

Indoor Gardening

Includes any kind of gardening that can be done indoors. This includes soil, hydroponics, and aquaponics. Also how to light your indoor garden and keep things running.

- Indoor Gardening Methods
 - Low Cost, DIY, Indoor Gardening Primer
 - Hydroponics
 - Aquaponics

Indoor Gardening Methods

Specific techniques on growing anything indoors. Read the primer to get started!

Low Cost, DIY, Indoor Gardening Primer

Summary:

This guide is to show that growing food, plants, flowers, ornamentals or whatever you want does not require massive amounts of land, time or money. Infact you can grow fresh, organic food indoors, in the middle of a city with very little upfront cost.

Ultimately plants require a couple things to grow:

- Light
- Water
- A growing medium
- A container to grow in, or an area to grow

That is distilling a ton of information out, but at the fundamental levels, that is what plants need. Think about these fundamental building blocks. They don't have to look like a massive field of crops. You can grow crops with an old yogurt container and a grow light in the trunk of a car.

This counts for plants grown from seed, cuttings, or plants you buy from the store. Seeds are the cheapest way to get a bunch of plants. And they are easier than you think. **Here is a guide** on making a small seed germination station / seed starter.

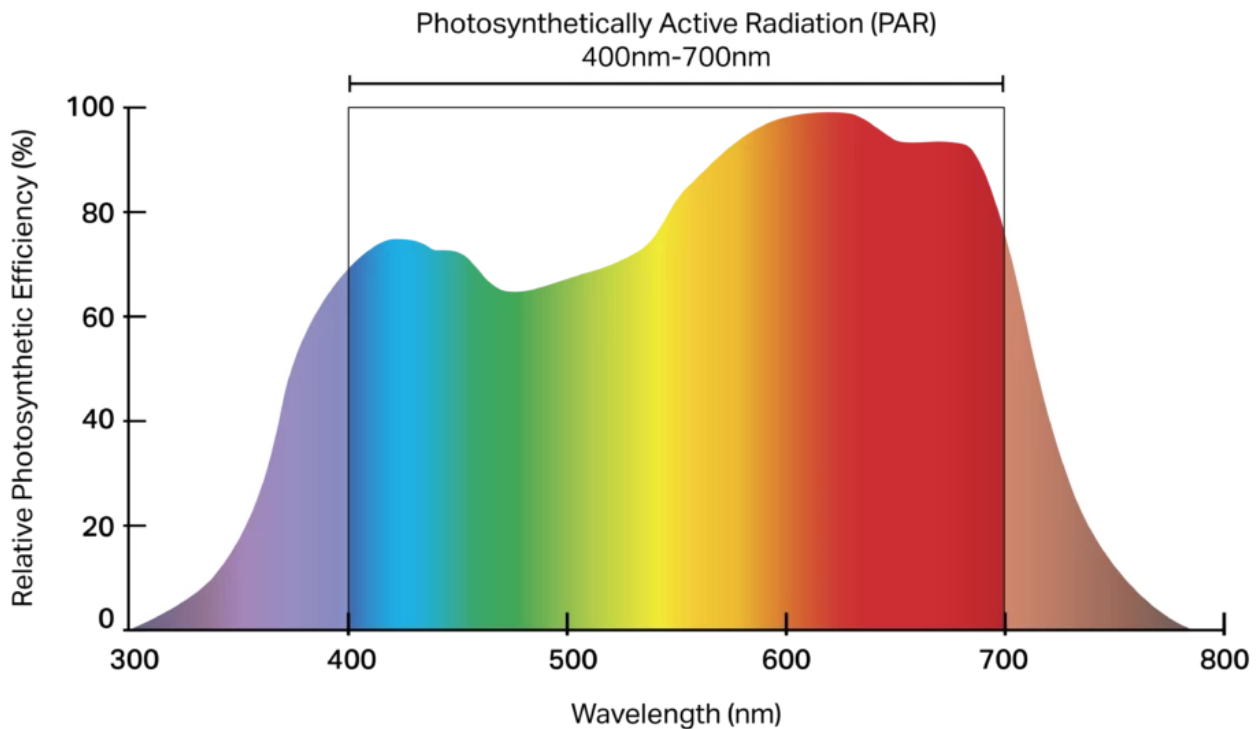
Let your imagination run wild of the places, and uses of objects. Yes you can use a handcrafted expensive planter combined with top of the line gardening soil in a large greenhouse. You can use an old tupperware container with a homemade soil mix and a grow light in a highrise apartment in innercity Chicago. Our concept of how and where we grow plants can change, and with that change we can grow things anywhere, even in the most hostile environments, even in trash.

