

DO IT YOURSELF AQUAPONICS



A STEP-BY-STEP GUIDE TO GROWING YOUR OWN FOOD

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TABLE OF CONTENTS

INTRODUCTION	4 - 6
What It Is & How It Works	
Nitrogen Cycle	
IBC Tote	
Grow Media	
Location	
BUILD YOUR OWN	7
What You'll Need	
STEP BY STEP	8 - 18
29 Steps From Beginning to End	
On How To Build Your Own Aquaponics System	
ADDING YOUR FISH & PLANTS	19 - 21
Cycling Your System	
Cycling With Fish	
Cycling Without Fish	
Fish Options	
Fish Food	
Growing Plants	
MAINTENANCE	22
CONCLUSION	23
TROUBLE SHOOTING	24

INTRODUCTION

What is Aquaponics?

Aquaponics is an incredible system for growing food by combining Hydroponics (growing plants in water without soil) and Aquaculture (farming aquatic organisms such as fish, crustaceans, etc. in water tanks). Both Hydroponics and Aquaculture come with their own advantages and disadvantages; however, your Aquaponics system still has the same advantages while avoiding most of the disadvantages.

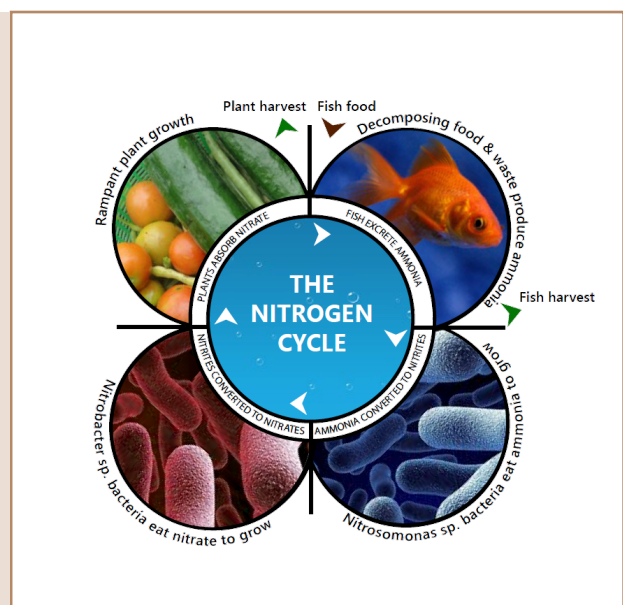
This is all possible as Aquaponics lets you create your own mini-ecosystem

that works with nature. Growing natural vine-ripened vegetables, while raising clean healthy fish to eat. All without any need for excessive pesticides and chemicals.

Aquaponics systems are very customizable with most of the work being done at setup, and the rest being nearly automated! The popularity of Aquaponics is growing worldwide as the simple design is a great long term food source that uses less than 90% of water that a conventional garden would. The system can easily be expanded to grow more vegetables and fish at any time with minimal cost.

HOW DOES IT WORK?

The fish in the fish tank produce ammonia, algae and other waste. This becomes harmful for the fish, and if it is not cleaned or replaced, the fish will die. This water gets pumped into the grow bed (or grow media). In the grow bed, there is a natural bacteria which converts this fish waste such as ammonia into nitrates for consumption by plants. The clean water from the grow bed now returns to the fish tank and the cycle repeats itself. How amazing is that?



THE NITROGEN CYCLE

One of the wonderful things of an Aquaponics system is that it restores that classic natural balance, allowing your fish and plants to work together. One of the most misunderstood and overlooked aspects of an Aquaponics system is the importance of good bacteria. The bacteria that grows in your food bed converts ammonia from the fish waste into nitrite. Another similar bacteria converts the nitrite to nitrate - one of the key minerals for plants. The health of your bacteria plays a significant role in the overall health of your Aquaponics system.

IBC TOTE

A great and effective way to house your Aquaponics system is to use an IBC Tote (Intermediate Bulk Container). These large industrial containers are used in a wide variety of ways to store and transport liquid products in a large range of sizes. These totes are made from plastic and are caged with a galvanized steel pallet to help support the weight of the container when full while also making it easy to transport.

The tank's dimensions are 48"L x 40"W x 48"H and weigh roughly 90-100 pounds when empty.



These totes can be purchased new or used. The cost of purchasing a new tote is around \$150 or can often be found used for around \$50 if you check your local classifieds. If previously used, ensure that the container is rinsed properly as some containers are used to store detergents or light chemicals.

