

HOW TO PLAN A HYDROPONIC GARDEN?

Kusinara Wijayabandara
Board of Study in Plant Sciences

Soil is the most available and highly used growing medium. It enhances proper root functions, supply water, adequate oxygen and nutrients to plant while providing physical support to the plant. However, there are limitations for plant growth in certain soil media such as, presence of soil born pathogens which cause plant diseases, poor water drainage, soil erosion and poor soil fertility. Hydroponics is an alternative method which can reduce the drawbacks of conventional method of growing plants. It is a technique which is used to grow plants by using liquid nutrient solutions with or without artificial medium such as coir, perlite, sand, gravel that provide physical support to the plant. The term "hydroponics" was practiced many centuries ago in different countries in the world such as Amazon, Babylon, Egypt, China and India. This word was derived from Greek as 'Hydros' (water) and 'Ponos' (working). In 1929, Dr. William F. Gericke introduced a laboratory technique of hydroponics into commercial horticulture (Roberto, 2013). Gradually this technique has been developed and home hydroponic kits were introduced during 1990s.

The basic types of hydroponic systems are Wick, Water Culture, Ebb and Flow, Drip (recovery or non-recovery), Nutrient Film Technique (N.F.T.) and Aeroponics. The Wick system is the simplest passive type hydroponic system. The nutrient solution is drawn into the growing medium (perlite, vermiculite, coir dust) from the reservoir with a wick (absorbent material). This system is most suitable for small crops. The water culture system is the simplest, active hydroponic system which is actively passing nutrient solution over plant roots. Plants are established on a platform which is made up of Styrofoam. Plants float directly on the nutrient solution. Oxygen is supplied by using an air pump. Fast growing, aquarium plants are the most preferred for this system (e.g. Leaf lettuce). In Ebb and Flow system the nutrient solution is pumped into the grow tray which contains aggregate medium. Then it floods the root zone temporally, and then allowed to drain back into the reservoir. However, most widely used type of hydroponic system in the world is Drip system. In this system, a timer controls a submersed pump. It turns the pump on and nutrient solution is dripped onto the base of each plant by a small drip line. Moreover, when we consider N.F.T. system the nutrient solution is pumped into the growing tray (slightly slanted tube) and flows over the roots of the plants, and then drains back into the reservoir. The aeroponic system is probably the most high-tech type of hydroponic gardening. It's growing medium is primarily air. The roots hang in the air and are sprayed with nutrient solution at regular intervals (Goto *et al.*, 1996).



Lettuce growing in NFT system
<http://www.roatanisland.net/hydroponictour.htm>



Hydroponic garden
<http://www.roatanisland.net/hydroponictour.htm>

The plants established in hydroponic system absorb nutrients from the solutions which are provided by the system. These solutions should contain macro and micro nutrients which enhance plant growth. Albert's solution is the mostly used solution in Sri Lanka. It contains NO_3^- , Mn^{2+} , $\text{B}_2\text{O}_7^{2-}$, Zn^{2+} , Cu^{2+} , Mo^{3+} , NH_4^+ , PO_4^{3-} , K^+ , Ca^{2+} , Mg^{2+} and SO_4^{2-} . Management of nutrient solution is an essential

factor in hydroponics in order to get high quality yield. However, pH level and electrical conductivity (EC) are the major factors which contribute in nutrient solution. (Saparamadu *et al.*, 2010). The optimum pH range for hydroponics nutrient solution is between 5.8 and 6.5 while the ideal EC range for hydroponics is between 1.5 and 2.5 dS/m (Department of Agriculture, 2014). There are many advantages and disadvantages of hydroponics.

Advantages of hydroponics:

- Absence of soil borne diseases
- Weeding is not necessary
- Off-season production is possible
- Water wastage minimum
- Less labor
- High yield

Limitations of hydroponics:

- Higher initial capital expenditure
 - Need high degree of management skills
 - Disease can spread easy
- Ex: Root rot diseases caused by *Phythium* sp.

When planning a hydroponic garden, should select a suitable space with minimum six hours sunlight. Furthermore, the effect of weather conditions including temperature needs to be considered. The hydroponics became more popular in a short period of time and this technique lead to begin indoor and outdoor hydroponic gardening very rapidly.

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