu fish
- **Carps**
- **Striped bass (the hybrid variety)**
- **Lake perches**

Most freshwater fish can thrive in an aquaponic system *unless* water temperature becomes an issue. If the fish requires lower water temperature, then an aquaponic system might not be the best option.

As for the plants, you can cultivate nitrogen-loving plants like tomatoes alongside plants that are not high-maintenance like hydroponic lettuce. Take note that your plants will not be able to consume all the nutrients that are passing through the gravel.

Nutrients *will* go back to the holding tank after each cycle. You don’t have to worry about nutrient overflow *unless* the water in the holding tank becomes polluted.

If you see signs of water pollution, you may have to drain water from the holding tank and add fresh water. Alternatively, you can also add more growing beds to your system so that more plants will be able consume the bounty of nutrients present in the water.
Frequently Asked Questions (FAQ) About Aquaponics

QUESTION: Why is an aquaponic setup needed to cultivate plants without soil?

Many people wonder why they can’t cultivate plants on jars of water. The answer lies in what’s in the water in first place. Plants need a lot of nutrients in order to grow. Aquaponics answers this need by providing a source of adequate nutrition to the plants -- 24 hours a day, 7 days a week.

QUESTION: I like the home-sized system you provided, but is there any way to get the same results with the plants without having to raise the fish?

Yes, you will need to add manure tea to the water periodically to supply the bacteria in the water with ammonia. Manure tea will also ensure that the plants get sufficient minerals from the water. However, this is no longer aquaponics – this falls under the realm of hydroponics only.

It should be noted that in a strictly hydroponic system, water has to be drained from the system to prevent toxicity in the system.

As a hydroponic system ages, chemical builds up in the water. Plants are very sensitive to chemical levels; that’s why the system has to be periodically purged of excess levels of chemicals to prevent toxicity to the plants.

This is not to say that pond culture is perfect. Far from it – fish ponds can be highly saturated with fish to the point that solid waste from the fish float on top of the water.
Because there is no way to filter and process the effluent waste from the fish, the waste remains in the water. Aquaponics remedies the weaknesses of traditional aquaculture (pond culture) and hydroponics and combines the advantages of both methods.

Aquaponics is specifically a hybrid form of farming that utilizes the breakdown of fish feces and fish feeds to nourish aquaponic plants.

Nutrient wastage is eliminated because the water is cycled through different tanks continuously. Stagnation of water is also prevented because water is regularly cycled with the help of a pump. For single-tank setups, water is still purified by the aquaponic plants.

**QUESTION: How come the roots of the plants don’t rot even if there is direct contact with water?**

The main idea behind hydroponics is to utilize the nutrients present in the water *without* having to depend on the soil. This is not to say that the plants are there without any medium. The plants still have to be transplanted upon a sturdy medium such as gravel or rocks.

Water penetrates the medium and the roots of the plants are able to absorb nutrients. Grow bed media also prevent the roots of the aquaponic plants from drying out. Adequate media, combined with an ebb-and-flow system or a once-hourly flow system, will ensure that the roots of the plants are *always* moist.
QUESTION: I don’t like the idea of pouring gravel into my grow beds. Is there any other way?

There is another way of cultivating plants without the use of regular grow bed media like gravel. It’s called D.W.C., or Deep Water Culturing.

As you can imagine, this technique allows the roots of the plants to be partially submerged in the nutrient-rich water. Styrofoam allows the plants to float on water. Narrow channels on grow beds allow the floating plants to absorb nutrients from the flowing water.

However, as we discussed in an earlier section of this book, when the roots of the plants are submerged in water 24 hours a day, 7 days a week, the roots can rot if the plants are not used to low nutrient levels. The nutrient film method is usually used for D.W.C. systems. (As a reminder, the nutrient film method utilizes a continuous flow system.)
QUESTION: **What is CHIFT? I’ve heard of this particular technique but I don’t know what it is.**

The CHIFT system. The dark gray pipes lead to the sump pit. The light gray pipe transport water back to the holding tank.

CHIFT stands for “constant height of water in the holding/fish tank.” The CHIFT system is one of most efficient home-sized systems around because all you need is a sump pit and a sump pump. Unlike other systems, the water pump is not placed in the holding tank. The water pump in the CHIFT system is in the third tank or the sump pit.

