Hydroponics, Aquaponics & Aeroponics, Oh My!

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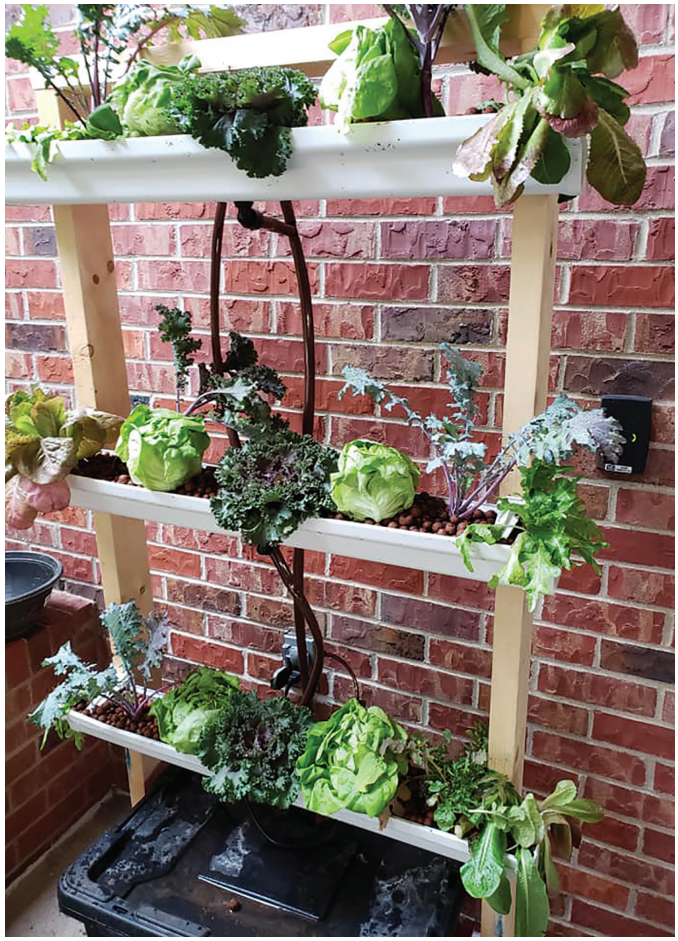
It seems that as interest in gardening grows, especially among younger generations, interest in different techniques that home gardeners use and different plants they grow are also on the increase. You see the old standbys like straw bales and containers emerge. Terraria, succulents, and air plants are having their moment. And all kinds of technology driven indoor growing systems are all over the web, mostly hydroponic, but some aeroponic and aquaponic as well. With each of these new technologies come different skills and methods for growing crops. The hydroponic, aeroponic, and aquaponic systems can be handy for growing fresh vegetables indoors, even on a small scale.

So how are hydroponics, aquaponics, and aeroponics different? In some ways, they use similar basic setups. All are based on soilless growing using an inert media to support plants, supplying nutrients and water directly to the plant roots, and providing light to the plants using either natural sunlight or supplemental lighting. Differences come from the source of plant nutrients and from how they are delivered to the plant.

Most people are familiar with the concept of hydroponics. This technique relies on roots being submerged in a nutrient-rich solution where the nutrient content is engineered from a variety of mineral sources. There are a variety of different systems (that will hopefully be the subject of an upcoming blog) where the root zone interacts directly with the solution. In some cases, roots are submerged in a large volume of solution while in others a film or shallow stream of water flows through the root zone. Systems where roots are submerged in the solution may simply be a large reservoir where the plants float on top where systems relying on flow may involve a pump. Movement of water adds another plant need -oxygen, which is required for respiration by the roots. In systems where there is no flow, air is often pumped in to provide oxygen.

Most flowing systems are recirculating, where the solution returns to a reservoir and is pumped back into a reservoir to be reused. While it may seem counterintuitive, these recirculating water based growing systems have been touted as production methods that conserve water. That's why some of the leading hydroponic production and research comes from areas of the world where water is scarce. Less common are flow through systems where water and nutrients are not recaptured but discarded after initial use.

Aeroponic systems have much of the same basic setup but instead of the roots interfacing directly with water solution it is applied as a pressurized mist. These systems generally use a much smaller volume of water, but there are some drawbacks. Failure of the system, such as an electric outage or clogging of the nozzles that pressurize the mist (which is a common occurrence) can quickly result in plant failure since roots can dry out quickly. Several systems that are sold commercially that market themselves as aeroponic, such as the AeroGarden or Tower Gardens, are more similar to a flowing hydroponic system than a pressurized mist aeroponic system.



The plant growing structures of aquaponics are similar to those of hydroponics, with the addition of larger reservoirs to accommodate the addition of aquatic livestock such as fish (or sometimes crustaceans). The waste produced by the stock provide the nutrients needed by the plants rather than an engineered nutrient solution. These systems require having the technical knowledge to meet the needs of the aquatic stock and balancing those with the needs of the plants. The addition of the aquatic stock also introduces a microbiome of bacteria and fungi, many of which are required for animal health but can also introduce pathogens that can negatively affect human health.

You don't have to buy a fancy system to get started, either. Systems can be as simple as a large container full of water with plants floating on top. You can get a bit fancier with your systems as well, and there are several books dedicated to building your own small hydroponic systems. One good book on the subject is appropriately titled "DIY Hydroponic Gardens: How to Design and Build an Inexpensive System for Growing Plants in Water" by Tyler Baras shares plans for building a variety of types of hydroponic systems using basic building materials like gutters and lumber, drip irrigation tubing and fittings, and various other bits and bobs. It also provides basic details on hydroponics and some background on diagnosing issues with your systems and plants.