JUST AGRICULTURE
multidisciplinary e-Newsletter

Hydroponics: A New Ray of Hope for Soilless Agriculture

Udita Mondal
Assistant Professor, Brainware University

ARTICLE ID: 005

Introduction

With the increase in population growth the need and demand for food products are increasing with every passing day. Just because of this growing demand the food crisis could pose a great threat to the entire human race. To prevent that crisis from happening some new and modern farming methods can be adopted. In such case hydroponics can be one of the best possible viable alternatives for crop cultivation. Hydroponics means growing of plants without soil using mineral nutrient solutions which is also termed as Controlled environmental Agriculture (CEA). In addition to water, oxygen, and sun light, hydroponic plant system needs some small number of inorganic elements for the growth of the plant. Hydroponics farming can be of great advantage in Indian agriculture with an aim to produce crops in every season without soil. This practice can help Indian farmers to increase their crop productivity even in a small land area. As hydroponics does not require any soil and root system is supported using inert medium such as clay pellets, gravels *etc*. (Cramer *et al*.2002).In this was roots can come in direct contact with nutrients in water as well as its already open to consumption of oxygen. (Anuragputra *et al*.2015). The term hydroponics was derived from Greek word „hydro" means water and „ponos" means labor. (Sardare *et al.* 2013)

Advantages of hydroponics

- It can be grown anywhere and it uses 20 times less water than soil based gardening.
- Your environment is sterile, which means no pesticides. As no pesticide is being used here, so the environment is safe and sound.
- It leads to water conservation.
- In this case no soil testing hazards are there.
- Mulching, tilling, weeding has nothing to do with hydroponics. As a result, crops can be grown round the year.

JUST AGRICULTURE
multidisciplinary e-Newsletter

- The crops can be grown even in indoor system with an easy load on harvesting procedure.

Disadvantages

- Establishment of a hydroponic system is a bit costly and sometimes may be a huge thing for small and marginal farmer.
- Hydroponic system includes continuous power supply for watering the crops and in any case if power cut is happening then watering should be done manually which can be a bit hectic.
- Constant monitoring is very important as water-based microorganism can infect and creep in easily.
- The production is not that much high and it also not possible to envisage whether in case of disease infestation only the diseased crop could possibly be removed or the entire crop would be affected.
- The initial cost of forming hydroponic farm in a country like India, is way higher than traditional or conventional method of farming. For regulating the environment and growth of the plants one needs a building along with food-grade plastic made trays and tubes as well. The cost of this infrastructure hovers around Rs. 50,000 and above per 1,000 sq. ft which is really high in case of country like India.

Land Use

With the bursting global population land use is quickly becoming one of the major factors in any manufacturing sector. Hydroponic agriculture has the key to massive reductions in the amount of land needed for proper crop cultivation. Ashydroponics is a soil-less growing method, it allows crops to grow without the need for an actual plot of earth or potting mixtures or fertiliser or else which is way too important in case of conventional agriculture. Instead, a small land may contain vertical stacks of plants which in due course multiply the efficiency of the said plot. Additionally it can be done at indoor and in alternative spaces, such as buildings or rooftops. The sheer efficiency of nutrient transfer associated with hydroponics can provide better yield. In fact, the hydroponic practice in greenhouse condition in the Arizona experiment bestowed the yield 11 times to the conventional methods of cultivation in case of lettuce.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Energy Demand

Hydroponic is actually a technological approach which relies on energy to provide optimal conditions to the crops. It's a systematic method which faces the challenges of providing either water, or oxygen to plant roots. Although new methods confront different challenges, they all come with energy consuming solutions.

When it comes to DWC (deep water culture) the roots are drowned in water. So pumps are inevitable to provide oxygen in this situation. So it can be concluded that when using pumps has to be done in commercial purposes electricity consumption will be higher leading to higher cost of investment.

Techniques such as NFT (nutrient film technique), allows the roots to be partly in the air which provides all their oxygen need. Additional oxygen has to be supplied by creating a "waterfall" from the pipe system or a simple air pump. In such case crops are planted on top of an enclosed channel or; tray; and nutrient-filled water from a reservoir is pushed into that channel. As those channels are at right angle gravity plays the key role in flowing the water down the channel. In case of NFT, shorter trays are chosen over bigger ones and only a little bit amount of water is pushed at a time to prevent the roots from further drowning or rotting.