With a \$10 grow light, an old lamp, a DIY soil mix, water and a tupperware container or any pot, you can grow food indoors, for very little.

How To:

Light

Plants grow best in specific light ranges. Unfiltered sunlight is interesting because it has a ton of different light on the spectrum that plants love and use to grow. We can also use artificial lights to mimic the color ranges that plants get from sunlight. Plants tend to get their energy from both Violet- Blue light in the 400 – 520 nanometer range and Red light in the 610 – 720 spectrum range.



Not All Natural Light Is the Same

Unfiltered sunlight means direct sunlight. This can be confusing because you may have put a plant on a window sill in direct sunlight and had it die. Most windows have a UV filter in the glass, so the light is actually filtered and may remove the beneficial light spectrums before they make it to the plant. That doesn't mean you can't grow plants in filtered sunlight, there will still be beneficial light coming in, though the more of the correct light spectrums plants get, the bigger and faster they will grow.

Artificial Light & Growing In The Dark

When you hear "grow lights" you might immediately think of expensive greenhouse lighting, which is normally where they are used. If you can afford a \$200 light that is great. There are affordable grow lights in big box stores and sometimes in gardening stores or hydroponics stores. They range anywhere from \$40-\$100, only get them if you have a specific use, like if you are doing rack style indoor gardening.

What if you could get a grow light for \$10? Well you can! Most big box stores sell grow light bulbs that screw into normal E26 light sockets. So you can turn an existing lamp or light fixture into a

growlight and grow plants 100% indoors.



This is really amazing because it saves money on the light itself and you can reuse and upcycle old lamps that otherwise might have gone to a landfill. You can make an indoor garden wherever you are. In the dead of winter, or on the 6th floor of an apartment building, in the darkest places you can grow plants. There is an electrical cost to it, but they double as regular lights so they are dual purpose. You get to see and your plants get to grow, everyone wins.

Water

When a plant needs to be watered depends on the plant. Some like very moist soil, a lot prefer quick draining soil and don't like their roots especially soaked. One tip that has helped take some of the guess work out of watering is this:

When watering a plant, it isn't really about how much water, but really how often you water it.

You can drown a plant in a container and it will stay alive, but if you water it once every single day and it is a plant that likes somewhat dry soil. It will die. So keep that in mind when you find a plant you like. Find out if it likes a ton of water, a normal amount or very little. That will determine how often you water the plant.

Growing Medium

Your plants will need a place to actually grow, most people choose good old soil but you can actually grow plants in water like in hydroponics or aquaponics. Again, this is a topic that we are

used to thinking of growing food in open pastures and farm land, it can also be done in a raised bed, or a container in the corner with a grow light!

Soil

Hot take, but MiracleGro is called that because it is a miracle anything will grow in it. Their premade soil mixtures tend to be not great. And a beginning indoor gardener might want to go with the cheapest option. Instead you can make your own mix that will do you pretty well for a little extra. A good mixture is compost, peat moss and perlite. All of those can be bought at a hardware store for less than \$25 and it makes a lot of mix. Wear a mask when working with perlite, it is basically ground up volcanic rock and you don't want to breathe the dust in. But mix all that together and you have some pretty decent potting mix for really cheap. I say decent because there are better soil mixtures but they require space to compost, or special stuff. You can buy really nice potting soil from garden centers but that's up to you. Tons of people only have access to a hardware store, or have limited options so you do what works for you.

Hydroponics & Aquaponics

There will be a full guide to hydroponic growing that goes into the details in how it works. At the most basic level hydroponics is growing plants in water mixed with a nutrient solution. This method is interesting and requires different things but it can yield plants that grow incredibly quickly and large. Some plants like root veggies can't be grown in hydroponics, and others will not mature in hydroponics unless you do a good amount of tinkering. It is great for young plants to be moved into hydroponics so they can grow incredibly fast and then put them into soil for them to fully mature.

