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# Hydroponic Gardening for the Homeowner and Small Grower

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Cultivating plants in Georgia's differing climate zones with unpredictable weather patterns has long challenged gardeners. However, gardeners with all levels of expertise can grow high-quality, year-round produce with a ***hydroponic system***. Plants grown in hydroponic systems absorb nutrients dissolved in water rather than taking them up from the soil.

Tailoring your approach to Georgia's unique environment by growing in hydroponic systems allows you to grow a wider range of plants and more efficiently control temperature, lighting, fertility, and moisture. This approach can be especially beneficial for those located in dense urban areas, such as Atlanta, where growing in a field is not an option.

There are several specialized hydroponic systems available, as well as simple do-it-yourself options. A lot of the excitement in hydroponics comes from choosing what works best for you depending on your desired crop, space, and effort!

To successfully grow in a hydroponic system, there must be light, air, a pH-balanced nutrient solution, and water. ***Active hydroponics*** utilize energy to deliver water and nutrients to the plant using a pump or aerator. Beginner growers typically shy away from active hydroponic systems as they require a larger investment in time and equipment. Many experienced producers prefer this option for plants that take a long time to harvest and require occasional pruning, like cucumbers, peppers, and tomatoes.

If you are looking for the simplest and most affordable method, you can experiment with ***passive hydroponics*** using the "set it and forget it" method. Passive hydroponics relies on the plant alone to absorb nutrients from the container. As the water decreases from plant growth, the roots stay aerated. This is a great option if you're wanting to grow lettuce or non-woody herbs like cilantro or parsley.

Well-rooted hydroponic lettuce grown in the author's office.

You may also have heard of producing crops through ***aquaponics*** systems. Aquaponic systems grow plants without soil, like hydroponic systems, but fish (rather than the grower) supply the nutrients for the plants. In this system, fish excrement is converted to the primary source of nitrogen for the plants by beneficial bacteria from a natural filter.

Commercial growers using aquaponics typically use tilapia fish as their source of manure. Special permits may be required to purchase tilapia since they are considered an invasive species. Some operations also have successfully used catfish.

Filtration and additional aeration are absolutely necessary in an aquaponics system. This option is usually more costly because of the additional air pumps and varying costs of fish. Depending on how large your tank is, it can take 6–8 weeks for the system to properly cycle. Be sure to monitor your water before and during gardening so your fish can have a suitable environment. New growers might want to check out more detailed information on growing with aquaponics from their bookstore or local library.

Regardless of which method you choose, if you follow these basic guidelines, you will be producing the same yields as conventional gardening using less space and water in no time!

## Hydroponics on a Small Scale

It does not take much space to develop a small hydroponic garden, and they can be grown anywhere that has either natural strong sunlight or artificial light available. There are many commercial hydroponic kits available to purchase, or the consumer may choose to construct their own.

Adequate lighting is a critical factor, and most hydroponic gardens use an artificial source such as a grower's light. A grower's light is a lamp that emits light similar to the natural sunlight spectrum. Seeds can be started directly in hydroponic containers or can be started beforehand in separate trays in a greenhouse or well-lit area. First-time hydroponic growers might want to start with something simple like some of the leaf lettuce varieties. They grow rapidly and are more compact, so they do not require the external support needed by other plants, such as tomatoes or cucumbers.

Tap water from either a well or city water source will suffice, as long as the pH is tested and adjusted and supplemental nutrients are applied. Many indoor water sources tend to have a high pH and need to be adjusted using an acidifying agent. Just as in a traditional vegetable garden, the pH of your water should be adjusted to be between 6.2–6.8. Growers can purchase liquid products that are designed to either lower or raise the pH as needed. Use caution when using these products, as a small amount can make a big difference in the pH.

Nutrients can be supplied by using some type of liquid-soluble fertilizer. The amount of fertility needed depends on the size of the container and the type of plants being grown. Follow instructions on your selected fertilizer product but lean toward using the lightest suggested rate to start. Small-scale hydroponic gardens probably will need additional fertility supplied every 1–2 weeks. It is also a good idea to completely change out the water in a hydroponic garden every 3–4 weeks to ensure there is no buildup of algae. Keep in mind that every time you change the water you will have to adjust the pH. Having a small pH meter on hand is essential for growing hydroponically. Depending on the type of hydroponic garden used, a water pump or aquatic aerator will be necessary to keep the water agitated and prevent it from becoming stagnant.



pH Up and pH Down are used to adjust the pH as needed.

pH meter

## Hydroponics for the Small Grower

More commercial hydroponic vegetable and ornamental operations are beginning to show up in the state of Georgia. These operations are costly to establish, but over time they can pay back dividends by not having to fight outdoor environmental influences. Most commercial hydroponic growers utilize large greenhouse facilities using multiple levels of grower trays to maximize space in their operation. They often run a multiple-pump system that continuously circulates fresh water. Nutrients are introduced directly into the pump at specific intervals based on the plants' needs. Most commercial hydroponic enterprises primarily sell wholesale and not directly to the public.

