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Hydroponics a novel technology for Horticultural crops

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ABSTRACT

Soil based cultivation is now facing difficulties due to different man-made reasons such as industrialization and urbanization. Also, sudden natural disasters, climate change and unrestricted utilization of chemicals for agriculture purposes cause the depletion of soil fertility and quality. That is why, scientists have developed a new alternative approach for cultivation system namely soil-less cultivation or hydroponics. Hydroponics is a method of growing plants in a water based, nutrient rich solution (Maharana and Koul, 2011). Through hydroponics a large number of plants and crops or vegetables can be grown. The quality of yield, taste and nutritive value of end products produced through hydroponically is generally higher than the natural soil-based cultivation. This cultivation is cost effective, disease free, eco-friendly and is gaining popularity all over the world, in both the developed and the developing countries. It has a great prospect in many countries along with high space research to fulfil the lack of arable land where proper cultivable land is not available. So, hydroponics would be a better technique to produce the different kinds of fruits, vegetables and fodder as well as meet the global nutrition demand with making advance future. In the future, hydroponics could be emerging techniques for the supplying of food to the world-wide population.

INTRODUCTION

Hydroponics is a subset of hydro culture and is a method of growing plants using mineral nutrient solutions, in water, without soil. Hydroponics is a technology of plants

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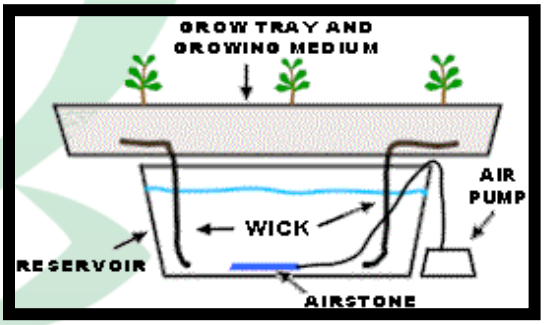
growing in a nutrient solution (containing water fertilizers) with or without containing of artificial medium (sand, vermiculite, perlite, gravel, rockwool, peat mass) to provide mechanical support.Utilizing this technology, the roots absorb balanced nutrient dissolved in water that meets all the plant developmental requirements.This technique is very useful for the area where environmental stress (cold, heat, dessert etc.) is a major problem. It is becoming popular because there is no chance of soil-borne disease, insect or pest infection to the crops. Crops in hydroponic system can be cultivated year-round and considered as off season. Higher yields can be obtained since the number of plants per unit is higher compared to conventional agriculture (Turner, 2008). In combination with greenhouse, it is high technology and capital intensive. Currently, demand of hydroponics cultivation has been increased in all the developing and developed countries. Holland, Germany, Australia, Japan and Brazil, USA are using hydroponics for crop production with amazing results. Various commercial crops can be grown using hydroponics including leafy vegetables, tomatoes, cucumbers, peppers, strawberries, papaya and fruit crop seedlings and many more.

TYPES OF HYDROPONIC SYSTEMS IN SOLUTION CULTURE

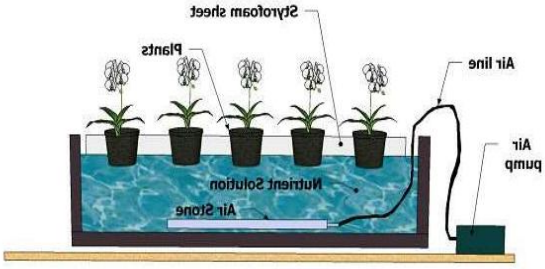
1.Wick System

The capillary or wick system do not use pumps or timers. Water and nutrients are drawn up to the roots by capillary action. These systems may be important when designing a system to operate in a space station where gravity is nonexistent.