As you can see from the illustration, the holding tank has to be higher than the growing beds. Pipes allow overflowing water from the holding tank to drain into the growing beds.

When water floods the grow beds, excess water will slowly drain into the sump pit (where the pump is located). The pump will slowly return water from the sump pit back into
the holding tank. When there is an overflow of water, the water will once again flow to the grow beds.

As long as the sump pump is returning water to the holding tank, the system will be able to sustain itself.

Here are the two main advantages of this system:

1. In the event that the sump pump does *not* work, water will cease to flow to the grow beds *but* the holding tank will still have a constant water level.

   If the system fails, the plants can still survive for a few days and the fish will not die immediately. In other systems, fish die shortly after power failure because of low water levels.

2. The system is so simple that you can probably finish an entire CHIFT system in half a day.

Are there any disadvantages when you use the CHIFT system?

The only perceivable disadvantage of this system lies in the pre-operational phase: you have to find a large, elevated holding tank for the fish (otherwise, the overflow system will not work) and second, you have to find a low yet high capacity sump pit.

The sump pit has to be low enough so that water can naturally drain from the grow beds without the additional help of siphons or a water pump. So the highest point in this system is the holding tank while the lowest point is the sump pit.
QUESTION: I like the idea of flooding a small grow bed with water from the holding tank. However, I want a system that does not require a sump pit. Is there a setup that is similar to a solar pond but still works like an ebb-and-flow aquaponic system?

Flooding and draining of a grow bed can be done by having a low yet high-capacity holding tank and an elevated grow bed.

The grow bed has to be directly above the holding tank. Periodically, a pump activates so that water from the holding tank floods the grow bed. Slowly, the water drains back to the holding tank.

This system is simple and very effective. It also reduces the incidence of root rot because the roots of the plants are not continually submerged in flowing water.

However, unlike the CHIFT system, the water level in this setup does not remain constant at all times. When the grow bed/s are flooded with water, the water level in the holding tank will decrease for a short period.
QUESTION: What are the advantages of keeping specific species of fish when I decide to set up an aquaponic system at home?

If you live in a warm region of the country and would like to raise larger fish, the barramundi is a good choice. The barramundi is a regal freshwater edible fish and is a crowd favorite in many parts of the country. The growth rate of barramundi is decent and you will not be disappointed during harvest season.

Regular catfish are also great for aquaponics because these fish can grow fairly quickly once they have established themselves in an aquaponic holding tank.

Take note, though, that catfish do not thrive in dirty water. Catfishes thrive in clean water, but are so adaptable that these fish have been known to survive in ponds and rivers that have toxic levels of waste and chemicals.

As you may already know, catfish do not have scales but instead have smooth yet tough skin. You don’t have to scale catfishes and during harvest, all you have to do is remove the gills and intestines and your fish are ready to be stored or cooked.

The carp family is celebrated in Chinese cuisine. However, carp are no longer welcome in many states in the US because these fish can invade and dominate bodies of water.

Carp are considered a pest species in many countries as well. Check with your local agriculture office before obtaining carp for your aquaculture set-up.

Are you interested in breeding fish in an aquaponic setup?
No other fish is easier to breed than the regular goldfish. However, it is generally known that goldfish need a thin cover of plant life (like duckweed) before these fish can breed in a holding tank.

Goldfish, like catfish, are tough and can withstand high levels of water pollution. Goldfish are also edible but are not usually eaten. You can mix goldfish with other ornamental fish if you have no interest in eating the fish in your aquaponic system.

Have you ever heard of the jade perch? The jade perch is an edible freshwater fish that has one of the highest levels of omega 3 fatty acids in its tissue. Omega 3 fatty acids are good for the heart and the brain.

That’s why some manufacturers are now breeding and raising jade perches in massive facilities so they can extract and process the omega 3 fatty acids present in the jade perch’s tissue. If you like heart-healthy protein, the jade perch is just right for you!

Koi fish are actually carp, but let’s put these fish in a separate category since these fish are sold as ornamental fish.

Normally, koi fish are placed in artificial ponds. You can also stock these fish in an aquaponic system, along with edible fish. As long as the fish are not fighting and the holding tank is not over-populated, you can mix and match freshwater fish.