Commercial hydroponic greenhouse.

## How to Build a Small Hydroponic Home Garden

One can simply go on the internet and find dozens of consumer-level hydroponic kits available. These may come in the form of flat trays or commercially available growing towers. The kits will normally include the container for holding the water, some type of pump or aerator, the planting

cups, and a growing medium for starting the seeds. For the do-it-yourself person, it is not very difficult to make your own small hydroponic garden at a very affordable cost.

Remember that you are going to need some type of light source if you do not have a greenhouse or sunroom for natural light. Grower-type lights are available to purchase, but you can also get away with using a bright tubular fluorescent shop light that you can purchase from a hardware or big box store. Regardless of which artificial light source you use, be sure you can adjust the max-height of the light, as it needs to start at a lower level above the seed trays and rise as the plants begin to germinate and grow.

Examples of consumer-type hydroponic gardens.

While there are many innovative hydroponic plans available, one simple method is using plastic storage containers with lids. When choosing a container size, it may be best to start on the smaller size until you get the hang of it.

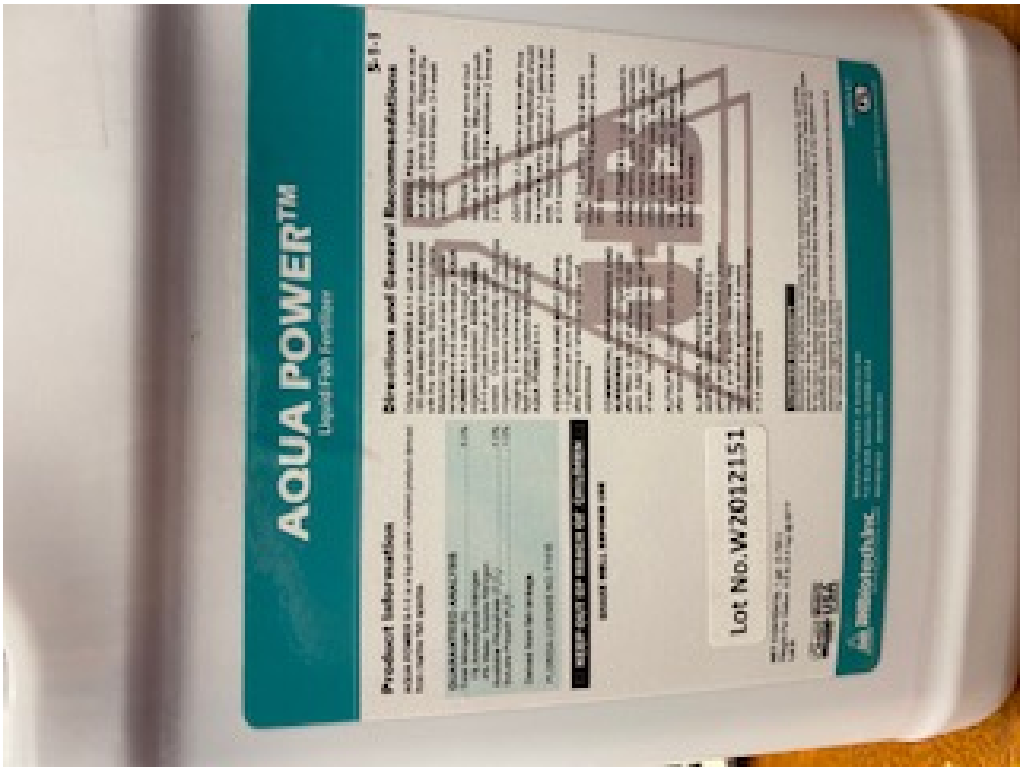
One simple plan is to use a storage container approximately 15–20 in. long and 12 in. wide. Look for something that is 5–6 in. deep as well. You will also need to purchase a supply of hydroponic net pots, as well as a medium to hold your seed, such as rockwool cubes. You will want to purchase a hydroponic pH-control kit that contains two bottles, which will either raise or lower the pH. A pH meter or test kit also is vitally important. A small fish tank aerator that has a rock bubbler on the end can suffice to provide the aeration needed to successfully aerate the water. You will need to purchase liquid fertilizer and the seed required for what you plan to grow.