GROW MEDIA

The plants you are planning to grow by using your Aquaponics system are planted in a soil-less growing medium. There are different types of media that allow the plants' roots to access oxygen and nutrient-rich water. Some media have advantages and should be considered over others.

Crushed stone or pea gravel for example can be used but often contains high pH minerals which cause your Aquaponics system to be a little unbalanced.

We recommend using clay pellets (expanded clay grow rocks) The clay is very lightweight and easy to plant with, while also being pH neutral. The downside of using clay pellets is that they're slightly more expensive than other media.

LOCATION

When locating your Aquaponics system there are a few things you want to think about. Once you add water to hold your fish, the system will be quite heavy, making location critical. Ensure that your system has access to good amounts of sunlight. The more sunlight your plants have, the better they will grow and survive. Keep in mind that your fish do not need sunlight as much.

In some cases, excess sunlight can cause algae build up around the inside of the fish tank.

Another thing to consider when deciding on your system's location is access to a power source. You will need power to run the water pump that cycles the water from your fish tank through your grow bed.

Typically, you'll want your Aquaponics system outside to harvest the sun's light and heat. If you're in a climate where temperatures often drop near to freezing, you'll likely want to erect a greenhouse to run your system year-round (and protect your system from pests and bugs).

In this book, we'll show you how to build your own Aquaponics system for your backyard. Let's get started.

What You'll Need To Build Your HYDROPONICS SYSTEM

WHAT YOU WILL NEED:



PARTS

- (1 QTY) IBC TOTE – 275 Gallon
- (2 QTY) 3/4" Barbed Tee connector PVC
- (2 QTY) 3/4" Ball Valves PVC
- (3 QTY) 3/4", 90 degree Barbed Elbows PVC
- (1 QTY) Auto Bell Siphon Kit
- (1 QTY) Piece of wood – 2x6x10 ft
- (1 QTY) 6 FT Long Black Vinyl tubing
- (8 QTY) Zip Ties
- Clay pellets (enough to fill the grow bed)
- (1 QTY) Submersible water pump– 500GPH

TOOLS

- Reciprocating saw
- Sharp knife or razor blade
- Tape measure
- 1 3/4" hole saw
- Sandpaper
- Wire Cutters
- Power Drill with drill bit variety
- Pencil
- Safety Glasses
- Work Gloves

ACCESSORIES

- Freshwater Master Aquarium Test Kit
- Digital Thermometer
- Water
- Fish
- Plants

Before starting this project it is important to read each step thoroughly and follow all safety warnings listed in this book and any included manuals.

Make sure you have prepared your site prior to starting this project. You will need a firm flat base for your Aquaponics IBC Tote. Once your system is loaded with media and filled with water, it may weigh several thousand pounds. Be sure to locate your system on a surface that can handle the load.

Before the final setup and testing of the system, it is recommended that you wash your media and tank thoroughly, to guarantee a clean environment for your grow bed and fish tank. You can find instructions on how to do this later in the book.

If you are planning on placing your Aquaponics system outdoors, please note that the plastic used in IBC Totes and PVC Pipes may break down with prolonged exposure to the sun. We recommend you place your system in the shade or paint your IBC Tote, PVC pipes and fittings with an environment safe, light blocker paint.

If you do decide to paint your IBC Tote, make sure to paint the outside of the Tote, not the inside. If you're painting the plastic tank, you'll need to prime the tank first.

How To Build Your Own AQUAPONICS SYSTEM

01

STEP 1: REMOVE METAL SLATS

Using a screwdriver or electric drill, remove the metal slats at the top of the IBC metal tote frame. Once removed, place aside as we will need to re-install the slats later.



02

STEP 2: MARK CUT LINE

Using a marker, mark the cut line on the IBC Tote. Start by marking just above the first rail on the IBC metal tote frame.

A: Pull Bin Out

Once you have marked your cut line, flip the IBC unit on its side and slide out the IBC tote.

B: Use Straight Edge to Mark Cut Line

Using a straight edge, finish marking the cut line on the IBC tote.



WARNING



Wear appropriate safety attire when cutting metal. Leather work gloves and safety glasses are a must.

03

STEP 3: CUT IBC TOTE

Using an angle grinder with a 1/8" blade, cut the IBC tote on the cut lines you made in the previous steps.



04

STEP 4: SAND EDGES OF IBC TOTE

Using sandpaper (or electric sander) sand the cut edges of both the grow bed and the fish tank.