In order to do hydroponics you really just need a vessel to hold your plant over the water solution, some water, and the nutrient solution. Foxfarms makes really nice hydroponic solutions, but you can find really any kind and use it. It is harder to find in big box stores and you might have to go to a garden store or hydroponics place, or online. Depends on your needs and how comfortable you are with things. But if you are just starting, just use soil. It is cheaper and will cause less headaches unless you like tweaking and messing with things.

Another method is aquaponics, where fish are making your nutrient solution. This might be a good option if you already have fish but this method is more involved than just keeping a grow light and watering a plant in soil.

Containers to grow in

We are used to seeing plants in black nursery pots or in nice planters. Everything can be a planter, and everything should be. Waste is so huge in our society and a great thing to do is reuse and upcycle wherever you can. A planter can be an old ceramic bowl with a hole drilled in the bottom for drainage. It can be an old plastic container that was lying around. An aluminium can, a soup can, an old kiddie pool makes a great space to grow potatoes. Think of a planter as a vessel. There

are so many around us that we can grow in.

Examples:

(Left) Corn being grown inside a regular pot in soil.

(Right) Peppers being grown inside in a hydroponic solution in a tupperware container.



Chinese kale growing in a hydroponic solution in a takeout container.



Resources:

[Hydroponic food growing basics](#)

[Grow veggies in storage totes](#)

Turn a kiddie pool into a planter

Growing potatoes in raised beds and kiddie pools

Making Mels famous garden mix

Hydroponics

Summary:

Hydroponics is a technique of growing plants without soil. Usually a plant is held over a container and the plant roots are semi submerged in a solution of nutrients that is mixed with water. It can be used both indoors and outdoors and is especially good at growing extremely large plants quickly. A big benefit to hydroponics is you can tweak the nutrient levels to the specific plant, and create more of a microclimate if you are growing rare or very specific types of plants.

There are both low tech, very minimal energy intensive ways to grow with hydroponics, and higher tech methods that cut down on algae growth and can make some plants grow even bigger.

It is simple to start and maintain, the materials needed range but you can start growing hydroponically using upcycled materials, make your own reservoirs or purchase pre-made systems.

Basic Components:

- Plants
- Water
- Nutrient solution
- A container to hold the plants (lid preferable but optional)
- A method to keep the plant upright and not submerged in the nutrient solution
- Light source (sun or artificial)

That's it! You can get started growing pretty much anything, indoors, outdoors, out of season, doesn't matter!

How To:

First step you will need plants:

- You can start plants from seed and use a small greenhouse to grow them in soil, then transfer them into a hydroponics system.
- You can also use existing plants that have been growing in soil and move them into a hydroponics system. Moving mature plants with established roots in soil can be a challenge because you have to clean the roots of dirt, and that can be hard when roots

grow a little crazy.

You can grow pretty much any plant in hydroponics, though some you cannot. Root vegetables like carrots, radishes, and onions will not be able to grow correctly as they need soil. There are ways to grow them in a hybrid approach but it is much easier to do in soil. Anything that grows underground typically will not work.

Hydroponics are great for pretty much everything else. You can grow amazing strawberries and giant heads of lettuce. Anything with roots will grow well in a hydroponics system.

Next you need a waterproof container

Use your imagination, anything that's waterproof can be used to grow a plant hydroponically. It can be an expensive custom made hydroponics rack, a 3D printed and sealed art piece vessel, a takeout container, a simple glass, tupperware, or a waterproof vase. All of them will work if you have a way to suspend the plant so it doesn't fall straight into the nutrient solution and has a little room for air near the roots.

Different net cups will come in different sizes, and if you buy a prebuilt container or system they may take a specific size. If you are using a recycled container, the size of the holes will depend on what size net cups you get or if you use something else to hold the plants.

The most common hole size is 2 inches.

Holding the plant in place

There are a couple options here but most people tend to use a combination of a **net cup** and **rockwool**.

The net cup holds the plant and roots in place and the rockwool holds the plant, and acts kind of like soil. These are pretty standard and most hydroponic growers use these. There are downsides of cost, and the fact that once a plant has grown into rockwool, it can be next to impossible to separate the plant from it without sacrificing some roots. So keep that in mind.



Another interesting option is to use cut up pool noodles to hold the plant in place. Because they can expand and contract they can fit into systems that use traditional net cups. They are also reusable and because the roots don't grow directly into it, they grow into the nutrient solution, the pool noodle section won't harm the root structure. Do not recommend using pool noodles as a replacement for rockwool and growing the roots directly into it. The pool noodle is to hold the plant right above where the roots start, not to actually grow in.