If you want fish that can be stocked in very high densities in a single holding tank, the murray cod is the best choice for
you. Murray cod tastes awesome and can grow quickly even if the environment is just a single holding tank. The only downside to stocking murray cod is that you have to keep the fish well-fed.

Otherwise the murray cods in your holding tank will begin to take small nips at each other. In the end, appetite and hunger will take over and the fish will begin attacking each other.

The murray cod is recommended for folks who have a lot of time for maintaining and adjusting their aquaponic systems at home. If you can only invest a little of your time every week to your aquaponic system, try raising other fish.

If you are not in a hurry to harvest your fish, you may want to try raising silver perches. Silver perches, unlike tilapia and murray cod, grow very slowly. A single batch of silver perches will require at least twelve months before the fish can be harvested. At twelve to eighteen months, an adult silver perch will reach the optimal harvesting size.

Tilapia may be the number one favorite when it comes to stocking a new aquaponic system. These fish are mild in taste, clean, and do not absorb high levels of chemicals in their tissue compared to other edible freshwater fish.

Tilapia are easy to raise and many tilapia raisers throughout the country can attest to the toughness of this fish when it comes to what type of fish food they’ll eat. In other countries, tilapia are even known to survive on detritus protein or waste protein found in ponds.
Harvest time for tilapia is four to six months, depending on the weight and size that the aquaponic farmer desires. Note that tilapia species thrive in *warm water only*.

If you live in a chilly part of the country, choose another species to raise and cultivate. Artificially heating the water would be expensive and counter-productive since the water would have to be kept at a fairly constant temperature twenty-four hours a day, seven days a week.
In Focus: Aquaponic Fish & Plants

Nothing is more rewarding than seeing aquatic life and plants thriving in an aquaponic system in your own backyard.

Nothing comes close to the feeling of exhilaration and joy in harvesting fish from your own tank – with full knowledge that this particular protein source is clean and free from toxic chemicals and disease-causing microorganisms.

Native Aquatic Life vs. Exotic/Foreign Aquatic Life

In addition to the fish that we mentioned in the previous section of the book, I highly recommend that you seek the guidance of a fish expert in your locality so you become more aware of local fish species.

Local species are easier to find and in most cases, you won’t have to ask for special permits or licenses to keep these types of fish in your backyard. If you are planning to keep exotic or foreign species, you may run into some legal troubles because right now the agricultural authorities are very sensitive to the idea of people releasing potentially troublesome species into the wild.

This brings us to another important note when raising fish: never release fish into the wild! Some people think that flushing fish down the toilet is a good idea because it kills the fish instantly. Flushing doesn’t kill fish – it just gives fish the chance to enter the city or town’s sewer system.

Sewer systems are not closed systems. Eventually, all the water will drain to the surrounding region’s waterway. That’s how invasive species acquire a foothold in new waterways.
And if there are no natural predators, foreign species have an unfair advantage over native fish species.

In time, this can translate to reduced native fish populations or even complete destruction of native fish populations. So be a responsible aquaponic farmer – take care of your fish and avoid releasing your fish in the wild.

If you really have to dispose of your fish, you can just sell your fish to whatever market is willing to buy and eat the fish that you have raised. You can also consult with your local agricultural authority so you can properly dispose of potentially invasive fish species.
Keeping the System in Balance

Let’s go back to the topic of fish that you can raise in an aquaponic system. Did you know that you are by no means limited to raising just fish in your aquaponic system?

Once you have properly cycled your holding tank, you can add most freshwater species. Only one factor has a direct effect on freshwater fish species survival – temperature requirements. Some fish thrive in colder waters, while others will survive only with warmer water temperatures.

If you like eating freshwater mussels and large prawns, don’t be afraid to try raising these aquatic inhabitants in your holding tank!

As long as your holding tank has enough capacity for all of the fish and your other fish are not natural predators, prawns and mussels will probably survive in their new habitat. Edible crayfish are also a great addition to any tank.

Filter-feeding aquatic animals such as mussels are actually a beneficial addition to an aquaponic system because these aquatic animals feed on the floating waste in the water. Such animals help keep the holding tank clear and free from pollutants.
Fish Density Per Holding Tank

What about the number of fish? Earlier in the book we discussed the ideal ratio of two fish fingerlings for every gallon of water in the holding tank. This is the *ideal* ratio, but I would be lying if I said that everyone follows this ideal ratio.