05

STEP 5: CUT METAL FRAME

Using an angle grinder or reciprocating saw, cut the IBC metal tote frame right above the first rail, where you marked/ cut the tote itself. It's important to wear leather gloves for this step, as the metal can get quite hot.



06

STEP 6: CREATING THE FISH TANK

Sit the IBC metal tote frame back up, and place the fish tank tote section inside the metal frame.



07

STEP 7: ATTACH SUPPORTS FOR UPPER GROW BED

A: Add Support Boards for Grow Bed

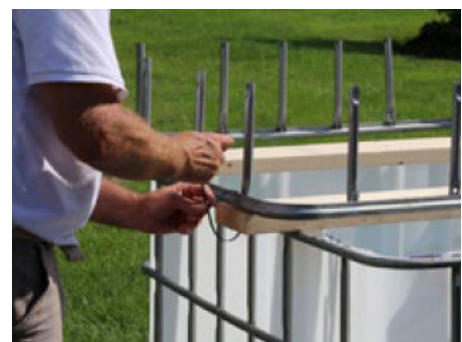
Take your 2x6x10' piece of wood and cut it in half, making two 5' planks of wood. You can trim down the edges later for a more aesthetic look.

Position the two planks of wood on top of the fish tank. Place one plank of wood 4" from the back of the tank. Mark 12" from the plank of wood at the back, and place the other plank of wood at this location.

Next, place your grow bed on top of the two pieces of wood. You may need to adjust the wood to better support the grow bed. Leave approximately a foot between the front of the fish tank and the grow bed. You will need this space later down the road for cleaning out the fish tank, and fixing any plumbing if needed.

B: Zip-tie in Place

After making final adjustments, including trimming the edges of the boards if needed, drill a hole in both ends of the two boards. Next, place your grow bed metal frame on top of the support boards. Using zip-ties, secure the grow bed frame to the two support boards.



08

STEP 8: CREATING THE UPPER GROW BED

After you have made any final adjustments, place the grow bed IBC tote inside the metal frame. Make sure the drain in the bottom of the IBC tote is securely tightened.



09

STEP 9: RE-INSTALL METAL SLATS

Next using an electric drill or screwdriver, re-install the metal slats onto the metal frame under the grow bed.



10

STEP 10: ATTACH VINYL TUBING TO FITTING ON PUMP

Take your submersible pump and attach vinyl tubing to the pump's fitting. Once done, place the pump on a level position at the bottom of the fish tank.



11

STEP 11: CUT VINYL TUBING AT TOP OF GROW BED

Extend vinyl tubing up and past the grow bed. Using wire cutters, cut the vinyl tubing at the top of the grow bed. Make sure to keep the excess piece of vinyl tubing, we will need this later.



12

STEP 12: ATTACH ELBOW TO END OF VINYL TUBING

Next attach one of the 90 degree elbows to the end of the vinyl tubing.



13

STEP 13: SECURE TUBING TO GROW BED

Extend the elbow joint over the edge of the grow bed. Secure the vinyl tubing to the metal frame of the grow bed with a zip-tie.



14

STEP 14: CUT REMAINING TUBING INTO 4 EQUAL PIECES

Take the remaining piece of vinyl tubing that you created in Step 11, and cut the tubing into 4 equal pieces. Cut each piece approximately 3 - 4" in length. We will be using these pieces in the next step.



15

STEP 15: CREATE GROW BED PLUMBING SECTION

A: Attach Vinyl Tubing to Elbow

Take one of the sections of tubing and attach it to the end of the 90 degree elbow.



B: Attach Ball Valve

Attach a ball valve to the section of vinyl tubing you previously attached.



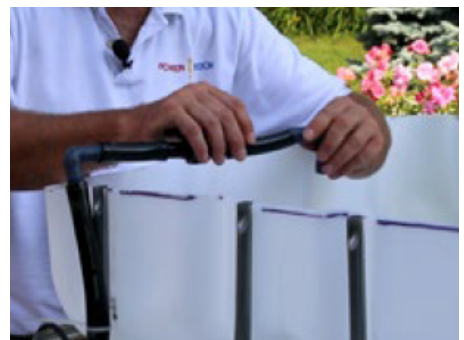
C: Attach Vinyl Tubing to the Ball Valve

Take another section of tubing and attach it to the end of the ball valve.



D: Attach Elbow to Vinyl Tubing

Finally, attach a 90 degree elbow to the end of the vinyl tubing. Make sure the elbow is facing down into the grow bed.



