Farming Without Soil in Today's Era

CHAITALI T. SHINDE[1], PRAJAKTA S. MARATHE[2]
[1] *MGV's Panchavati College of Management and Computer Science, Nashik-03, India*
[2] *K.V.N. Naik College, Nashik-03, India*

Abstract- ***In recent days we have been experiencing a lot of climatic changes as well as water shortfalls, resulting in an adverse effect on crops yield. In this paper we shall be discussing the technique to overcome these problems related to plantation. The technique called Hydroponics is briefly discussed in this paper. Also, Modern-day families are increasingly becoming an environmentally conscious and health conscious. People in urban areas are now adopting hydroponics — the method of growing plants without soil. Although clean eating caught the attraction of people a few years ago, this subset of hydro culture is a relatively new practice that's finding prominence in neighbourhoods across India as well as in some parts of India.***

Indexed Terms- Hydroponic, pH range, greenhouse, polyhouses.

I. INTRODUCTION

The hydroponic system could be attracting a large amount of population these days but the method came in to existence in late 600 B.C which was commissioned by King Nebuchadnezzar II and was called Hanging Gardens of Babylon. These are believed to have been one of the first mass scale hydroponic projects. The need of Hydroponic system is developing drastically as free land areas are diminishing. Although the farming is soil-less, plant growth rate is high and so the yield is comparatively high. The need of hydroponics also includes the reasons like off-season production, less water consumption, pesticide free, and no real dependency on the weather. All over India the Hydroponic farming is spreading its roots. A hydroponic system containing greenhouse farming, are taking the urban farming to a level which is making the agriculture process easier. Hydroponic is proving to be one of the profitable business in India. There are many factors like large population which makes it possible to increase the market growth rate, rich climatic conditions, presence of favorable labor cost and intelligent human capital. Also, the hydroponic methodologies, food safety, pest management and other essential farming expertise, already exist in the market. Leafy vegetables and vine plants can be grown using hydroponics. At commercial level there are two major factors that need to be considered one is free space and the other is budget, depending upon what you want to grow the system needs to installed likewise. Hydroponic farming can easily be done in garden and rooftops as well.

II. GROWN CROPS IN INDIA

Some of the commonly and successfully grown crops in India through hydroponics are tomatoes, lettuce, Radish, Spinach, herbs, chilies, corianders, etc [3].

The most important factors that need to be considered while growing any plant using hydroponics is the pH level in water, Electrical conductivity (EC)/ TDS and atmospheric conditions like temperature, relative humidity and sun light. For every plant the pH level differs accordingly.

A. Tomatoes: Many types of tomatoes are grown widely. The pH level needed for tomatoes is in the range of 5.5-6.5 and require more sunlight. A wick system or Ebb and flow systems and Dutch bucket works effectively and efficiently for the production of tomatoes.
B. Lettuce, Radish & Spinach: A cold weather crops like lettuce is being produced throughout the year by maintaining a cool temperature with the help of fan and pad polyhouse. This crop needs the pH level in the range of 6-7. Hydroponic systems like Nutrient Film Technique (NFT), Deep Water Culture (DWC) and an advanced version called Aeroponics and Aquaponics, are best for plants like lettuce, radish, spinach, and other leafy vegetables, as they have short roots and are above ground height and take less time to grow.

C. Strawberries: In commercial hydroponic the most popular plant grown is strawberries. It adapts so well in the system and with a favorable temperature and pH level 5.5-6, gives yearlong crop. For these plants Wick system or Ebb and Flow systems are preferable.
D. Herbs: All the environmental factors like lots of light, warm temperature and pH level 5.5-6.5 are maintained using Hydroponics which enhances the flavor of the herbs. The NFT or Drip system are well suited for basil crop. A wide variety of herbs grow exceptionally well in hydroponic gardening with a more flavorful and aromatic produce, than those grown in the soil. Basil, chives, cilantro, dill, mint, oregano, parsley, rosemary and thyme are all great options. All hydroponic systems can be used to grow these herbs, where nutrient level, pH level, and temperature, needs to be optimized as per the plants need.
E. Flowers: flowers like carnation, gerbera, zinnia, can also be grown using hydroponics. The pH value needed for these plants to grow varies from 5.5-7.0

It has become very convenient and easy to grow crops and vegetables with basic skillsets and knowledge about hydroponic. This technique has made it possible to grow almost every plant without water. In addition to the aforesaid crops the other crops grown are potatoes, cabbage, bell pepper, beans, cucumber and kale. Some gardeners are trying to achieve what seems to be impossible and experimenting each day with hydroponics to take it to further.