2. Deep Water Culture

Deep Water Culture (DWC) systems are by far the simplest method of hydroponics. They are often used in classrooms to provide a working example of a hydroponics system. It is also not an appropriate hydroponic system



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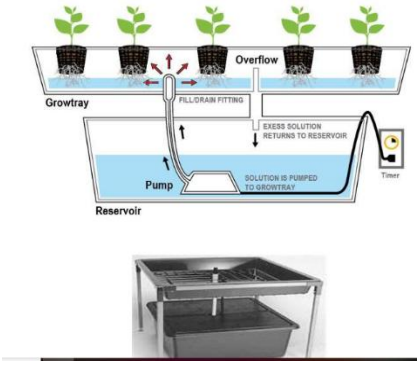
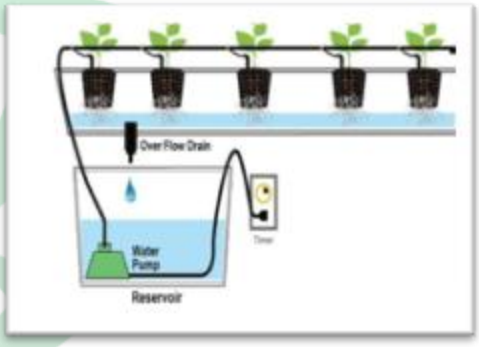
for every type of plant: Because the roots are constantly submerged in an abundance of nutrient solution, many plants will suffer from beingoverfed. Therefore, it is recommended only use this system for water-loving plants, such as lettuce.

3. Ebb & flow (Drain and flow)



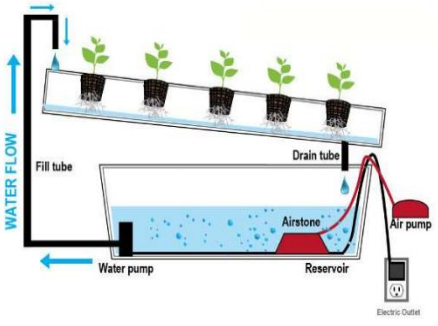
The ebb and flow hydroponic system (otherwise known as a flood and drain system) is also a very popular form of hydroponics. They work in a similar way to the drip system, but are actually even more simplistic to use. Use of a nutrient reservoir, keeping the water in a separate tank to the plants, which are placed in a grow tray above. A timer is set to periodically activate a pump which is kept in the nutrient reservoir. All plants in the growth tray will be flooded equally.

4. Drip system Recovery/ Non recovery



The most used hydroponics system is the drip system. The main principles behind the hydroponic drip system are relatively simple which makes them incredibly easy to use, hence their popularity. Nutrient reservoir which is kept separate from the plants. There are two types of drip systems: the recovery drip system and the non-recovery drip system.

5. N.F.T. (Nutrient film Technique)



NFTs are often used in commercial hydroponics, particularly for short harvest crops. In India NFT technique used for vegetables and ornamentals growing. NFT system does not require a timer. The growing chamber is built with the slightest downhill decline, allowing the solution to trickle from the top end of the

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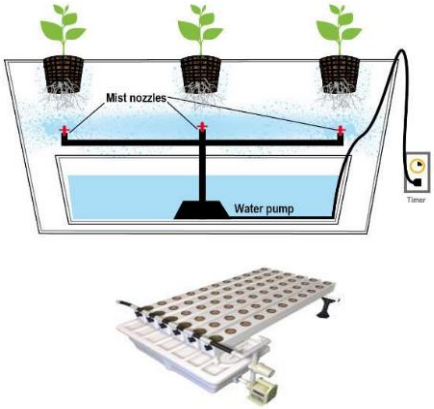
tray to the bottom, where it is recycled back into the nutrient reservoir. Instead of a regulated watering schedule, the plants in an NFT hydroponic system are provided with a constant flow of nutrient solution. Only a small film of nutrient solution is accessible to the plants which are suspended above with their roots hanging down - at any given point.

