

FREE eBook - Hydroponic For Ultimate Beginner (Growing Medium, Nutrients, System Setup)

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Introduction

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Hydroponic gardening is going to save the world.

In a world short on freshwater and where most of the population live in cities, hydroponics can grow nutritious fruits and vegetables with very little water right in the middle of even the densest urban neighbourhoods.

Plus, hydroponics is just fun. You learn some science and DIY your own apartment window system. Or you grow a hydroponics empire, growing and selling hyperlocal food. Or start somewhere in between.

Okay, sure, it'll save the world, you say. But what exactly is hydroponics?

What is Hydroponic Gardening?

Hydro (water) + Ponics (Working) = Growing food in water

Hydroponics sounds very complicated, and the systems themselves can get very elaborate, but the concept itself is very simple: you grow food in water instead of soil.

What You Need to Get Started with Hydroponics

Nutrient solution

Hydroponics just doesn't work without nutrient solution (unless you're using aquaponics). Nutrient solution is not fertiliser. Most fertilisers focus on the macronutrients nitrogen, phosphorus, and potassium (NPK), relying on the soil or other amendments to add necessary micronutrients. But your hydroponic plants

won't have soil. They are 100% reliant on the nutrients you feed them, and if they don't get them, they'll starve.

The good news is that there are a bunch of manufacturers out there each concocting the perfect formula to feed your plants at each stage in their growth cycle. All you need to do is pick some up and follow the instructions.

Nutrient solutions are often sold in multiple bottles, usually one base and one for the growth stage, and need to be combined. This is because some of the nutrients, when combined with other atomic chemicals, do what atoms do best — combine into compounds. That seriously reduces the shelf-life.

Growing Medium

This is what you grow your plant in. Yes, I said that hydroponics is about growing in water, but you still need a growing medium to sprout the seed and retain moisture and nutrients to continue to feed your plants. Plant roots also need oxygen, so a good growing medium allows roots to breathe.

What growing medium you choose depends on the system you use and your personal preferences.

Just note that while hydroponics is sustainable overall, not all growing mediums are. Rockwool is a really popular growing medium, but also bad for the environment and bad for you.

They're made by melting rock and spinning it into long fibres, so they're energy-intensive to make and while you can't reuse them, they'll last into infinity. The fibres and dust can cause harm to your eyes, nose and lungs.

A few popular growing mediums include:

- **Coconut coir.** A fungus-free medium that retains moisture, but if not used correctly, may drown plants. Salt build-up may also be a problem. Renewable

source and would otherwise be discarded but is transported over long distances.

- **Expanded clay pellets.** Porous clay balls that are reusable and pH neutral. The downside is that they dry quickly (meaning roots dry and die), they can be very heavy, and they're strip-mined.
- **Growstones.** Glass bottles crushed, melted and mixed with calcium carbonate to become something that looks like lava rocks. The downside is that they're irregularly shaped, so they may fall into your reservoir if you're not careful, and they're hard to clean.

Net Pots

Net pots are mesh containers that hold the growing medium and plants out of the water while allowing roots to grow through the holes to reach the nutrient solution.

They're pretty inexpensive, but you do need to buy in bulk. If you just want to try out hydroponics with a Kratky system, then you can DIY a net pot by potting holes in a single-serve yogurt container.

Light Source

Plants can grow without soil, but they can't grow without light. If you're planning to set up your system in front of a south-facing window, rooftop, balcony, or yard, you're golden.

But if that's not an option, invest in some grow lights. Grow lights differ in pricing based on how good the light is. But note that with LED lights, watts don't mean much, even if manufacturers will try to gouge you for it.

Plants need a full spectrum of light with at least both blue and red spectrums. Some LED lights come in purple or can be programmed for blue or red based on the growth stage.