Techniques of hydroponics

Deep Water Culture: - This system involves active moving parts where roots of the plant are totally dipped into the water which contains the specific Growth nutrient. The oxygen is supplied trough air pumps for the roots to breathe. Few plants other than lettuce can do well in this type of system. In this systematic hydroponic system the platformsused are usually made of Styrofoam and floats directly on the nutrient solution.

Fig 1. Deep Water Culture

JUST AGRICULTURE
multidisciplinary e-Newsletter

Ebb & Flow System (Flood & Drain):- This hydroponic system works by flooding the growth trays temporarily. The nutrient solution from a reservoir surrounds the roots before draining back. This is an automated system with a water pump with a timer in it.

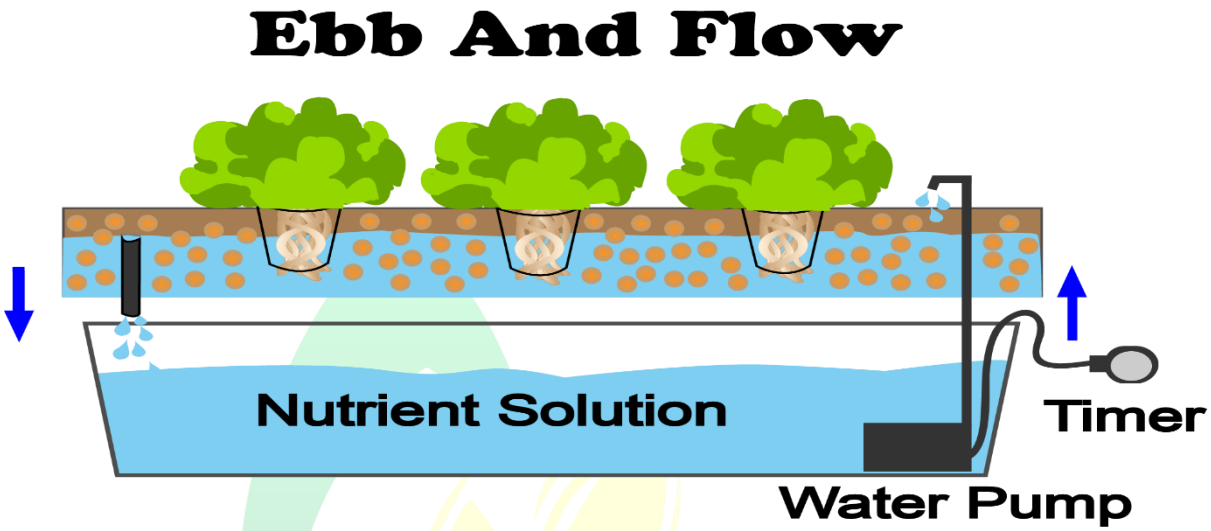

Fig 2. Ebb and flow

NFT System: - The Nutrient Film Technique (N.F.T) system is the most dominant kind of hydroponics these days. It includes u a constant flow of the Growth Technology nutrient solution with no timer being included here. The nutrient solution is pumped from a reservoir into the growing tray. The growing tray requires has no growing medium or soil or organic manure. The roots extracts the nutrients for their growth and demand from the flowing solution provided through the channels. The downward flow is turned back into the reservoir for further recycling. Pump and electric maintenance should be constant because failure of them may result into drying out of roots rapidly when the water flow stops in that case.

