
Methods Of Growing Plants in Water

Growing plants in water is becoming increasingly popular as the world population steadily climbs. Since industrialization and the amount of mouths needed to feed is ever-growing, society needs to find dependable sources that can provide enough ailment for the entirety of civilization while saving space. Famine is a genuine concern to countries that are full of poverty and strain, and hydroponics is a potential solution to such plights. Hydroponics has been proven to speed the process of growing produce, all the while using less materialistic resources and labor. Hydroponics is obviously beneficial, but aquaponics, the cultivation of both food and fish, is perhaps even better. Either way, both offer the key to solving the growing problems of dwindling food outlets.

While they are relatively similar to each other, aquaponics, hydroponics, and aquaculture are all different practices. Regardless, they all pose potential answers to the growing concern of food productivity in the world. While hydroponics is simply the cultivation of plants in water without a soil medium, aquaculture farms fish. Aquaponics is the combination of both that creates a natural ecosystem that maintains itself. Aquaponics reaps the benefits of both as well as reducing the disadvantages of each. Aquaponics is the method of raising both food and fish in one environment. It grows more food while using less materials like water, land and labor than traditional agricultural farming by integrating fish farming and soilless plant culture. It is extremely versatile and be used at any time during the year because it does not rely on outside weather to farm the plants and fish. Instead, aquaponics relies on the temperature of the water, pH levels, and the correct amount of sunlight, which can all be corrected anytime, anywhere when provided with human intervention to ensure the growth of both plant and fish alike. Fish in the same water as the plants need to have similar pH levels and temperature regulations in order to optimize productivity. These elements are easily maintained and aren't costly. There is a significant less amount of materials used in aquaponics that is used in agrarian farming; aquaponics only uses 17% of water used in typical traditional agriculture, which creates up to eight times more products.

Other benefits of aquaculture are that the produce is free of harmful chemicals like pesticides and herbicides, the fish are free of steroids and hormones, and diseases that are born from soil are nonexistent. The systems are also efficient and sustainable for most varieties of plants and fish, and are environmental friendly since no runoff or toxic waste is produced. The fish also produce an effective, all-natural fertilizer for the plants. Other advantages of aquaponics include reduced labor, no weeds, recyclable water, and that it can range in sizes. Systems can be as small as a tank or could be as large as a pond. However, there are some drawbacks to having an aquaponic system. The plants are still susceptible to potential pathogens, fish can be temperamental and need proper conditions to ensure that they can live comfortably, copious amounts of fish food is needed and must be available, and there is a higher initial cost to maintain the system. Pumps, filters, heaters, plumbing, and other factors must be used. Although the initial cost is generally larger than that of traditional agriculture, the money is easily made back and profits are generated.

Perhaps the most important part of aquaponics is the fundamental relationship between the plants and fish that coexist within one system. Fish provide a natural fertilizer for plants in the

same water. The plants gather nutrients from this fertilizer to help boost their growth. The fish also produce carbon dioxide (CO₂) through respiration, which the plants absorb to help cleanse the water and make oxygen. This interaction creates a mutual symbiotic relationship where both sides benefit from the other (source 3). This relationship in aquaponics encourages the natural ecosystem, or biological cycle, between the plants and fish. When the fish produce waste, microbes in the water, or microorganisms responsible for fermentation, turn the waste into fertilizer the plants can use. The plants use this to grow and in turn filter the water that returns to the fish. Essentially a circle of life, it constantly cycles with only one interference on human's behalf.

The single intervention needed to properly sustain an aquaponics system is fish food. Without fish food, the fish being farmed will eat the plants that are being cultured, which makes the whole system ineffective and useless. With fish food, however, the system will maintain itself as a functioning environment. Humans also have to ensure appropriate conditions like pH and temperature to have a productive system, but they do not interfere with the fish or plants and disrupt the natural cycle.

In hydroponics, only plants are cultured in water. There are no fish, only water that is rich in nutrients. Seeds and pods need some support in water, so mediums that allow easy access to water and can be soaked are used. Roots are suspended in substances that do not move, such as clay pellets and rockwool, rather than soil. The whole point behind hydroponics is to provide maximum contact between plant roots and the solution of water and nutrients to boost plant growth. The mediums help to ensure this, and thus accelerate growth significantly. Compared to a typical soil setting in agriculture, hydroponics grows up to 25% faster with 30% more produce, showing an increased rate of growth compared to soil grown plants. If a system of hydroponics is properly maintained and used effectively, it can easily surpass the quality and quantity of produce from traditional soil systems. Since plants are given water that is infused with nutrients, plants do not expend as much energy obtaining these nutrients and can instead focus on growing their leaves rather than the roots. Much like aquaponics, the plants in a functional hydroponics system need proper pH levels as well as nutrient levels that are constantly monitored and maintained.

Hydroponics has advantages against traditional farming, including faster growth of plants, weeds are non-existent, less space used, as well as less labor and water, and a well-cared for and maintained system can be grown indoors. However, like any configuration, it has its own drawbacks. It is fairly expensive to initially set up, water levels have to constantly be monitored for nutrient levels to ensure plant growth, artificial light may have to be provided, and it will take time to set up equipment like plumbing.