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# ***Hi-Tech Vegetable Production System - Hydroponics***

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## **ABSTRACT**

**A quantity of 160g/day/person vegetables is consumed against the ICMR recommendation (300g/day/person). Area expansion for vegetable crops is very limited, because cultivable lands are utilized for non-agricultural activities. Alternate growing medium may be used for stable vegetable production to save the natural resources. Under this scenario, hydroponics is one of the alternate production system for raising the crops in nutrient solutions. The media required for hydroponics are coir compost, peat, perlite, sand, vermiculite and rock wool. Majority of these units function automatically to manage the movement of water, fertilizers and light requirements for various crops viz., tomato, cucumber, chilli, brinjal, strawberry and lettuce.**

## **INTRODUCTION**

India produces 18 crore tons of vegetables from 110 lakh hectares area. In India, a quantity of 160g/day/person vegetables is consumed against the recommendation given by ICMR (300g/day/person). Reducing the gap between demand and supply is very much essential to alleviate malnutrition and fulfill the requirements of the increasing population. Area expansion for vegetable crop cultivation is very limited, because cultivable lands are utilized for industries and buildings.

Alternate growing methods may be used to increase vegetable production and conserve the natural resources for future generations. Hydroponics is one of the solution to raise the vegetable crops without conventional soil media. W.F. Gericke of University of California was first used this technology during 1930's. In India, W.J. Shalto Douglas established hydroponics during 1946 at Kalimpong in West Bengal. Majority of hydroponic units function automatically to manage the movement of water, fertilizers and light requirements. The vegetable crops cultivated under hydroponics are tomato, cucumber, chilli, brinjal and lettuce.

### **MERITS OF HYDROPONICS**

- Crops can be grown in the fields which are having unsuitable soils for cultivation *i.e.* salt affected soils, soil borne disease prevailing areas.
- Dependency on farm labourers for various field operations are minimized.
- High profit can be earned by minimizing the expenditure.
- Efficient utilization of water and nutrients in this system paved a way to protect the natural resources from pollution by least usage of chemicals.
- Timely application of nutrients, water and regulation of light, temperature, humidity and air composition is easy under this system.
- The harvest of the crops grown under this system is simple compared to conventional systems of cultivation.
- Protection of crops from UV rays is possible in installation of hydroponics under closed structures.
- Development of good and vigorous root system is obtained in hydroponics and it will protect the plants from contaminants, diseases and pest infestation.
- Year round cultivation of vegetables is possible and highest market prices are received during lean season.
- Utilization of vertical space is more under hydroponics.

### **DEMERITS OF HYDROPONICS**

- Initial cost for establishment of hydroponics unit is high compared to conventional system.
- Skill is important for application of nutrients, climate control and other intercultural operations.
- Rapid transmission of newly introduced soil borne diseases and nematodes is possible if same nutrient tank is used for cultivation.
- Maintenance of water quality and free from salts are very essential in hydroponics.

### **IDEAL CHARACTERISTICS OF MEDIA USED IN HYDROPONICS**

1. It should supply nutrients for better growth.
2. It must retain sufficient amount of water.
3. It may simultaneously supply water and gases.
4. It should provide anchorage to the crop.

**GROWING MEDIA**

**COCO PEAT**

It is prepared from coconut husk. It is commonly followed for cultivation of tomato, brinjal, cucumber and bell pepper under soil less systems. The high water retaining property reduces the effect of excess heat and maximum yield with sufficient aeration.

**PERLITE**

Greyish white silicate mineral obtained from volcanoes with an approximate pH of 7. The surface of each particles carrying the moisture and nutrients transferred to plant roots. The shape of each particle form air ways and same will provide better air and drain.

**VERMICULITE**

Vermiculite is a hydrated magnesium aluminium silicate and micacious mineral. Vermiculite has high moisture retention and provides aeration and drainage. It supplies good amount of potassium and magnesium. Even though, durability is less than sand and perlite, its properties are highly preferable for container media.