You have a few different options:

- **Full-spectrum (daylight) LED light bulbs** or **Miracle LED Grow Lights**.
- **Fluorescent lights**. These are pretty inexpensive, and for the most part, the fitting is going to be the most expensive part. The downside is that they don't last as long as LED lights and they're filled with mercury, making environmentally-friendly disposal a problem.
- **LED Grow Lights**. These can range from \$40 for a 20" lightbulb to thousands of dollars, depending on the quality. If you're a hobbyist, pick something reliable and inexpensive. If you're growing commercially, invest. They last a long time and save money on electricity, which is especially important the more lights you have.

pH Control and Testing Equipment

pH is how acid or alkaline a solution is. Plants need a [pH between 5.5 and 6.5 to grow properly](#), so you'll need to test your water every time you mix more nutrient solution.

With more complex systems, you'll need to continually test. If your pH is off, you'll need to add a pH Up or Down formula, which you can usually buy from the same place as the nutrient solution.

Now that you have an idea what equipment you'll need, let's talk about hydroponics systems.

Types of Hydroponics Systems

Non-Circulating Hydroponic Method (The Kratky Method)

This is the simplest simple and what every other system is based on, so this is the system I personally recommend everyone new to hydroponics try first. It'll teach you how to mix the nutrient solution, check the pH balance, and grow lettuce using hydroponics, all skills necessary for other hydroponics systems.

All you need is a mason jar (or similar-sized jar), a newspaper or other paper wrapping, a growing medium, a net pot, nutrient solution, and lettuce seed.

You can fudge a little by using a seed starter as your growing medium, a DIY yogurt container as your net pot, and water-soluble fertiliser as your nutrient solution. Yes, I know I said you can't use fertiliser, but if you do have some hanging around and the package gives instructions on how to dissolve said fertiliser in water, then you can use it for this short experiment.

- Place your growing medium in the net pot and soak it.
- When the growing medium is damp, plant the lettuce seed.
- Fill the mason jar with water and dissolve your nutrient solution in it (following the instructions on the label).
- Put the net pot in the mouth of the mason jar (the net pot should barely touch the water).
- Wrap the newspaper around the outside of the mason jar (roots hate light).
- Place the jar where it will get sunlight.
- Harvest when the lettuce is fully grown.

As time passes, the water will disappear from the mason jar, but the lettuce roots will grow to reach the water. The mason jar should have enough water at the start to last the entire growing period.

That's it! Congrats, you've grown your first hydroponics vegetable!

If you're using smaller containers than a large mason jar, like a plastic cup, you'll want to replace the water and nutrient solution before it's gone. Pour the water from a distance to add some lovely oxygen for your plant roots.

You can also use much larger containers.

Best for greens that you harvest once, like heads of lettuce.

Deep Water Culture (DWC)

The Deep Water Culture system builds off of the Kratky method by adding one element: an air pump.

Roots need oxygen just as much as they need water. That's why plants have a hard time growing in compacted soil — they need the space in between the soil for water and air. While the Kratky method is great for short-term growing, if you want to grow other crops with better yields, you'll want to oxygenate the water.

An air pump has three components: the air stone (which goes inside the tank), the airline tubing (to move the air from pump to air stone), and the air pump itself (the thing that makes it all work). The bigger the tank, [the more powerful air pump you need](#).

The DWC is still low maintenance, only requiring a change of water every twenty weeks or so. And if the power fails or the pump breaks, your plants will survive for a while, unlike the systems below.

You can also scale this system from a 6 plant DIY to a commercial growing operation. Just make sure your grow bed is on even ground, or some of your plants will wilt from lack of water.

Best for growing lettuce, leafy greens, and herbs.

Wick System

Have you ever dabbed a paper towel with a drop of water? The drop soaks through just one spot but as you watch, the damp spot spreads. That's because of capillary action, and that's what self-watering pots and the wick system is based on. Instead

of the plant roots reaching down to the water and nutrient solution, you bring the nutrient solution up to the roots.

The wick system is simple and space-efficient. You do need to select a growing medium that aids in moisture transference, like coco coir.

The downside is that the system creates a humid and damp environment that aids fungal outbreaks and rot.

Best for growing lettuce and herbs that like to be dry.

Ebb and Flow (or Flood and Drain)

This system is true to its name. The grow bed is built with a timer on the pump, so that on a timed interval, the grow bed floods with water, delivering nutrients to the plant roots. The timer shuts the pump off and the water drains back into the reservoir via gravity, allowing the roots to breathe. (The water does not cover the stem or foliage.)