Truth be told, many aquaponic farmers use *much higher* fish densities in their own holding tanks. Once you have gained enough experience in aquaponics, you can increase the density of fish in your holding tank. Here’s the thing: with higher fish density per gallon, the chance of fish mortality *increases* significantly.

A holding tank is a closed system: fish have *nowhere* to go when the water becomes polluted or when food becomes scarce. Your fish are *wholly* dependent on the fish feed and the self-cleaning system that you have designed for them.

So if you want to keep *more* fish (beyond the 2:1 ratio I recommended) you have to watch your system carefully, every day, to make sure that all your fish are healthy and thriving in the holding tank. If something *does* go wrong, you have to be prepared to bail out some of the fish or pump some clean water into the system to reduce the level of water pollution.

All of this might sound stressful to someone who is just beginning to experiment with an aquaponic system.

However, it’s better to be fully prepared before you try advanced techniques in aquaponics. You can succeed with higher densities of fish per holding tank but it is not going to be a walk in the park. That is why I *still* recommend that you opt for lower fish density per tank.
Advantages of Low Fish Density Per Tank

Here are some of the benefits of having fewer fish per holding tank:

- It would be quite practical to have only a few fish in a holding tank if you are interested primarily in a larger plant harvest. Based on studies, a medium-sized growing bed with a variety of vegetables can be supported by a tank that has only nine or ten adult fish.

- Fewer fish per holding tank means less stress on the fish. Stress can actually stunt growth and may prevent fish from breeding (if you want your fish to breed in the holding tank).

- Fewer fish per tank means the chances of adding too much fish feed in the water is reduced or eliminated.

- If one or two fish become ill, fewer fish will be exposed to the same risk of contracting any disease that may have been caused by contaminants or microorganisms in the water.

- Fish that are kept in smaller groups in closed systems grow much faster, unless the fish are used to high population densities in the wild.
Keeping the Fish & Plants Healthy

Every aquaponic adventurer needs to know two things before they commence with their own backyard project:

1. Nutrient deficiencies may occur in an aquaponic system.

2. Nutrient deficiencies must be dealt with in a manner that will not harm the three proponents of every aquaponic system: the beneficial bacteria in the water, the hydroponic plants, and the freshwater fish in the holding tank.

Since aquaponic systems do not have soil (which is really the selling point of aquaponics), we have to deal with some level of nutrient deficiency. Nutrient deficiency usually occurs when you give your fish poor-quality fish feed.

I know – we want to reduce operating costs as much as possible. But when your fish and plants suffer, the cost-cutting you’re doing won’t generate a much higher return of investment. It is far better to invest in high-quality fish feed and let nature generate a healthy bounty of vegetables and fish for you.

In the final analysis, you will still save money once your system is up and running smoothly. And remember: backyard aquaponics is all about providing clean food to your family. Your backyard aquaponic system will not be able to do this if the sole source of nutrition is not adequate to meet the demands of the plants and fish.

Now, if nutrient deficiency persists despite changes in the fish’s diets, consider adding mineral supplementation to the water. Consult with an agricultural expert so you can gain
some insight as to which specific particular minerals your plants need to survive in an aquaponic system.

Always consult with an agricultural expert before adding anything to the water. Remember, everything that goes into the water affects not only the fish, but also your plants and all the beneficial bacteria in the water. If one particular supplementation destroys the beneficial bacteria in the water, your system will fold and collapse!
Get Ready for Blooming Grow Beds

There is no doubt at all that plants will thrive in a grow bed that is regularly inundated with a nutrient-rich soup from the holding tank. Are you excited?

You should be! If you have your aquaponic system in place, it’s time to pick the plants that you will be transplanting to your grow bed media. The following are crowd favorites because these plants simply thrive in an aquaponic set-up:

1. Eggplants
2. Tomatoes
3. Chili plants
4. Bell peppers
5. Beans
6. Cabbages
7. Lettuce
8. Papaya
9. Peas
10. Beetroot
11. Carrots
Now, it should be noted that aquaponic grow beds can support *root crops, seeds,* and *seedlings.* You are by no means limited to planting seedlings!

If you want to plant seeds, all you have to do is to choose the appropriate plant type and plant the seeds in the grow media. You can also plant seedlings along with seeds.