Here is a list of steps to produce a small container hydroponic garden:

- Use a drill and circle cutter bit to cut the holes out of the lid of the container. Measure carefully, as these holes should be slightly smaller than the lip of your netted pots. The pots need to slip through the holes, but the lip of the net pots needs to sit on the top of the lid.

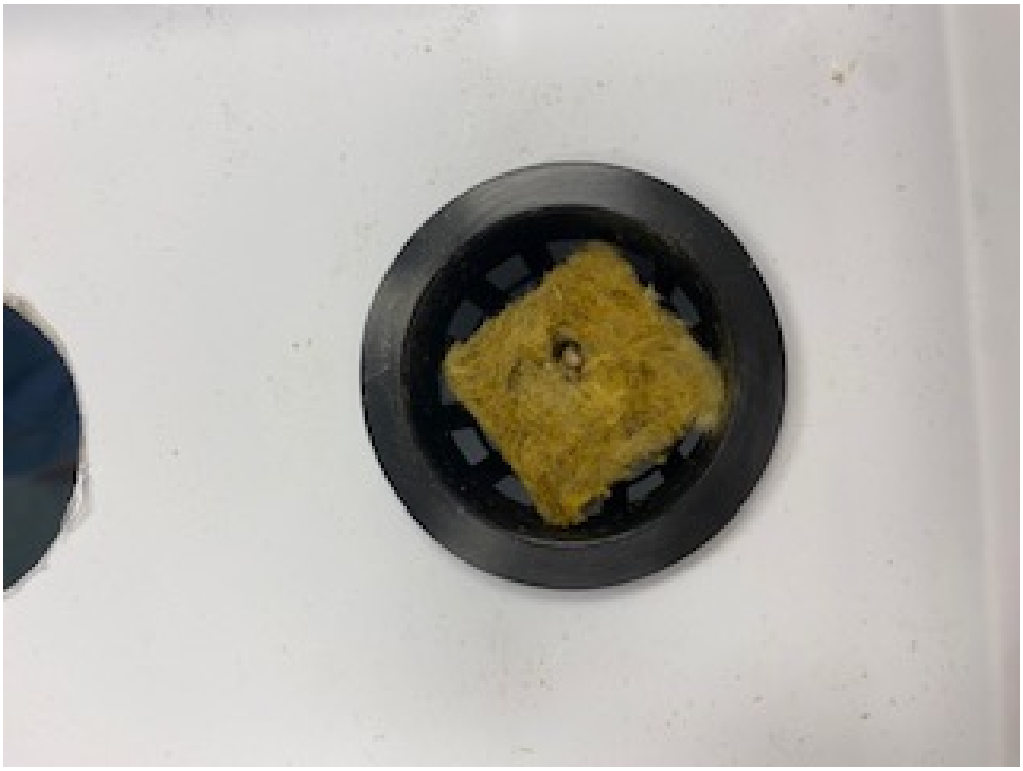
Drilling holes for hydroponic net pots.

- Fill your container with water to the depth at which it comes in contact with the bottom of the netted pots.
- At this time, test the water to determine the pH level and adjust to 6.2–6.8.
- Add fertilizer according to label recommendations, starting with the lightest rate suggested.




Liquid fertilizers work best with hydroponics.

- Cut a small hole for the aerator tube to pass through the top of the container, allowing the bubbler stone to rest on the bottom of the container.
- Put one cube of rockwool into each netted pot and insert the pots into the container holes that you drilled.
- Take your desired seed and place one seed in the small dimple hole of the rockwool.