16

STEP 16: CUT TUBING 1" BELOW GROW BED

Next, cut the vinyl tubing hanging from the grow bed. Make a cut approximately 1-2" from the bottom of the grow bed.



17

STEP 17: INSTALL T-JOINT TO VINYL TUBING

Once the tubing is cut, attach a T-joint to the ends of the vinyl tubing.



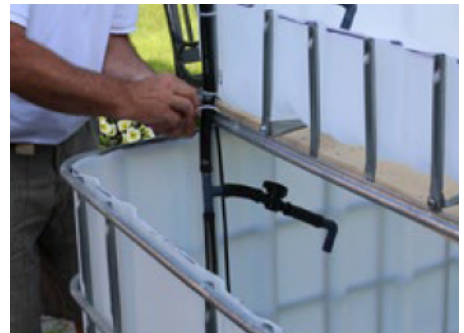
18

STEP 18: CREATE FISH TANK PLUMBING SECTION

Repeat Step 15 to create the fish tank's plumbing:

Tubing - Ball Valve - Tubing - Elbow Joint

Once assembled, connect the plumbing section to the end of the T-joint. If you want you can secure the vinyl tubing in place with some zip ties.



19

STEP 19: DRILL HOLE IN BASE OF GROW BED

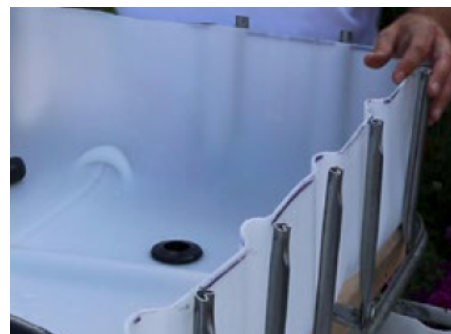
Using a 1 $\frac{3}{4}$ " hole saw, cut a hole in the base of the grow bed. Make sure the hole is 7- 8" away from the front, right corner of the grow bed.



20

STEP 20: MOUNT BULKHEAD TO GROW BED

Next, take your bulkhead fitting with the gasket on top and place it through the hole in the base of the grow bed. Fasten the bulkhead underneath the grow bed with a bulkhead nut.



21

STEP 21: ATTACH ELBOW TO VERTICAL DRAIN

Take the threaded elbow and attach it to the 6" drain.



22

STEP 22: INSTALL VERTICAL DRAIN TO UNDERSIDE OF BULKHEAD

Next, attach the vertical drain (which you created in the previous step) to the bulkhead on the underside of the grow bed.



23

STEP 23: INSTALL HORIZONTAL DRAIN TO ELBOW

Attach the horizontal drain to the elbow of the vertical drain. Make sure the elbow is facing down into the fish tank.



24

STEP 24: CREATE & INSTALL STANDPIPE FUNNEL

Take the standpipe and attach it to the funnel, then install the standpipe funnel into the bulkhead at the base of the grow bed.



25

STEP 25: PLACE BELL OVER STANDPIPE

Next, place the bell loosely over the top of the standpipe.



26

STEP 26: PLACE MEDIA GUARD OVER BELL

Place the media guard over the bell. Make sure the slats are facing downwards.



27

STEP 27: FILL GROW BED WITH MEDIA

Before filling the grow bed with media, make sure the threaded drain at the bottom of the grow bed is tight. Next, using clay pellets (or your chosen grow media) fill the grow bed 1-2" from the top. Make sure the media is evenly distributed throughout the grow bed.



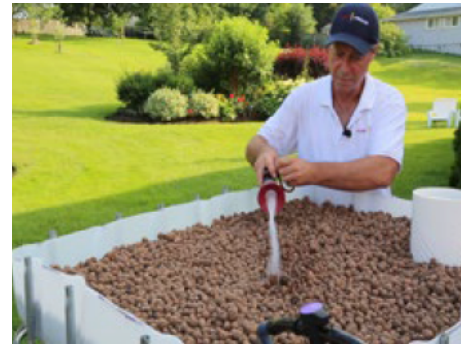
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STEP 28: RINSE YOUR MEDIA

It's important to rinse your media thoroughly prior to planting and filling the fish tank with water.

Once your grow bed is full of water, the Siphon should "fire" and the dirty water in your grow bed should empty into the fish tank.

Rinse the media a couple times to make sure you start with a clean grow bed. To empty your fish tank of the dirty water, you can use the drain in the front of the IBC tote, or you can redirect your pump to push the water out of the fish tank onto your lawn. You may need to rinse out the fish tank of any media residue.