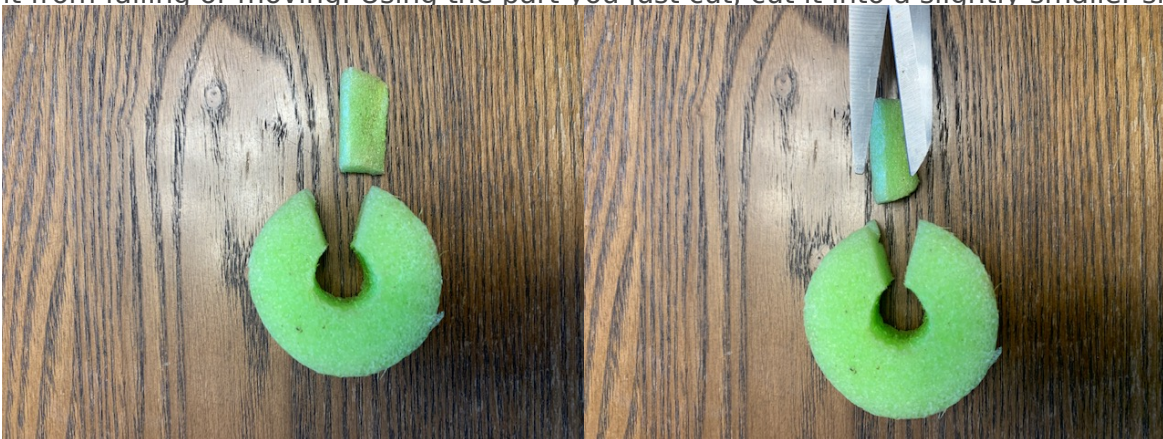


Pool noodle net cup alternatives

You can use any pool noodle and cut it into about 1 - 1 ¹/₂ inches thick disks. You will get a ton of little pool noodle pucks and these are super economical because they cost next to nothing to make.

Once you have your pool noodle broken down, for each one cut a part out of the circle. Don't cut it so big that it won't fit in your hydroponic basin.

The part you cut out from the noodle will be used as a wedge to hold your plant securely and keep it from falling or moving. Using the part you just cut, cut it into a slightly smaller sliver. You will get



Then you put your plant in the hole with the wedge. Depending on how big the stalk is you might not need a wedge in there or you may need a decent sized one. Trim to your plants size needs.

There is a sweet spot of not suffocating the plant, and not letting it fall into the solution so aim for the sweet spot.



Nutrient solution and water

You can experiment here, pretty much just looking for any kind of hydroponic solution. This can be found at garden centers, hydroponics stores or online. The solution can be very cheap and some hydroponic brands have different solutions for different growing stages.

You take the solution and dilute it into water, and you are done! Each brand will be different and call for specific measurements. They will have a chart on the bottle, It is easier to use a 5 gallon bucket with a lid just to ease measuring and the need for math. Fill up your water container and mix in your hydroponic solution and you are ready to rock.

High Tech Hydroponics Vs Low Tech Hydroponics

This will depend on your wants, needs and how many supplies you can afford. There is a stereotype of hydroponics being this insanely expensive way to grow plants, and it can get expensive quickly. For the most part though you don't need high end supplies to have amazing plants grow. There are a ton of different methods, so many that it would be hard to list them all here.

The higher tech methods use pumps and various methods of recycling the nutrient solution. There are flood and drain methods that water the plants at specific times. Deep Water Culture (DWC), Nutrient Film Technology (NFT), and a couple others. [Here is an article](#) going over all the different methods but the basics still apply to all of them.

Technology in this case doesn't mean technical complexity, but mostly that it requires added equipment or uses more electricity compared to the Low Tech versions which are more of a passive, less energy intensive way to do hydroponics.

High Tech / Active Hydroponics:

Air stones and airstone systems are often used in hydroponics as a method of introducing more oxygen to the plant roots. This can help plants grow to be healthier and also fight off algae growth by basically just spraying a bunch of air into the nutrient solution to keep it moving. These run off a central machine and have tubes run where the air comes out of.



These do add cost to the entire setup but can really help make sure the plants are receiving enough oxygen.