III. TYPES OF HYDROPONICS

1. Passive Wick System: It is a simple system which contains no moving parts. Nutrient solution is delivered with a Wick. Fig-1 shows grow tray and media, reservoir, wick, air stone, air pump and it works on the principle of capillary action in which plants are placed in an absorbent medium like vermiculite, perlite with a nylon wick running from the reservoir of nutrient solution to plant roots [1]. This system is useful for small plants, herbs and spice [2].

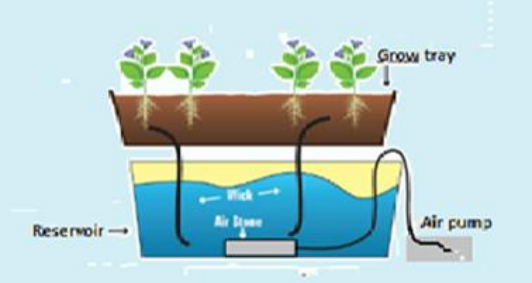

Fig-1: Passive Wick System

2. Water Culture System –Floating Platform

In water culture, Fig.2 shows Plants get matured on platform where the roots are suspended into solution. Air bubbled into nutrient solution to provide oxygen for roots and evaporative cooling. This type does not work well with some types of plants or long-term growing. This system is use for cucumber and tomato [2][4].

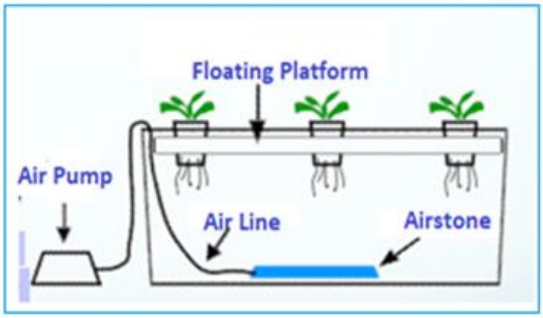

Fig-2: Water Culture System

3. Nutrient Film System –Gutter System: Most popular. Also known as gutter hydroponics. Nutrient solution washed onto plant roots. Fig.3 shows Reservoir contains nutrient solution which is pumped through system using a water pump. This technique mainly used for lettuce production and other leafy green vegetables [2].

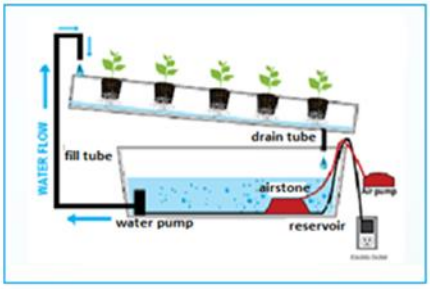

Fig-3: Nutrient Film System

4. Continuous Drip System:

Fig.4 shows Nutrient solution dripped onto plant from a line either above the plant or sitting on the grow medium. Water and nutrients in separate tank pumped through system.

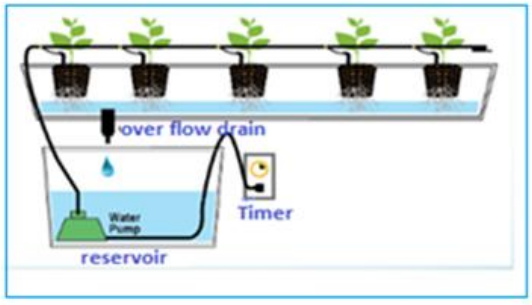

Fig-4: Continuous Drip System

5. Ebb and Flow System: An Ebb and flow system Fig-5 Consists of the grow tray in which the nutrient solution is temporarily and regularly flooded. Submerged pump is connected to a timer. When the timer is off, the solution flows back into the reservoir. Plants can dry out during cycles

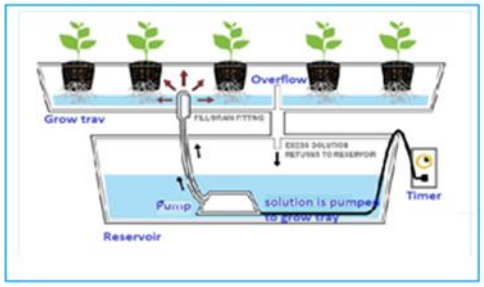

Fig-5: Ebb and Flow System

6. Aeroponics System: Fig-6 shows nutrient solution sprayed or misted onto roots in growing chambers where roots are suspended in air. Used in many grow tower commercial systems. Nutrient solution can be in a grow chamber or outside [1][4].