At the outset, the seedlings will appear healthier than the seeds, but don’t worry – once the seeds develop mature root systems, your seeds will thrive. As for root crops, you just have to let plants such as beetroot grow a little longer in the aquaponic setup. Crops like beetroots can grow as large as one kilogram each!

What if you are interested *only* in cultivating healthy vegetables? Should you opt for *hydroponics* exclusively instead of aquaponics?

The answer is: not really. You see, based on recent studies, a balanced and well-cycled aquaponic system can cause plants to grow *four times faster* than plants that are dependent on a purely hydroponic setup.

The big difference lies in the *amount* of nutrients that the plants are getting and the *type* of nutrition being provided to the plants.

Fish feed and fish waste are excellent sources of minerals and other plant nutrients and *all* your plants will be getting a *consistent amount* of plant nutrients *every day.* That’s why aquaponic plants grow faster than hydroponic plants.
Here are some more plants that you can try cultivating in your own backyard aquaponic system:

<table>
<thead>
<tr>
<th>Curling lettuces</th>
<th>Sugar pods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savoy spinaches</td>
<td>Onions</td>
</tr>
<tr>
<td>Grosse lisse tomatoes</td>
<td>Beefsteak tomatoes</td>
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<tr>
<td>Lebanese cucumbers</td>
<td>Fordhook beetroot</td>
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<tr>
<td>Cos lettuce</td>
<td>Rockmelons</td>
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<tr>
<td>Comfreys</td>
<td>Yarrows</td>
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<tr>
<td>Lemongrass</td>
<td>Sage</td>
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<tr>
<td>Coriander</td>
<td>Mizuna</td>
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<tr>
<td>Chives</td>
<td>Broccoli</td>
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<tr>
<td>Cabbages</td>
<td>Snow peas</td>
</tr>
<tr>
<td>Watercress</td>
<td>Celery</td>
</tr>
</tbody>
</table>
Aquaponic System Troubleshooting

Legend: (P) = Problem; (A) = Answer

**P: My plants are all wilting and dying. What’s wrong with my system?**

A: Wilting plants may be caused by extremely high or extremely low pH levels. Check the pH level of your water and check the tolerable pH level for the plant types in your grow beds.

If you have a continuous flow system in place, the roots of the plants may not be getting sufficient oxygen. Try switching to a once hourly system or ebb-and-flood system instead.

If this doesn’t work, try cultivating another type of vegetable and see if the new seedlings survive the grow bed. Pests may also cause wilting so be on the lookout for large pests and small bugs that may not be immediately apparent to the naked eye.

When in doubt, contact an aquaponic specialist in your area and consult with him/her. If it’s *not* wintertime and your plants are suddenly showing signs of imminent demise, the nutrient levels in your water may not be adequate.

You can immediately remedy this problem by adding more fish feed to your holding tank. However, increasing fish feed may cause cloudiness in your holding tank, so make sure that you cycle the water frequently. If all else fails, draining the holding tank partially and refilling it with clean, non-chlorinated water will help clear up the effluents.
P: It is wintertime here and my plants are all wilting.

A: If you have planted native vegetables and fruits in your grow beds, then the problem is probably plant nutrition. During winter, all animals (with the exception of the polar bear, perhaps) move more slowly because of the dropping environment temperature.

When fish move more slowly, they require less food. With less food, you have less ammonia in the water – and plants need the ammonia in order to survive.

To improve this situation, you can choose to add some heating to the holding tank to encourage the fish to become more active. When the fish become more active, consider adding more fish feed so the effluent level in the water will increase. If this fails, you have no choice but to reduce the number of plants in the grow beds.

P: The leaves of my plants are turning brown or yellow for no reason at all

A: Yellowing or browning leaves are characteristic signs of toxicity. In some cases, the nutrient-rich soup being pumped into the grow beds may have high levels of minerals – too high for plants to tolerate.

Plants are extremely sensitive to chemicals. Plant tissue succumbs almost immediately to high levels of mineral salts in the soil.

The same thing happens when there’s a high level of mineral salts in the water. Inversely, yellowing or browning of leaves may also indicate nutrient deficiency. In such cases, add more fish feed to the holding tank to increase the nutrient levels in the water being cycled to the grow beds.
P: I see aphids eating my plants!