**DIFFERENT SYSTEMS**

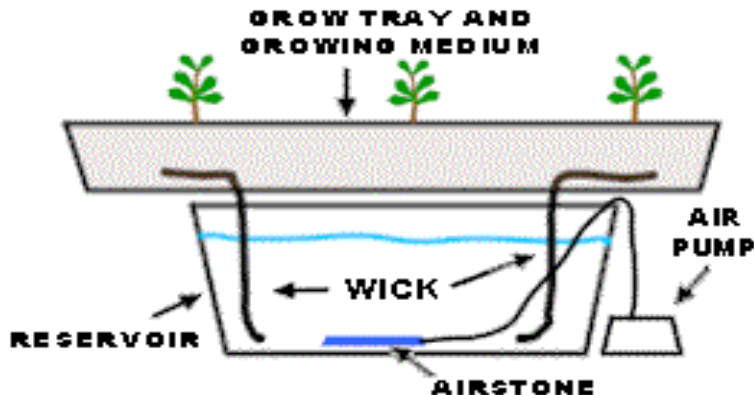
**AEROPONICS**

The plant roots are dipped in the mist form of fine drop lets without any substrate. Good aeration to the roots is the significance of this technique. (Figure 1)



**WICK METHOD**

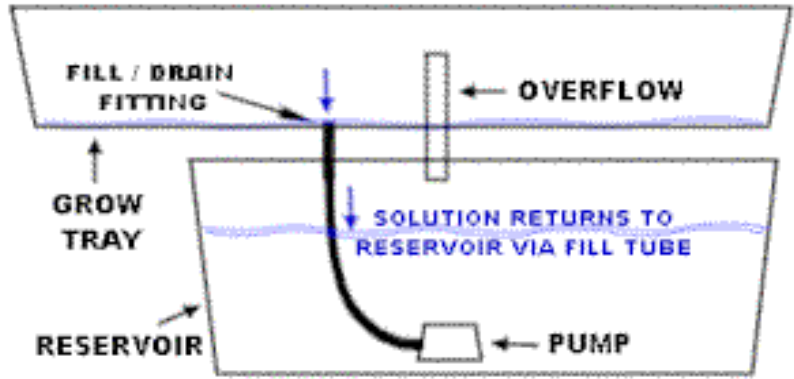
It is easiest system and the plants are kept in coco peat or vermiculite with nylon wick moving from roots to the water tank. Water is provided to the plants by capillary movement. This method is not recommended for high water consumptive crops because pumps are not used for irrigation.



**EBB AND FLOW METHOD**

This method functions on the concept of wet and dry. Here, water with nutrients are taken from a reservoir to the media, wet with solution for minimum time and then the solution is moved out

from the media to the reservoir. This solution movement in the media provides aeration and O<sub>2</sub>. The plants obtain water and nutrients from this medium. The wet and dry concept in this system is not found suitable for desirable growth, even though performance of plants is satisfactory. Occurrence of root rot, algae and mould is common in this system. Hence, modified system with filtration is needed.



**DRAIN / EBB CYCLE (PUMP OFF)**

**DEEP WATER CULTURE METHOD**

The roots of the plants are soaked in water which is having more amounts of nutrients. The oxygen is supplied by an air stone. The concentrations of oxygen and nutrients, salinity and pH levels should be noted frequently to avoid the growth of algae and mould in the water source. Cucumber and tomato are suitable for this system.



**TOP FED DEEP WATER CULTURE**

This system supplies high oxygen for roots directly. The excess water collected from the plants after water uptake moves again to the water source. The air stone in the water source assists to add oxygen with the help of pump and hose attached in the outside for a day.