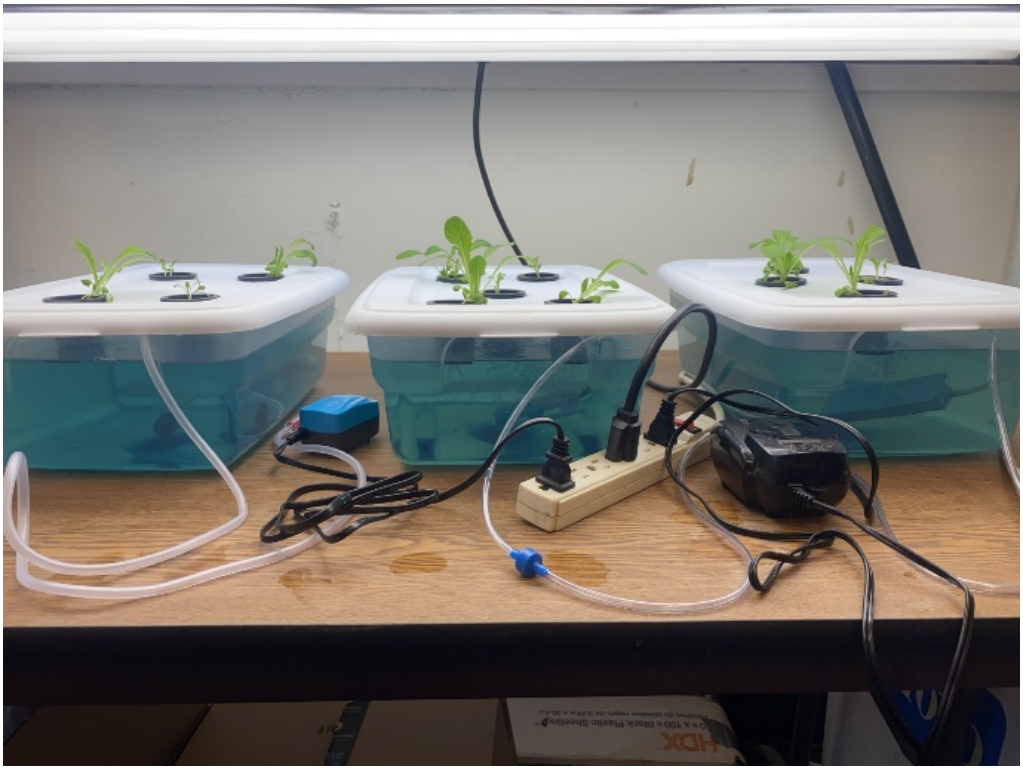
Rockwool is used as a growing medium to start seeds.

- Turn the aerator on and adjust your overhead light to be 3–4 in. away from the top of the container.

A small aquatic aerator is used to circulate and aerate the water.

- Aerators should operate continuously, with artificial light being utilized at least 12 hr a day.
- As your seeds begin to germinate, continue to adjust your artificial light source up and away from the germinating plants.
- If you are growing leafy greens, begin harvesting the lower, more mature leaves as soon as they are large enough to use. Some varieties will even come back if you harvest the entire head at one time.

Be sure to provide plenty of light for good seed germination.



Romaine lettuce growing in small homemade hydroponic tubs.

Lettuce ready for harvest.

# Troubleshooting Problems in Hydroponics

While growing hydroponically definitely cuts down on environmental issues, problems can still occur. These are some common issues that you may encounter when growing hydroponically:

- Poor germination: Vegetables such as spinach can be difficult to germinate under hydroponic conditions. Some vegetables might germinate better in a soilless substrate environment and then can be transplanted into the hydroponic unit when they are very young.

- Leggy plants: Sometimes plants can become leggy, which could indicate that they aren't receiving adequate light. Increase the amount of light or adjust your light source closer to the trays to help seeds germinate and thicken up.

- Yellow or light-colored foliage: This could indicate that your plants are suffering from nutritional deficiency. Fertilizer rates may need to increase slightly to meet the needs of the plants.

- Tip burn or necrotic tissue on leaves: Dieback on the ends of the leaves normally indicates a water issue. Perhaps the water level has dropped too low, and the roots are no longer able to reach the moisture. Temperatures that are either too high or too low in the growing area also can cause burns on the foliage. Most hydroponic plants grow best when the air temperature is maintained between 65–75 °F.

- Non-leafy green plants will not fruit or produce vegetables: If plants show excessive healthy growth but never seem to flower or fruit, they may be receiving too much nitrogen. Cut back on fertility to trigger plants into reproductive mode.

- Insects and disease: While generally protected from the outside environment, insects and disease can be introduced unintentionally into the hydroponic production area. It may be necessary to apply the proper fungicide or insecticide to combat the specific problem at hand. Consult with your local county Extension office for specific control recommendations.

Although there are fewer issues, keep a close eye on any disease or environmental inputs that can cause problems on hydroponic plants.

## Resources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