Media like clay pebbles and growstones work best, as they absorb water during the flood stage and keep the plant moist during the drain stage. (They can also be cleaned and reused, hurray!)

But if you don't time the stages properly, or if your pump fails, the plant roots will drown or dry out and die. Likewise, you need to ensure the grow bed drains properly. If water remains, you'll have problems with root rot and other diseases. Cleaning the grow bed and equipment regularly will help keep mould and insects at bay.

Best for growing pretty much anything, including tomatoes, peas, cucumbers, and pepper. You can even grow root vegetables like carrots! They just need a deeper grow bed.

Nutrient Film Technique (NFT)

NFT runs water (and nutrient solution) continuously over the plant roots. The grow bed is made with plastic pipes as channels, which are tilted so gravity pulls the water through. A pump brings the water up from a reservoir to the top, the water runs through the channels, then back down a pipe back to the reservoir to start the process all over again.

Because NFT uses less water, the whole system is lighter, making it perfect for rooftops and balconies.

The downside is that if your pump fails or the roots clog up the channels, your plants will die.

To keep crop failures to a minimum, take advantage of NFT's modular design when scaling up. Instead of making a really big NFT, make three smaller ones, each with their own reservoir and pump. That way, if one fails, you don't lose your entire crop.

Best for leafy greens and herbs. You could grow tomatoes if you add a trellis.

Drip System

The drip system takes NFT, flips it vertically and uses even less water. A network of tubes drips nutrient solutions to your individual plants. The nutrients soak into the growing medium to continue to feed the plant and the excess drains away, either to be reused in a recovery system (best for home growers) or discarded in a non-recovery system (best for large-scale growers). While the latter seems like it wastes water, the non-recovery system still uses a lot less water than the systems above.

The upside is this system is really easy to scale up and can grow all your dream vegetables, no matter the size.

The downside is it's high maintenance. You need to continually monitor the nutrients and keep the tubes from clogging. If you use a non-recovery system, you will need to continually prepare more nutrient solution water. If you use a recovery system, you will need to monitor, rebalance the pH, and add more nutrients to replace what the plants have already absorbed.

Drip systems can get really complicated. If you're a home grower, [Windowfarms has free crowd-sourced plans](#) to help you build drip hydroponics out of plastic bottles to hang in your apartment window.

Best for any kind of vegetable, including large vegetables like melons, pumpkins, zucchini, and winter squashes.

Aeroponics

Aeroponics (air + working) uses mist to deliver the nutrient solution straight to the plant roots. Built in an enclosed tower, mist starts at the top and cascades down. The roots are exposed to a lot of oxygen, delivering an oxygen surplus that results in fast, high yields.

You can already guess the major disadvantages. They're super expensive, costing thousands of dollars a tower, and while you can DIY a system for less, it's far more difficult to build than a deep water culture or wick system.

Since your roots are exposed to air with very little moisture, any interruption in power can destroy your crop.

They also require a lot of maintenance and need to be cleaned frequently to prevent mould and root rot.

But if you're growing commercially, the benefits can outweigh the disadvantages.

Best for nightshades (tomatoes, bell peppers, and eggplants), lettuce, greens, strawberries, and watermelon.

Aquaponics

Aquaponics and hydroponics seem confusingly similar. Aqua and hydro both mean water, right? In this case, aqua comes from aquaculture, the practise of raising fish in a controlled environment.

Aquaponics takes Deep Water Culture systems and adds fish to create a self-sufficient system. The fish eat and produce ammonia that's converted into nutrients by beneficial bacteria. This nutrient water is pumped into the grow beds where the plants absorb the nutrients before being recycled back to the fish tank to start the process again.

You can scale aquaponics to commercial growing, but the more fish you have in a small space, the more you're going to need antibiotics, making it not so organic.

Tilapia are the most popular go-to because they are hardy, eat algae, and need little space, but there are [other fish](#) to consider based on your local regulations.

Best for lettuce, greens, herbs, and fish.

Best Plants For Hydroponics

Now that you know what equipment you need and have an idea of what hydroponics system you want to use, there's just one last step before you start growing: choosing what you grow.

