Article: RT0296

How to cite this article?

Yuvaraj and Subramanian, 2020. Different Types of Hydroponics System. Biotica Research Today 2(8): 835-837.

Biotica Research Today

Vol 2:8 835/837

2020

Different Types of Hydroponics System

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Open Access

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Keywords

Hydroponic, Nutrient Film Technique, Nutrient management, Water conservation

Abstract

Currently hydroponic cultivation is gaining popularity all over the world because of efficient resources management and quality food production. Soil based agriculture is now facing various challenges such as urbanization, natural disaster, climate change, indiscriminate use of chemicals and pesticides which is depleting the land fertility. In this article various hydroponic structures viz. wick, ebb and flow, drip, deep water culture and Nutrient Film Technique (NFT) system; their operations; benefits and limitations; performance of different crops like tomato, cucumber, pepper and leafy greens and water conservation by this technique have been discussed. Several benefits of this technique are less growing time of crops than conventional growing; round the year production; minimal disease and pest incidence and weeding, spraying, watering etc can be eliminated.

Introduction

Hydroponics is a technique of growing plants in nutrient solutions with or without the use of an inert medium such as gravel, vermiculite, rockwool, peat moss, saw dust, coir dust, coconut fibre, etc. to provide mechanical support. The term Hydroponics was derived from the Greek words hydro' means water and ponos' means labour and literally means water work. The word hydroponics was coined by Professor William Gericke in the early 1930's; describe the growing of plants with their roots suspended in water containing mineral nutrients. Hydroponics is a technology for growing plants in nutrient solutions (water containing fertilizers) with or without the use of an artificial medium (sand, gravel, vermiculture, rokwool, perlite, peat moss, coir, or sawdust) to provide mechanical support. Liquid hydroponic systems have no other supporting medium for the plant root (Bulgari *et al.,* 2016).

Types of Systems

Within hydroponics, there are several techniques to allow for optimal customization of a growing operation. Whether you're a hand-watering hobby grower, or looking to start a massive commercial farm, there is a growing technique perfectly suited for your goals. And the best part is you don't have to choose just one! With enough space, you can use any or all of these techniques in tandem (Maboko *et al.,* 2011) (Figure 1).

There are many ways to do it but often it is done on styrofoam insulation boards (4ft×8ft). By drilling tapered (conical) holes in the boards to the size of the growing media you select, you can drop in your germinated plant and it won't fall through. The roots are suspended in about 6 to 18 inches of a well-

Article History

Received in 20th August 2020

Received in revised form 27th August 2020

Accepted in final form 28th August 2020

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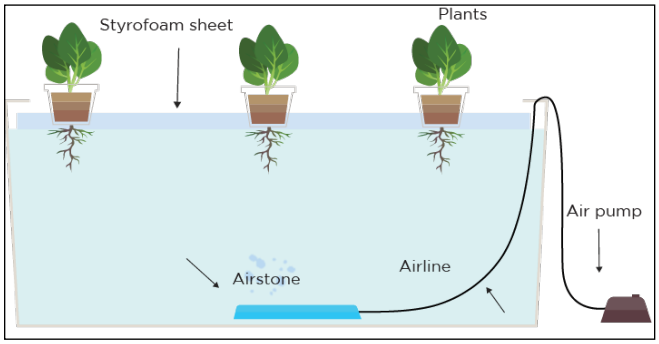

Figure 1: Deep Water Culture (DWC)

oxygenated nutrient solution until harvest. It's perfect for short-statured leafy greens and herbs as they do not require much root support. DWC systems often hold a large volume of water slowing any swings in the chemistry of the solution. Additionally, if there is ever a pump malfunction in a DWC system, you would have many hours to fix it before you ran into any significant problems, like the roots drying out (Figure 2).

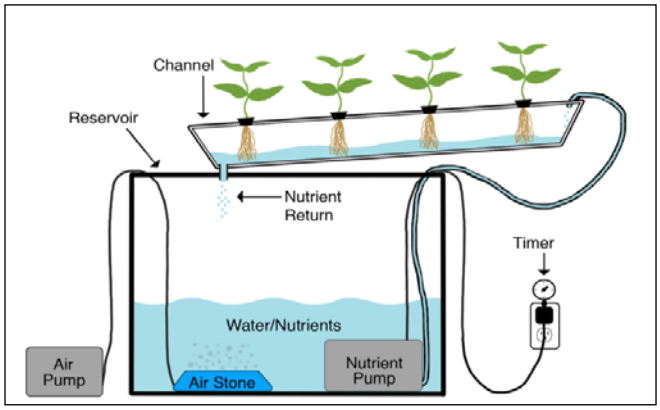

Figure 2: Nutrient Film Technique (NFT)

This versatile technique uses channels or troughs, set up on a slight angle for drainage purposes, and running a very shallow stream of water to the roots. It can be done on a timer or with a continuous flow. The solution is held at the lowest point in a reservoir that contains a submersible pump and usually air stones for optimal dissolved oxygen levels and stagnation prevention. Once the water saturates the roots, it drains back into the reservoir. NFT is best for short-statured plants like DWC, but these systems hold much less water per plant and are more easily stackable, cleanable, and customizable for your grow space (Majdi *et al.,* 2012).

Ebb and flow systems can be as basic as a small plastic bucket with some expanded clay pellets or other rock media that you hand water and drain. It can also be as complex as adding a large media filled bed onto an aquaponic system and flooding it with the liquid waste from the system. In every instance, the grow tray is temporarily flooded with solution every few hours, submerging the roots before returning to the reservoir. Because of the root support and oxygen levels they can provide, ebb and flow systems are great for growing pretty much anything, but especially fruiting crops. You just have to be sure that however it's being done, the setup can support the weight of that entire media and water and your containers drain completely (Figure 3).

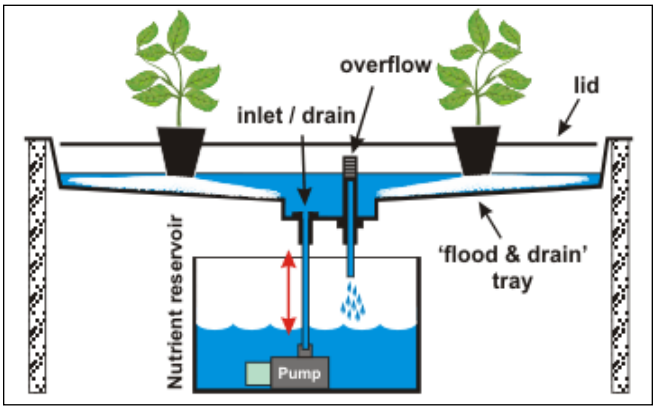

Figure 3: Ebb and Flow (Flood and Drain)

Drip System

Drip systems are another common and simple technique whereby a pump on a timer delivers a slow feed of the solution to the base of each plant individually. The excess solution can be either returned to the reservoir or not collected. It works well with growing mediums with high water retention (*i.e*. coco coir, peat moss, or rockwool). When the system is working correctly, it is very low maintenance and high output, but the drip lines can get clogged, which results in dried out plants. Synthetic nutrients are the logical choice for these systems because organic materials clog lines much faster.

Conclusion

Hydroponics was method of growing plants using mineral nutrients solutions instead of soil. Aeroponic was a form of hydroponics technique. Hydroponics and aeroponics plays very important role for the commercial food production. Hydroponics grown plants will get perfectly balanced diet. In India, the hydroponic industry is expected to grow exponentially in near future. To encourage commercial hydroponic farm, it is important to develop low cost hydroponic technologies that reduce dependence on human labour and lower overall startup and operational costs.

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