6. Aeroponic system



The aeroponic system is the most technologically advanced of all the hydroponic systems. The plants are suspended in the air, as in the NFT system, with their roots hanging down below. The nutrient solution is then pumped with a tube, where a second higher pressure pump sprays the solution as a mist over the dangling roots. The reason this technology is considered essential for future food production is that it offers the possibility of a group of plants to be grown vertically, meaning less land is required to farm.

SOIL MEDIA CULTURE

1. **Hanging bag Technique**:

In this technique thick UV stabilized polyethylene bags filled with cocopeat or coconut fiber in cylindrical shape one meter high are used to grow plants. The bags are suspended vertically and supported overhead and collecting channel is placed below for the nutrient solution. It is suitable for growing lettuce, leafy vegetables, strawberry and small flower plants.

2. **Grow Bag Technique:**

In this technique grow bags made with UV stabilized polyethylene sheets of 1 meter length, 15-20 cm width and 8-10 cm height are used for growing plants. Single or paired rows can be used with the plant spacing kept at 30-60 cm depending on the type of crops. It is very common, cheap and easy technique.

3. **Trench or trough technique:**

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In this technique plants are grown in trenches or trough made with UV stabilized PVC/HDPE sheet, bricks, concrete or other local material. Trench or trough is filled with inert organic, inorganic or mixture of materials like coco-peat, sand, perlite, vermiculite with the depth ranging from 30-60 cm depending on the type of crops.

4. **Pot technique:**

In this technique readymade pots made of plastic in the range of 4 inch to 12-inch diameter are used for growing plants. Pots are filled with inert organic, inorganic or mixture of materials like coco-peat, sand, perlite, vermiculite etc. The volume of the container and growing media depends on type of crops and it varies from 01-10 liters.

MEDIA USED IN HYDROPONICS

1. Coco-Coir

Has an excellent air to water ratio with great water retention.

2. Rockwool

A fibrous material made from melted rock. Not biodegradable. Hazardous to health. Must be pH balanced. Excellent water retention.

3. Perlite

Perlite is a mineral that has been superheated so it expands into light weight pebbles that are pH neutral, porous and very absorbent.

4. Vermiculite

Another type of expanded mineral, vermiculite is very similar to perlite, but with a higher cation-exchange capacity, allowing it to store unused minerals for release to the plants as needed at later time.

5. Expanded clay

Most popular media, drain quickly and pH neutral, reusable.

CROPS GROWN ON SOIL-LESS OR HYDROPONICS CULTURE

It is practically feasible to grow any kinds of vegetables, fruits, fodder or crops using this technique. Flowers give a better bloom and colour when grown hydroponically. Hydroponics system might be automated, that is why it is well controlled and better for end

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product collection. Several plants including vegetables, fruits, flowers, medicinal crops can be grown using soil-less or hydroponics culture (Sardare and Shraddha, 2013).

Major advantages of hydroponics cultivation are as follows:

- Soil-borne pathogens and diseases avoidance
- Soil disinfection and treatment avoidance
- Cultivate greenhouse crops in poor quality soil
- Precision nutrition control in inert media
- Optimum control of environmental parameters
- High yield and better quality of products
- High water and nutrient use efficiency
- Round the year production

Major disadvantages/limitation of hydroponics cultivation are as follows:

- High initial investment
- Highly technical
- Precision surveillance

CONCLUSION

Hydroponics is the fastest growing sector, and it could very well dominate food production in the future. Hydroponics is one of the potential technologies for doubling farmers income. In the changing scenario of food habits hydroponics technology is going to play a major role for sustainable and round the year production in urban and peri-urban areas. As population increases and poor land management, people will turn to new technologies like hydroponics and aeroponics to create additional channels of crop production. Due to rapid urbanization crowded cities without gardens, there is no option but adopting soil-less culture to help improve the yield and quality of the produce so that we can ensure food security of our country. It can be said that hydroponic and soilless culture is “the next logical step” after traditional agriculture.

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