Low Tech / Passive Hydroponics:

There are less energy intensive options that don't require extra aeration. One is called the **Kratky Method** named after the scientist who has been researching no to low aeration plant growth. With the added benefit of lower costs both in equipment and electricity, there comes a cost. Algae will be the number one issue with Kratky method hydroponics. Growth will depend on your container material. Any material that is see through or light in color can allow algae to form. This doesn't happen everytime and most of the time it won't be an issue besides having some green nutrient solution. For the most part algae will not hurt the plants that much, but keep in mind it is another organism taking nutrients that should be going to your plants. Don't stress too much about it. You can wrap containers in newspaper or use opaque or slightly darker containers to curb algae growth.

Here are plants in pool noodles in nutrient solution resting in a tupperware container. These plants have no extra aeration which cuts down on costs. You can also grow these outside as well and never need artificial light. The benefit of growing indoors is you can grow plants out of season or in the dead of winter, sometimes it can be worth it. You decide that for yourself when embarking on

the journey of growing plants in hydroponics.



Examples:



Hydroponic flood tray system made from wood and pond liner with polystyrene holder to suspend multiple plants. This also carries over into aquaponics systems.



Resources:

[Full detailed breakdown of the different hydroponic systems](#)

[Growing veggies with the Kratky method](#)

[Pool noodle net cups / cheap hydroponics](#)

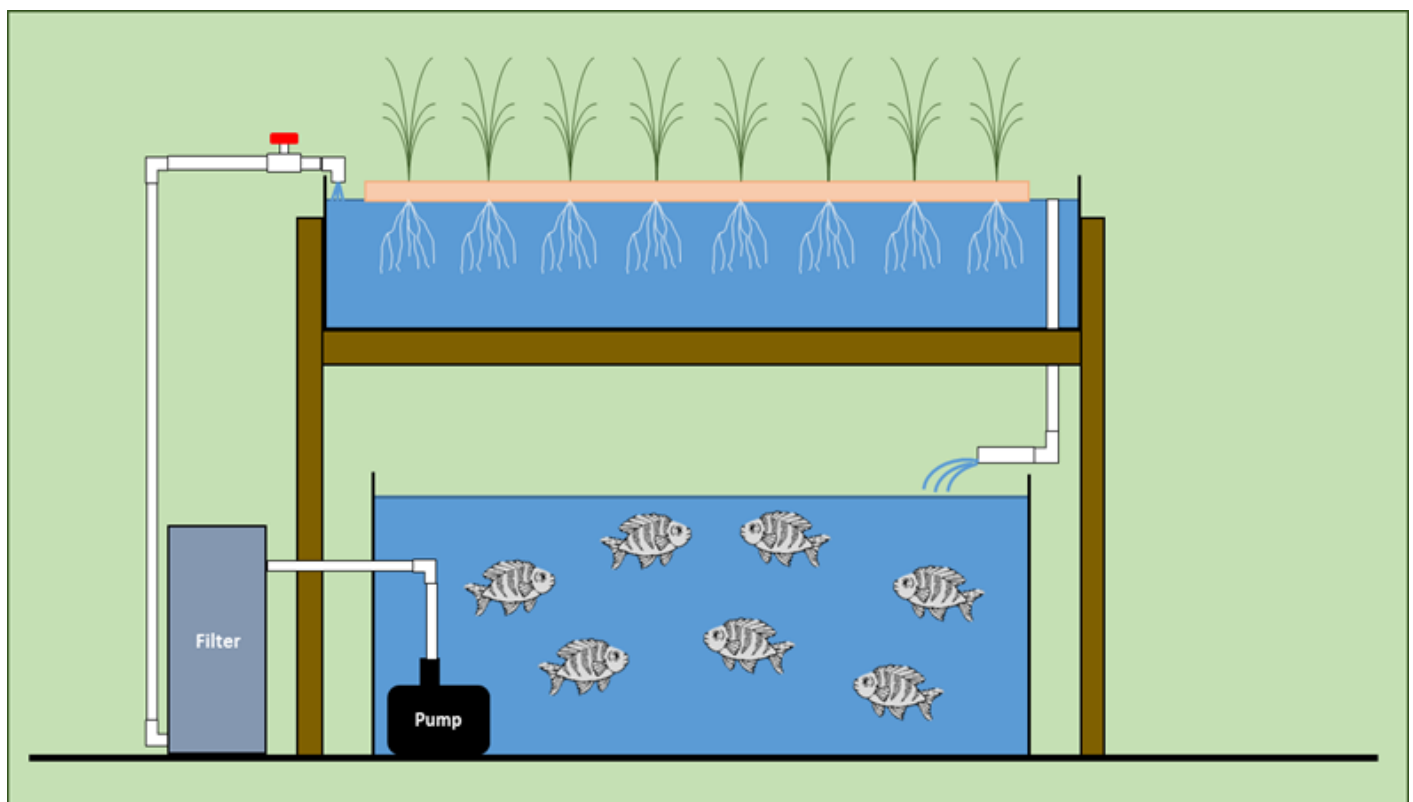
[Growing food in upcycled containers](#)