29

STEP 29: TEST YOUR SYSTEM & FINALIZE YOUR SETUP

- ✓ **Fill your fish tank with water.**
- ✓ **Slightly adjust the two faucet valves to open.**
(Grow bed faucet and Fish tank faucet)
- ✓ **Make sure your pump is plugged in.**
- ✓ **Check system plumbing for leaks.**
Turn off the pump and fix any plumbing connections if necessary.
Turn the pump back on and test for leaks again.
- ✓ **Once all leaks have been fixed, it's time to tune your Siphon.**

Ensure the pump is running and the grow bed is filling with water. Once the water is approximately 10" deep the Siphon should "fire" causing most of the water in the grow bed to empty into the fish tank.

Once the water in the grow bed drops to approximately ½" deep, the Siphon should "break" (or stop emptying the water). This in turn, causes the water in the grow bed to rise again.

HELPFUL TIP

Check the Troubleshooting section in this book for information on how to fix common Siphon "firing" problems.

Adding Your **FISH & PLANTS**

CYCLING YOUR SYSTEM

Before you can add your plants and fish to your Aquaponics system, it is important to focus on a key element that makes your system work, the bacteria growth. Ammonia needs to be present to attract bacteria. This can be added in two different ways - cycling with or without fish.

Testing your water for ammonia, nitrite, nitrate, and pH levels will assist you in ensuring that your system is healthy and cycling properly. We recommend purchasing an aquarium test kit to check your levels and for future troubleshooting. Keep in mind that when you achieve cycling, the system will in most cases run on its own with little monitoring needed. Some testing of pH in the water will help diagnose or ensure an optimal environment going forward.

CYCLING WITH FISH

Some people decide to add fish and plants on day one to kickstart cycling. This method requires that the bacteria grows quickly enough to help convert the ammonia from the fish waste.

Many people use goldfish for this initial cycling, as they are inexpensive and can tolerate high levels of ammonia. Some of these fish may be sacrificed in obtaining proper ammonia levels before adding your fish of choice such as tilapia.

When you begin to test the water, the ammonia levels will start to increase from the fish waste or from leftover fish feed decomposing in the water. As you monitor the water levels for a few weeks or so, you will begin to notice that nitrite levels are beginning to increase and the ammonia levels may slowly drop.

This is a sign that one of the two healthy bacteria is growing, starting to convert ammonia into nitrites. After another 10-14 days of this process, you should see nitrite levels drop and nitrate levels increase as the second healthy bacteria starts converting nitrites to nitrates.

Nitrates act like a plant fertilizer and will be used to feed the plants. Soon you will see all levels drop to near zero, which shows that your system is cycling properly.

CYCLING WITHOUT FISH

Without fish, the system can take less time to cycle, and is often easier to set up. Rather than relying on fish, you are introducing elements to the system. The key step to start the cycling process is adding ammonia to the water. This can be done using a few different methods.

The easiest way is to use the aquarium test kit mentioned prior. Other methods include adding dead fish to your tank to decompose and provide ammonia or by purchasing pure ammonia at your local hardware store.

Since you have no fish or plants to stress over, you can add larger doses of ammonia to the water tank to begin faster growth of the bacteria. Make sure to monitor all your levels of ammonia, nitrites and nitrates as you could begin cycling within 10-14 days time. Once your nitrate levels increase to 5-10ppm you can add your fish and start planting.

FISH OPTIONS

Do some research on the species of fish you would like to use in your Aquaponic system. A popular fish used in Aquaponics systems are Tilapia as they grow fast and withstand poor water conditions.

One of the main factors in your decision should be the water temperature you are looking to maintain, and the foods you want to grow. Some fish require warm water while others such as Trout prefer temperatures between 50°F – 68°F. You also want to consider what is available in your local area, and where you can purchase fingerlings (juvenile size).

Many Aquaponics growers have used crayfish/crawfish, mussels, or prawns, as they make a nice addition to your system. Do your research as every different animal has a preference in pH levels and water temperature. Find out what is available to you and what works with your system.

FISH FOOD

So how many fish can I grow in my IBC Tote system? Every system has a slight difference as we all have individual requirements. Your plant choices, the temperature of your water, and the surrounding environment can impact how much you can grow. With that all said, there is a general guideline we can all follow to help us establish how many fish our system can support while keeping everything balanced.

One step that this system cannot provide naturally is food for your fish. Since this is inexpensive, it's a minor consideration, given how many vegetables and fish your system will provide.

