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# Soilless Agriculture

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## Abstract

Soil less agriculture is a method of growing plants using mineral nutrient solutions, in water and in other mediums, without soil. Terrestrial plants may be grown with their roots in the mineral nutrient solution only or in an inert medium, such as perlite, gravel, mineral wool, or coconut husk. The two main types of hydroponics are solution culture and medium culture. Solution culture does not use a solid medium for the roots, just the nutrient solution. The three main types of solution culture are static solution culture, continuous-flow solution culture and aeroponics. The medium culture method has a solid medium for the roots and is named for the type of medium. For all techniques, most hydroponic reservoirs are now built of plastic, but other materials have been used including concrete, glass, metal, vegetable solids, and wood.

## Introduction

Researchers discovered in the 19<sup>th</sup> century that plants absorb essential mineral nutrients as inorganic ions in water. In natural conditions, soil acts as a mineral nutrient reservoir but the soil itself is not essential to plant growth. When the mineral nutrients in the soil dissolve in water, plant roots are able to absorb them. When the required mineral nutrients are introduced into a plant's water supply artificially, soil is no longer required for the plant to thrive. Almost any terrestrial plant will grow with hydroponics. Hydroponics is also a standard technique in biology research and teaching.

## Advantages of Soilless Agriculture

Some of the reasons why hydroponics is being adapted around the world for food production are the following:

- No soil is needed.
- The water stays in the system and can be reused - thus, lower water costs.
- It is possible to control the nutrition levels in their entirety - thus, lower nutrition costs.
- No nutrition pollution is released into the environment because of the controlled system.
- Stable and high yields.
- Pests and diseases are easier to get rid of than in soil because of the container's mobility.

Today, hydroponics is an established branch of agronomy. Progress has been rapid, and results obtained in various countries have proved it to be thoroughly practical and to have very definite advantages over conventional methods of horticulture. The two chief merits of the soil-less cultivation of plants are, first, hydroponics produces much higher crop

yields, and, second, hydroponics can be used in places where in-ground agriculture or gardening is not possible.

## Disadvantages of Soilless Agriculture

The hydroponic conditions (presence of fertilizer and high humidity) create an environment that stimulates salmonella growth. Other disadvantages include pathogen attacks such as damp-off due to *Verticillium* wilt caused by the high moisture levels associated with hydroponics and overwatering of soil based plants. Also, many hydroponic plants require different fertilizers and containment systems.

## Different Types of Techniques

### Static Solution Culture

In static solution culture, plants are grown in containers of nutrient solution, such as glass Mason jars (typically, in-home applications), plastic buckets, tubs, or tanks. The solution is usually gently aerated but may be unaerated. A homemade system can be constructed from plastic food containers or glass canning jars with aeration provided by an aquarium pump, aquarium airline tubing and aquarium valves. The nutrient solution is changed either on a schedule, such as once per week, or when the concentration drops below a certain level as determined with an electrical conductivity meter. Whenever the solution is depleted below a certain level, either water or fresh nutrient solution is added (Figure 1).



Figure 1: Hydroponics

### Continuous-Flow Solution Culture

In continuous-flow solution culture, the nutrient solution constantly flows past the roots. It is much easier to automate than the static solution culture because sampling and adjustments to the temperature and nutrient concentrations can be made in a large storage tank that has potential to serve thousands of plants. As a general guide, flow

rates for each gully should be 1 liter per minute. At planting, rates may be half this and the upper limit of 2 L/min appear about the maximum.

### Aeroponics

Aeroponics is a system wherein roots are continuously or discontinuously kept in an environment saturated with fine drops (a mist or aerosol) of nutrient solution. The method requires no substrate and entails growing plants with their roots suspended in a deep air or growth chamber with the roots periodically wetted with a fine mist of atomized nutrients. Excellent aeration is the main advantage of aeroponics.

### Medium

One of the most obvious decisions hydroponic farmers have to make is which medium they should use. Different media are appropriate for different growing techniques (Figure 2). The most popularly used medium are peat, calcined clay, rock wool, coconut fiber (coir dust), pine bark, perlite, pumice, saw dust, vermiculite, rice hulls, sand, gravel and wood shaving (Gsaba, 1995; Olympios, 1992).



Figure 2: Soilless agriculture (Courtesy: Image via Garden Design Plus)

## Conclusion

Soilless culture system is one of the most common methods of production technique. It will result in higher yields, even when the conditions are not conducive for production. Many organic and inorganic soilless media was used to improve growth and yield. The selection soilless culture system is based on crop productivity, usage life and cost economics.

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