Aquaponics

Summary:

Aquaponics is similar to hydroponics but instead of having to buy an external nutrient source, you are using fish to produce nutrients for your plants while also raising fish to keep as nutrient creators or consume for protein. These systems require more upkeep but remain some of the most ecological as they can be close to self sustaining systems. If you want to grow food and also have fish, this is perfect.

The basic layout of an aquaponics system looks similar to this:



How To:

If you have a hydroponics system, a tray system or a waterproof bed then you already have half of the work done. You can use multiple grow beds, but that increases the complexity. It's possible but takes a ton of work.

Hydroponic grow tray that is suitable for aquaponics systems:



There are multiple ways to set up an aquaponics system, the most common contains these main components:

- Fish Tank
- Solids Filter
- Biologically active substrate like lava rocks
- Hydroponics
- Post filtration
- Sump Tank (optional with benefits)
- Fish

Fish Tank

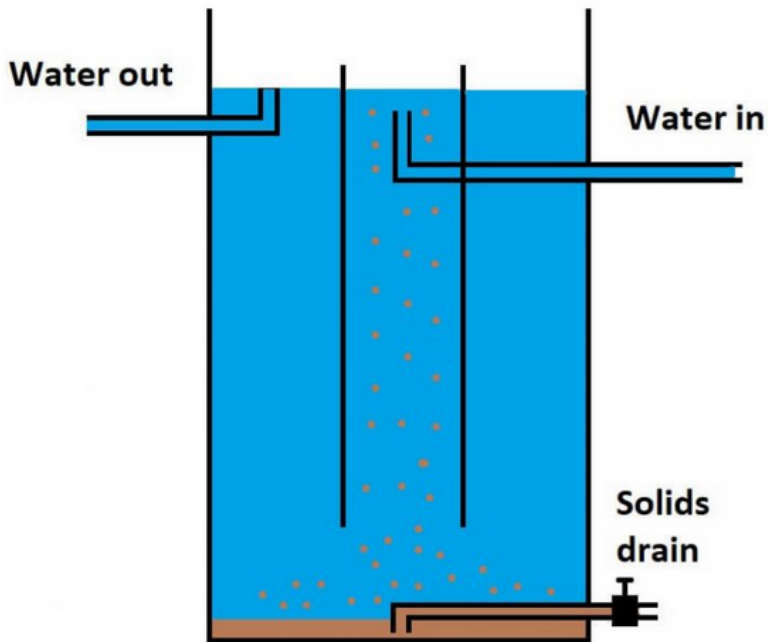
The size of the fish tank depends on the size operation you want, and the size of your fish. Most people who run aquaponics systems use IBC Tanks/Totes, which are large plastic containers with the tops cut off for access. You will need to locate a provider for your local area. They tend to run around \$300 each brand new. There are plenty of used IBC totes but be 100% sure they were used for potable water and not hazardous chemicals. Alternatively you can use a regular fish tank, cattle feeders, or even a portable swimming pool as a large pond.





Solids Filter

Most aquaponics systems use a Radial Flow Separator. There are many designs such as a clarifier, raft filters, bird netting, screens. But most will use an RFS.

