

Hydroponics: An Emerging Technology in Agriculture

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INTRODUCTION

Hydroponics is a technology, in which we grow plant by using nutrient solution (water, having fertilizers) we can use artificial medium (peat, gravel, vermiculite, sand, perlite, moss, sawdust, rockwool) to give mechanical support. There are two types of Hydroponic system, 1. open (in which, only once we can provide nutrient solution to the plant root, it is not reused), 2. closed (here nutrient solution can be reused) (Jensen, 1997). The places which are not fertile enough for plant growth, there we can use this gardening method. In the next upcoming 50 years, we can see hydroponic system around us, because we will have poisoned all the soil with chemicals.

Hydroponic system is not new, in ancient time inside the palaces, people used to grow plants. In Egypt, archaeologists found some lotus and lily seeds going back more than 2,000 years ago in a palace in pond excavation. In the palace of Chinese emperor, there were floating gardens. And these were more than 4,000 years ago (Dueep Jyot et al., 2016).

The famous hanging gardens of Babylon was the earliest recorded use of hydroponics. This growing technique was extensively in Babylonian, Chinese cultures and Aztec, but formal studies on hydroponics starts from 17th century with the published works of Sir Francis bacon and John Woodward. Hydroponics gardening was featured in TIME magazine in 1938 and during the second world war soldiers used hydroponics to grow food (Tripp Timothy, 2014).

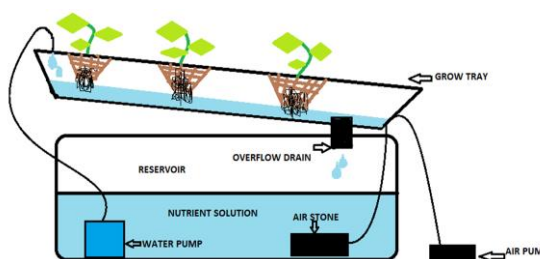


Fig. 1: Hydroponic system

AGGREGATE HYDROPONIC SYSTEM

- 1. Open system: Rockwool Culture:** It is the most widely used medium in hydroponics. Rockwool is ground-up basalt rock that is heated then spun into threads making wool. It is very light weight and we get it in cubes from market. To promote optimum root growth Rockwool is capable to hold water and it can retain sufficient air space (minimum 18 percent).
- 2. Closed system: NFT and Rockwool:** By using The Water Culture System plants are planted on small rockwool is the simplest of all active hydroponic systems. The platform made of Styrofoam which holds the plants and it directly floats on the nutrient solution. An air pump supplies air to the air stone that bubbles the nutrient solution and supplies oxygen to the roots of the plants in channels containing recycled nutrient solution.
- 3. The Ebb and Flow System:** works by temporarily flooding the grow tray with nutrient solution and then draining the solution back into the reservoir. This action is normally done with a submerged pump that is connected to a timer. The timer is set to come on several times a day, and humidity, temperature and the type of

growing medium used according to the plant size and types of plant.

- 4. Drip Systems:** are probably the most widely used type of hydroponic system in the world. Submersed pump is controlled by a timer. The timer turns the pump on and nutrient solution is dripped onto the base of each plant by a small drip line. (Shrestha et al., 2010).

PROVIDING NUTRIENTS TO THE PLANTS

The volume and frequency of the nutrient solution applied depends on the crop (species and stage of development), the type of substrate used (physical, chemical and volume characteristics), the crop and irrigation systems used, the size of the container, and the prevailing climatic conditions. We should fed the plant daily. We can add nutrients by hand or mechanically. Temperature also plays important role during nutrient mixing to hydroponic system. In high temperature, evaporation will be high, then plants will need more nutrients every day to avoid plants to get dry out. In small containers nutrients can be added by hand also. But in large containers we can use gravity –feed system. A pump can be also used for providing nutrients to system (Butler et al., 1962).

Table 1: Characteristics of nutrient element with their sources

SOURCE	ELEMENT	CHARACTERISTICS
Potassium nitrate KNO ₃	N, K	Very soluble salt
Potassium phosphate monobasic KH ₂ PO ₄	P, K	Corrects phosphorus deficiency
Magnesium sulfate MgSO ₄	S, Mg	Cheap, highly soluble, pure sal
Iron chelate	Fe Cit	Best sources of iron
Boric acid H ₃ BO ₃	B	Best source of boron
Calcium nitrate Ca(NO ₃) ₂	N, Ca	Very soluble salt

HYDROPONICS IN THE HOME GARDEN

For the hobbyist, we can adopt hydroponics in our everyday use, it is so simple technique that any one can grow it at their home. Many of the advantages of commercial hydroponics also apply to the home and hobby gardeners. In many industries, small systems are developed,

and then expanded for large scale use. Conversely, in hydroponics, it is very common to grow hydroponics in large scale, while it is more of a challenge to make smaller systems economically feasible (Shrestha et al., 2010).

LIST OF CROPS THAT CAN BE GROWN IN HYDROPONICS

To maximize the yield, light is added to lengthen the day and we can provide carbon-

dioxide into the sealed greenhouses, in their environment to increase growth, or, control vegetative growth etc. (Sardare et al., 2013).

Table 2: Production of vegetables under soil-less culture in India

Vegetables	Production (g/m ² /day)
Carrot	56.5
Cucumber	226
Garlic	57
Ginger	57
Potato	56.7
Onion	56.5
Tomato	113

ADVANTAGES OF HYDROPONICS

In the urban areas where people do not have sufficient place to grow plant they can use this hydroponics system and can get vegetables, fruits, herbs etc in minimum space. There are many other benefits with the use of hydroponics in urban areas-

1. Food is top priority for all people all over the world. It should be pest free it should be nutritious and safe to eat. Thus we can grow it without pest.
2. By providing nutrients which are naturally occurring, we can produce food with highly nutritional value, people who grow hydroponics gardens are able to grow seasonal foods.
3. For those who live in urban areas, many of them may never had experience gardening people may get knowledge how to grow food. (Tripp, Timothy. Hydroponics advantages and disadvantages: Pros and cons of having a hydroponic garden. Speedy Publishing (LLC, 2014).
4. Some crops, such as lettuce and strawberries, can be lifted from ground level to a much better height for planting, cultivation and harvesting. This provide much better working conditions and hence there will be lowers labor costs.
5. It can be used in places where in-ground agriculture or gardening is not possible (for example, dry desert areas or cold

climate regions).

6. Crop yield will be higher.
7. Elimination or reduction of soil related insects, bacteria and fungi.
8. More complete control of nutrient content, growing environment and pH.
9. Lower water and nutrient costs associated with water and nutrient recycling.
10. We can see faster growth because plants will get more oxygen in root area.

DISADVANTAGES OF HYDROPONICS

1. In hydroponics the operational and Initial costs are higher than soil culture.
2. To operate properly, skill and knowledge are needed so that it will help to operate the system carefully.
3. Some diseases like Verticillium and Fusarium can spread quickly through the system. However, many varieties resistant to the above diseases have been bred. (Shrestha et al., 2010).

CONCLUSION

Nowadays the use of hydroponics has increased gradually leading to an increase in research and experimentation area of indoor and outdoor hydroponic gardening. As the condition of soil and its fertility rate is getting depleted day by day, the industry is expected to grow exponentially also in future. Specially, in a country like India, where urban concrete

conglomerate is growing each day, we can use soil- less culture which will help to improve the quantity and quality of food (Shrestha et al., 2010).

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