A: Sadly, this is Mother Nature’s way of feeding aphids. Insects do not discriminate between wild-growing vegetables and cultivated vegetables so you have to take care of the aphid invasion immediately. There are two ways that you can deal with this problem without resorting to pesticides.

Your first option is to plant vegetables that will attract beneficial creatures such as lady bugs. The lady bugs will take care of the aphids for you. This is a good long-term solution but sadly, it may not work if you have an intense aphid invasion on your hands.

The second option is to purchase a pack of adult lady bugs from your local agricultural supply or plant nursery. Now, be careful when introducing lady bugs to your grow beds. Chances are, there are ants nearby.

Aphids and ants have a symbiotic (mutually beneficial) relationship and therefore, anything that threatens the aphids will be dealt with by the stronger and meaner ants. It will be best to introduce beneficial insects during the evening when insect activity is generally lower.

P: I see caterpillars munching on my vegetables!

A: Again, this is just nature’s way of feeding the ‘young ones’. You don’t have to be mean to the caterpillars. If you can make a homemade garlic spray, use that.

If not, just put on your gloves and manually pick off the caterpillars. Don’t squish the bugs though! Instead, put the caterpillars in a jar with some leaves so you’ll have some live food for your fish. This way, nothing is wasted and you are able to turn the tables.
P: My plants seem to be stunted.

A: This is most likely nutrient deficiency. Check one of the solutions stated previously. If none of the solutions work, check the pH level of the water. If the water is too alkaline, that may be the cause of the slow growth of your aquaponic plants.

P: The water level in the holding tank is always below the optimum level.

A: It may be hotter this time of the year or your plants are growing at a faster rate. In either case, just add more water.

Make sure that the water has been de-chlorinated. You can also add a booster dose of pond water to ensure that the bacterial population in the water remains constant. Water loss of more than fifty percent in a single holding tank system may require cycling of bacteria.

P: The water in my system is extremely dirty and there are a lot of floating effluents in the water. I can barely see my fish!

A: This is a bad situation because your fish can die in a matter of days if the water has become so polluted. The most common cause of polluted water in an aquaponic setup is too much fish food being added to the water.

If this is not the case, then the buffer (media) and the filtration mechanism are not performing well. You can add an additional filtering mechanism to the return line to clean the water. Any cleared waste from the water must be removed manually. Do not return filtered waste to the system as this will pollute the water once again.
P: There is a thin layer of ice on top of the holding tank.

A: The weather has finally gotten the better of your system. Consider heating the holding tank and installing additional ‘bubble makers’ to create mini-currents in the holding tank. The extra water movement will help decrease the incidence of ice formation on the surface of the water. But before you do any of these steps, check if your fish are still alive!

P: There is foaming in the water, even if the water has been cycled adequately a few weeks before.

A: There should be no foaming in established aquaponic systems. The most common cause of foaming is household detergents.

Household detergents may have been introduced when you ‘topped off’ the holding tank with more water. To remedy this problem, drain fifty percent of the water content of the holding tank and add de-chlorinated water. Continue doing this every day until the foaming goes away.

P: There are dead fish floating in the holding tank.

A: Remove the dead fish quickly. An aquaponic system is not designed to deal with dead fish – the excess of ammonia will overwhelm the system and may also cause increased fish mortality.
P: All of the fish are nearly dead but are still gasping for air.

A: There’s no point in prolonging the agony of the fish. Aquaponic farmers usually just flatten the heads of almost-dead fishes. This is really the only way to dispose of the fish. If you let the fish die in the holding tank, the water will only become more polluted.

P: Fish in the holding tank are not acting normally; some are swimming sideways, some are not eating well.

A: If this is your first time to raise such fish species, you may have given the fish the wrong type of food. Consider switching brands.

P: Fish seem to be gulping at the surface of the water.

A: The oxygen level in the water is insufficient to support all the fish. Add additional aeration mechanism to keep the water well oxygenated. This should solve the problem.

P: Fish are jumping out to catch insects that are hovering near the top of the holding tank.

A: The easiest way to deal with feisty fish is to install a screen on top of the holding tank.

P: I see red worms in the tank!

A: Don’t worry about the red worms. If you can collect the worms, do so. You now have free, live food to give to your fish.
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