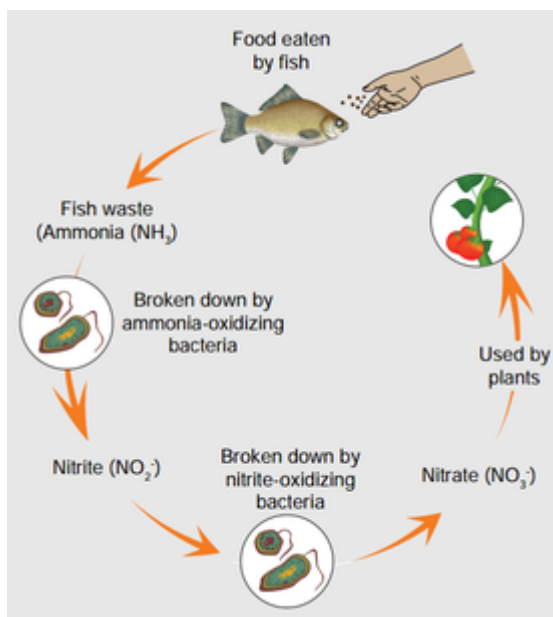


The solids filter is great because you can use the solid waste in the garden too, so nothing really goes to waste.

Biologically Active substrate

This depends on how your plant growing system is designed. If you are using hydroponics you can grow into something like lava rock or lecca or set them at the bottom of the hydroponic tank. The largest reason you need a porous surface in the system is to encourage the growth of beneficial bacteria that will break down the fish waste. This bacteria will convert the fish waste into nitrogen and other compounds that your plants will use as food.

The key to maintaining an aquaponics system is the balance of waste, bacteria and the nitrogen cycle.



Hydroponics

The hydroponics system works the same as a conventional hydroponics system, only that the nutrients come from a natural resource (fish) and don't require outside resources to run the system.

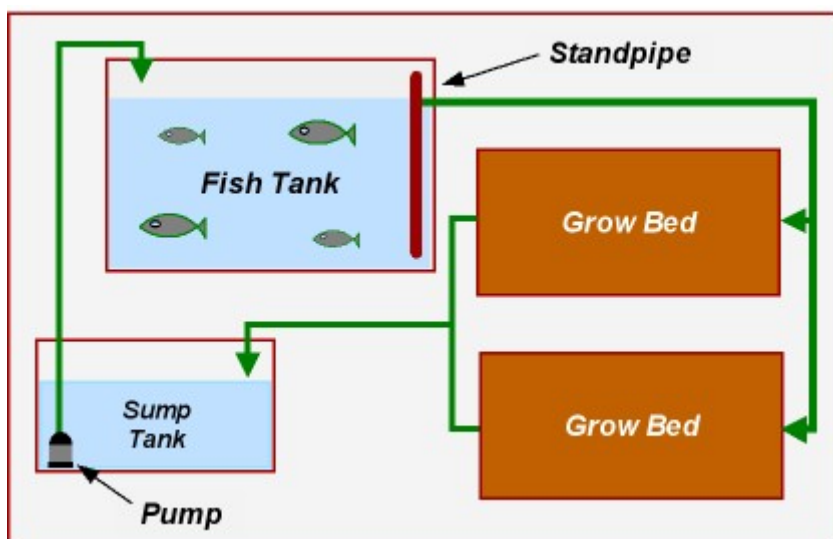
A full guide to hydroponics can be found [here](#).

Sump Tank & Post Filtration

Some systems use what is called a "sump" tank. Instead of directly recycling the water into the aquaponics system after going to the hydroponics bed, the water is held in a separate tank and then pumped back into the system. This is also a great additive to a system because you can filter out any solids that may come from the hydroponics bed.

Why is this a benefit?

Aquaponics nutrient systems must remain balanced and a large part of keeping both plants and fish happy is maintaining the correct PH balance of the water and nutrient rich water. A sump tank gives you an option to balance the PH of the water for the fish before it recirculates in the system. The PH and nutrient concentrations overtime will fluctuate and there may be the need to periodically lower or raise the PH to maintain a healthy tank.



Fish

You can use any type of freshwater fish but the specific fish that works for your setup depends on how big of a tank you will have, and what fish will fit in that space. Tilapia are a common fish to use for aquaponics because they grow fast, self regulate their population, and are a great protein source. There are too many fish types to list here so start with tilapia or research what fish would work for your uses. Not everyone wants to eat fish, or maybe prefer to keep more ornamental fish. That is entirely up to you!

Examples:





Resources:

How to build a simple DIY aquaponics system at home

Purdue presentation on aquaponic systems

Recommended fish for aquaponics system

Food and Agriculture Organizations of the United Nations (FAO):

Small-scale aquaponic food production: Integrated fish and plant farming (PDF)