**RUN-TO-WASTE**

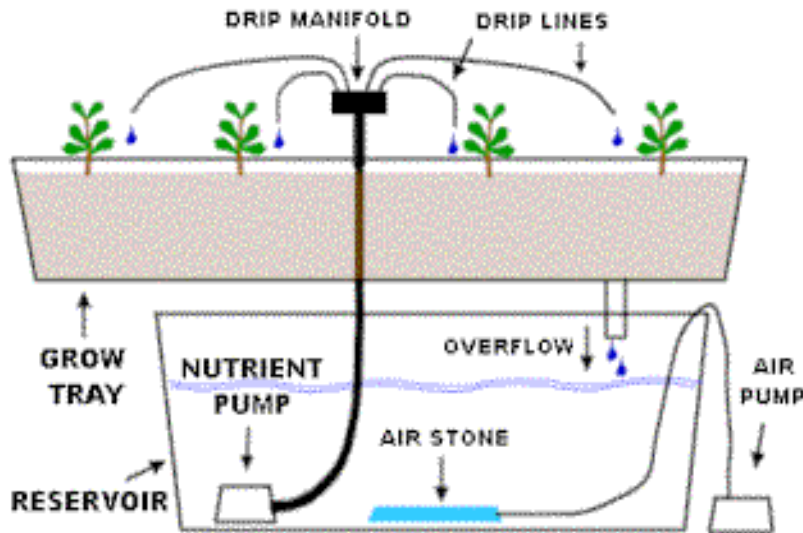
The nutritive elements and water is regularly provided manually to the media. This system is having delivery pump with automatic mechanism, timer and irrigation tubing to release nutrients

in the solution form based on growth stage of the plant, weather and conductivity, pH and water content of the substrate.



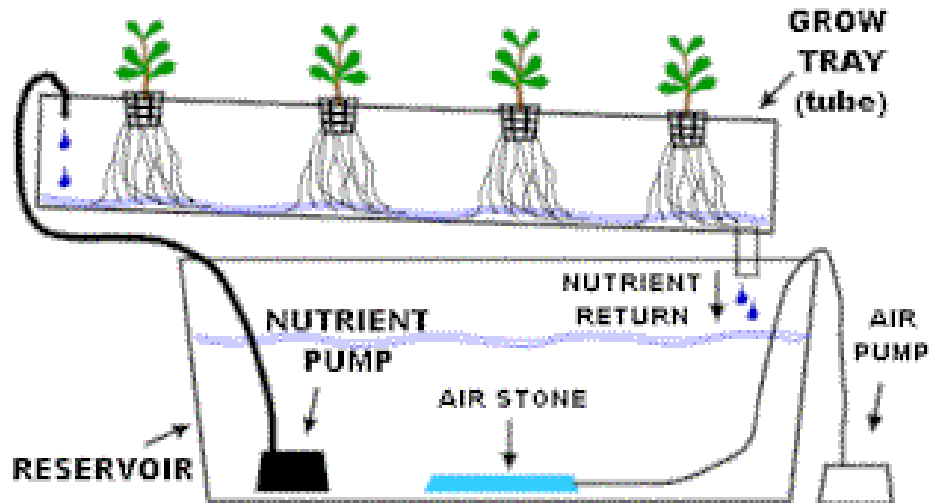
### **DRIP METHOD**

The nutrient solution from the water source is supplied to the roots in optimum levels by using pump.



### **CIRCULATING METHODS NUTRIENT FILM TECHNIQUE**

This technique was discovered by Dr. Allen Cooper during 1960's. Thin film of solution with nutrients moves continuously wetting the roots. The nutrient solution collected from the bottom channels and go back to the tank. Spinach is highly suitable for this system of cultivation.



**NON CIRCULATING SYSTEMS  
ROOT DIPPING TECHNIQUE**

The plants are raised in small pots. Lower part of the pots dipped in nutrient solution. Few roots are soaked in the solution and remaining roots are hanging in the air.

**CAPILLARY ACTION METHOD**

The solution moves to medium by capillary action. Ornamentals and flowers are grown in this system.

**CONCLUSION**

Hydroponic system is most effective method of cultivation in developed and developing countries for vegetable production in minimum space. This system minimizes the water usage, protects environment. The plants raised under hydroponics grow 50 per cent faster than soil by supplying optimum levels of readily available nutrients. The yields obtained under hydroponics are higher than traditional system of cultivation.