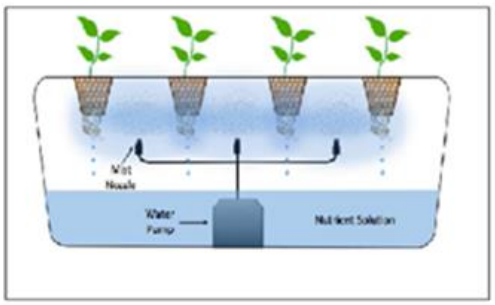

Fig-6: Aeroponics System

IV. HYDROPONICS GROWING MEDIUM

Table 1. List of Hydroponics growing medium [4]

Sr. No	Medium	Description	Images
1	Rockwool cube	It is a horticultural growing medium made from natural elements such as basalt rock and chalk. First, as rigid slabs, blocks and squares which are called "bonded" products. Secondly, Rockwall is available as a highly refined and compatible hydrophilic or hydrophobic granulate that is basically a water absorber or water repellent[4][5].	
2	Cocopeat	Cocopeat, also known as coir pith, is a spongy material which is made from pith inside a coconut husk. It is naturally anti-fungal and organic medium[6][8].	
3	Light expanded clay aggregate (LECA)	Light expanded clay aggregate is also known as LECA. This growing medium is suitable for all plants. It gives excellent drainage as well as moisture retention. It is also commonly referred to as "grow rock", is ideal for indoor hydroponic growth[4][7].	
4	Coconut coir	Coconut Coir is also known as coco coir and it is 100% organic media made from the husk of the coconut. It can be used in soilless potting mixes or mixed with soil in concentrations of up to 80 percent of the mixture.It improves water holding capacity and soil structure[1][4][8].	
5	Vermiculite	Vermiculite is a silicate mineral that expands as much as perlite when exposed to extreme heat. As a growing medium, vermiculite is similar to perlite but has a relatively high cation-exchange capacity, meaning it can hold nutrients for later use[4][9].	
6	Perlite	Perlite is inorganic and neutral pH .It is also lighter than grit or sharp sand, pumice, or other aggregates—which can also be used to break up compacted soil and improve drainage in a garden bed[4][5].	

V. CURRENT USAGE OF HYDROPONICS IN INDIA

As hydroponic systems do not use pesticides, young entrepreneurs in Indian cities such as Delhi, Mumbai and Bengaluru are turning their attention to this kind of farming, where plants do not need soil for growth and are nourished with mineral nutrients through water. Hydroponics uses very less water than conventional farming does, therefore it has won attention as a sustainable farming method in several countries, such as the Netherlands. Places in India like Rajasthan, Gujarat, some areas of Maharashtra are likely to have this kind farming as these places suffer from lack of availability of water. Therefore, the use of Hydroponics is likely to grow on a larger scale in

these areas. Some areas in India have opted to put up their ventures in poly houses on the city's outskirts. In some areas of the country hydroponics is done in the heart of the city, in residential or commercial areas, where the plants grow in laboratory-like conditions under artificial light that simulates sunlight. The technique is easy to understand and implement and can be learnt from internet and through trials and experiments in homes as well.

VI. ADVANTAGES

1. Hydroponic do not use pesticides and harmful chemicals.
2. It requires less space as well as water for plantation
3. Plantation is not dependent on outside climatic conditions
4. The process is time saving as compared to the legacy farming process.
5. Produces organic plants with good taste and quality.

VII. DISADVANTAGES

1. Requires high investment.
2. Needs expert supervision who having knowledge of all factors like plant growth-selection, habits of selected plant growth, climatic needs or adaptations of the crop, and pollination requirements.
3. Specially formulated, soluble nutrients must always be used.
4. Some water borne diseases can spread rapidly in recirculation system.

CONCLUSION

The paper gives a brief idea about what hydroponic system is and how it is beneficial to use hydroponics instead of conventional farming methods. Thus, Hydroponics is one of the promising methods over legacy farming method. As this method essentially consolidates non-chemical products the growth of the plants is organic and harmless. Although some aspects need improvement, but there is no doubt why this method is well suited and convenient for the growth of mentioned plantation.

ACKNOWLEDGMENT

We are very much thankful to M.G. V's Panchavati College of Management & Computer Science, Nashik for providing lab facility with computer and internet, we specially thanks to Principal of our college, for his constant guidance and extensive support to encourage for this work.

REFERENCES

[1] Hussain, Aatif, et al. "A review on the science of growing crops without soil (soilless culture)-a novel alternative for growing crops." *International Journal of Agriculture and Crop Sciences* 7.11 (2014): 833.

[2] Malo, Mousumi. "INTEGRATED FARMING SYSTEM: A ROADMAP FOR INDIA." *Editorial Board*: 1

[3] http://www.fnbnews.com

[4] Pandey, Renu, Vanita Jain, and K. P. Singh. "Hydroponics Agriculture: Its Status, Scope and Limitations." *Division of Plant Physiology, Indian Agricultural Research Institute, New Delhi* 20 (2009).

[5] https://www.hydroponics.net

[6] https://www.gardeningknowhow.com

[7] http://www.gbcindia.org

[8] https://www.gardeningtips.in

[9] http://www.homehydrosystems.com