We recommend using fish pellets for feeding your fish. These can be purchased at any aquarium store. So how much do you feed your fish? A good rule of thumb is to feed your fish a small amount and see what they consume in 3 minutes.

If all the feed is gone, make note and add a little more on the next feed. We do not want to overfeed as it can disrupt the balance of the water as the leftover food sinks to the bottom and rots. Feeding smaller amounts a couple times a day is a great way to start with smaller fish.

GROWING PLANTS

When planning out items to grow with your Aquaponics system we recommend starting off with seedlings, as you can expect faster results and the plant is more established. Since we are not using soil in our growbed, when planting your seedlings, wash off all the soil so you are left with just the roots. With all the nutrients coming from the water, you can plant your vegetables as close together as you like to maximize space.

There are over 280 different plants that have been used in Aquaponic systems so finding some that you want to eat should not be a problem. The key is to give yourself variety, as you don't want to eat the same vegetable everyday. Also, you don't want to pull all the plants at once, since the plants play a big part in how the system works. Use different plants which provide food at different times to ensure food is always available.

Here are a list of popular vegetable plants that work well in a Aquaponics system: Cabbage, Broccoli, Cauliflower, Leafy greens such as Lettuce & Spinach, Tomatoes, Peppers, Peas, Herbs such as Basil & Mint and Kale/Swiss Chard

MAINTENANCE

One of the best things about having an Aquaponics system is that mostly everything is designed to support itself with little maintenance required. Feeding your fish versus weeding and watering on a regular basis is a great trade off.

With that said, there are still some routine tasks to ensure everything is working healthy. Some tasks should be done daily while others can be done once a week or once a month. Here is a itemized list to follow:

01

DAILY

- ✓ Feed fish twice a day (once a day is ok as well).
- ✓ Check the fish tank temperature so that your fish are comfortable.
- ✓ Make sure your pump is running and there are no issues with blockage or leaks.

02

WEEKLY

- ✓ Check ammonia levels to ensure water is healthy along with your bacteria. - Check pH levels as levels can change - ideal range should be 6.8 - 7.2
- ✓ Watch your water level - you may need to add a little.

03

MONTHLY

- ✓ Check for solid waste near the bottom of your tank, mix it around so it gets pumped into the grow bed.
- ✓ Test Nitrate levels to make sure you have enough plants using the nutrients. - Inspect pipes as some may need removal and cleaning.

CONCLUSION



Having an Aquaponics system can provide a sustainable food supply by raising fish and growing fresh produce.

This journey is not only fun and rewarding, it helps you appreciate how this small ecosystem comes together to provide for you and your family. I hope you enjoy this wonderful experience as more and more people see the benefits of Aquaponics systems all around the world. To some this is a hobby, and to others it is a way of life... either way, gardening will never be the same.

Trouble Shooting Your **AQUAPONICS SYSTEM**

We have provided some answers to a few problems you may incur with your Aquaponics system.

Keep in mind that your living organisms may become sick, or your system may not be in balance. If you find that your questions or concerns cannot be answered below, take the time to research online

Q. MY SIPHON IS NOT FIRING?

- ✓ Increase the amount of water flowing into the growbed.
- ✓ Make sure your piping is connected properly and not clogged.

Q. MY SIPHON WILL NOT STOP?

- ✓ Reduce the amount of water flowing into the growbed.

Q. MY FISH ARE NOT EATING, WHAT SHOULD I DO?

- ✓ Ammonia levels may be too high.
- ✓ pH is outside the optimal range.
- ✓ Water temperature may be too cold or hot.

Q. I HAVE ALGAE IN MY TANK, HOW DO I GET RID OF IT?

- ✓ Try covering the water tank as sunlight helps algae grow.
- ✓ Use an aquarium skimmer tool to remove once visible.

Q. MY PLANTS LOOK WILTED, WHAT IS WRONG?

- ✓ Too much water as the grow bed is not draining.
- ✓ Too little water (pump is on timer and not always on)
- ✓ Check water pH as it might be out of the ideal range.
- ✓ Not enough sunlight

Q. MY PH IS HIGH OR LOW, WHAT DO I DO?

- ✓ Test your water to see if there is a spike in ammonia.
- ✓ Check water temperature.
- ✓ Make sure the water pump is working.
- ✓ Ensure your siphon is firing.

AQUAPONICS

DO IT YOURSELF GUIDE

*A step-by-step guide to
growing your own food.*

Having an Aquaponics system can provide a sustainable food supply by raising fish and growing fresh produce.