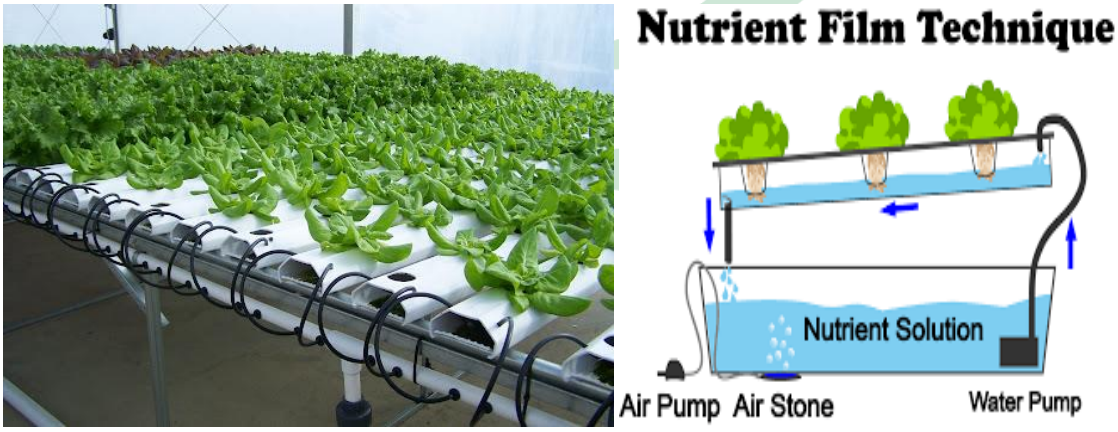

Fig 3. Nutrient Film Technique

JUST AGRICULTURE
multidisciplinary e-Newsletter

Aeroponic System: -Unlike N.F.T system, growing medium here is primarily air. The roots are hanged in air with spraying of nutrient solution in the form of mist. The misting of roots done are very frequentlyin every few minutes. In case of any interruption roots will dry-out. A timer is needed here like other hydroponic systems as well.

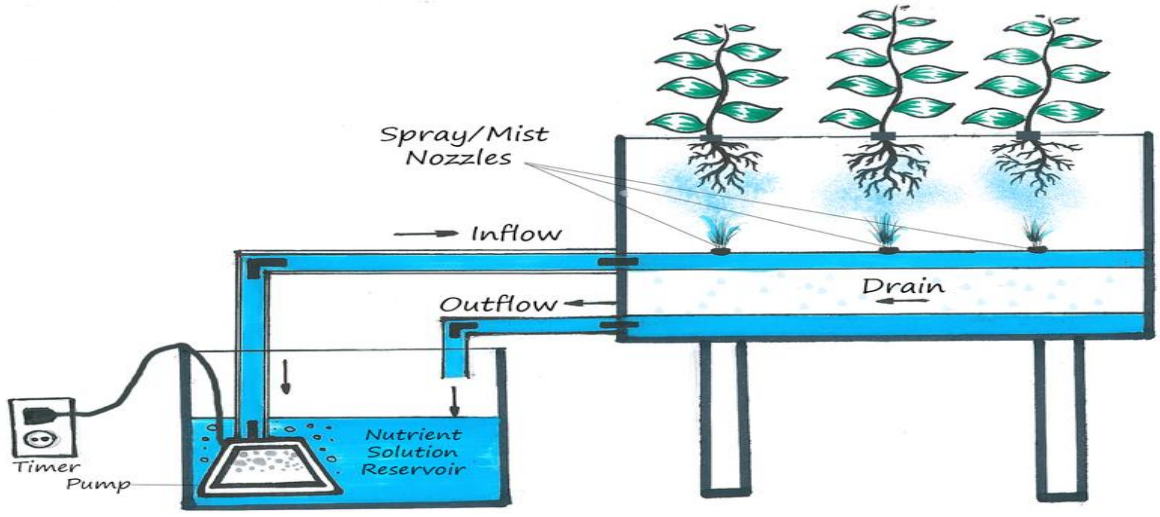

Fig 4. Aeroponics

Conclusion

With ever increasing population in the entire world demand for food is also increasing at an alarming rate. To feed this huge amount of population the production of food and vegetables should also be increased simultaneously. But as we know that the horizontal area is decreasing we must utilise the vertical area and hydroponics can fit in that strategy very well. Meanwhile the traditional and conventional method of cultivation requires soil with good health and fertility level which means we need land. In such scenario alternative planting system like hydroponics can prove to be an efficient system which requires less no. of workers. Althoughit's expensive and complex to maintain but the high rate of productivity will compensate in the long run. Along with that the soil less farming in India can provide us food which is 100% organic, toxic free and have a great future ahead.

Reference

Anuragputra, P., Yuliando, H., (2015): Soil less culture system to support water use efficiency and product quality: A review Agriculture and Agriculture science Procedia, 3: (283-288)

JUST AGRICULTURE
multidisciplinary e-Newsletter

Cramer, G.R. (2002) Sodium-calcium interactions under salinity stress. In: Salinity: Environment-PlantsMolecules, A. Lauchli& U. Luttge: 205-227, Kluwer Academic Publishers, Dordrecht, Netherlands

Sardare M.D., Shraddha V., Admane(2013): A review on plant without soil – Hydrophonics. Journal International *Journal of Research in Engineering and Technology* (02): 299-304.