How To Choose The Right Vegetable For You

Here are a few things to consider:

- **What fruits and vegetables work with your chosen hydroponics system?** Or, what hydroponics systems can you reasonably afford/maintain that will grow your chosen vegetable?
- **What fruits and vegetables do you like to eat?** This is especially important if you're growing food for yourself. There's little point in growing something that you don't want to eat.
- **What fruits and vegetables have the highest profit margin or save you the most money?** For commercial growers, you need to maximise the profit on every square foot to make your hydroponics business profitable. For home growers, you can save money on your grocery bills. Organic vegetables are expensive. You won't believe how much I saved by growing my own cut-and-come-again romaine lettuce this past summer.

Head Lettuce



Head lettuce is the easiest to grow and thus highly recommended for beginners. They're forgiving of pH imbalance, they only require one nutrient solution type (the vegetative growth), and they work with every hydroponics system out there.

Some systems may allow you to grow it as cut-and-come-again, but it's best if you harvest the whole head at a time. Stagger when you start lettuce (called succession planting) and you'll have fresh lettuce for your salads every week.

Growing your own fresh lettuce will save you a lot of money and it'll taste better than what you buy at the grocery store. There are a ton of delicious, nutrient-dense varieties that you can grow from seed that you won't find in a store.

Herbs



Are you ever cooking when you realise that you need basil, and the fresh basil you bought from the store three days ago has already wilted? Then this is the right crop for you.

Herbs are also easy to grow. If you grow too much, pour a little olive oil on them in an ice cube tray and put them in the freezer, and they'll be ready to pop into your cooking. (Maybe not the mint, though.)

Basil is really easy and you can get a ton of basil off a few plants. As the basil grows, keep pinching the top leaves off to encourage bushy growth. Basil needs bright light, though, so you either need it close to a south-facing window or use grow lights.

Mint is hard to start (few seeds germinate) but once you get it growing, it grows like a weed. You may want to buy a mint seedling and transfer it to the bedding material. Mint likes low light, making it a good choice for east and west-facing windows. Like basil, keep harvesting it and it'll last for months.

Cilantro grows really quickly, ready to harvest in as little as 4 weeks. For most people, it adds a cool, fresh taste. For the rest, it tastes like soap. If you like **coriander** spice, encourage cilantro to go to seed. That's what coriander is, after all.

Watercress



You won't find watercress on a lot of lists of hydroponics vegetables, which is strange, because watercress is ideal for hydroponics. They love really moist, rich soil, and what is hydroponics but exactly that? This leafy green also prefers the shade, so they'll thrive with lower quality light or just in a window.

Watercress is also packed with nutrients and has a peppery taste and crispy texture. You can cook watercress, but it's best fresh. Always wash watercress before eating if you're using a non-circulating system.

Tomatoes



Tomatoes are both popular and easier to grow with hydroponics than outdoors. They're heavy feeders that are vulnerable to tomato blight, which can destroy outdoor crops in days. Nutrient solution solves the first problem. Growing indoors cuts down on the second. Make sure you keep tomato leaves dry to prevent rot and blight from forming.

The downside is that you need a more complex hydroponics system, like flood and drain, NFT, and drip systems, and they need a light. Unlike lettuces, you'll need to switch to a bloom formula when flowers start to bud.

If you're growing indoors, you will also need to pollinate the flowers to produce fruit, whether by hand pollination or, if you have a growing operation, releasing beneficial pollinators in your growing area.

There are two main types of tomatoes: bush and vine, also known as determinate and indeterminate.

Bush tomatoes will only grow so big and produce so many tomatoes before they die. This is why they're called determinate. They will still need a trellis to keep them upright.

Vine tomatoes will grow as high as they have trellis and so long as you keep harvesting, they'll keep producing more tomatoes. Thus why they're called indeterminate. You can see the appeal. If you do go with vine tomatoes, you'll want to stake them. That means providing one stake or rope that the leader branch grows up while pruning the rest.

Strawberries



And I saved the most delicious for last. Strawberries are another common hydroponics crop to provide delicious strawberries out of season. Like tomatoes, strawberries need bloom formula nutrient solution, a more complex hydroponics system, and pollination. They don't require trellising.

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