



Assessment Of Hydroponic Technique The Future Soil-Less Farming Technique Of India

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Abstract-

The present papers records the various types of technique of hydroponic system used in India and give us an idea of the preparation of a nutrient film technology system of hydroponic. Hydroponic is a technique in which plants are grown in water that harmonizes dissolved essential macro and micronutrients. Construction of the NFT hydroponic system and the overall present study is done in Bazpur U.S.Nagar in November 2021 to check the growth of various plants. There are total 5 systems of the hydroponic system are used in India Ebb and flow, Drip system, NFT (Nutrition Film Technique), Aquaponic, And Aeroponic. The nutrition film technique (NFT) of the Hydroponic system was used in the present study.

Keywords- *Agriculture, Hydroponic System, Soil-less Farming, Nutrition film technology, Aeroponic.*

Introduction-

Photosynthesis is a process that is responsible for the growth of plants. By photosynthesis, plants make their food. In this process, plants use sunlight, carbon dioxide, and water to form glucose and oxygen, chemically (Carbon dioxide + Water → Glucose + oxygen). There's no mention of soil anywhere in there and by this, we can say plants can grow without soil if we provide nutrition media with water. Most people define the word hydroponics as "growing plants without soil" Hydroponics technique is widely used all over the world for gardening purposes. Home gardeners use hydroponics techniques on a smaller scale to grow fresh and healthy vegetables, greenhouses and nurseries grow hydroponics.

Ebb and flow system- The ebb and flow system consist of a nutrition solution tank and a growing bed. The growing bad consist of gravel and sand. Ebb and flow beds have watertight trays that are 15-30 cm deep. The tray groove touches the water level at the bottom. This system was first used during World War II (1940-1944). This method involves flooding the trays to a depth of 10 to 20cm for up to 10 minutes. This allows the potting substrate to absorb the nutrient solution (Bartok, 1989). Nutrients solution is recirculated to be used again and the pH of the solution should be monitored and maintained because they affect the physiological system of plants (Poole and Conover, 1992). After some fixed interval of time, the nutrition solution should be replaced (Anon, 2016). Water uptake by potting media and distribution during irrigation has been simulated (Anlauf, Rehrmann, and Schacht, 2012).

Wick system- Nutrition solution is absorbed by the medium in this technique. The Wick system contains soil-less mediums like cocopeat, perlite, and cotton wicks, (Anon, 2016). Wick system has many advantages, electricity is not required (Andriolo et al., 2004), and the ability to use nutrition and water (Son et al., 2006). The Wick system is used for the cultivation of Chrysanthemums and Poinsettias plants by (Kang et al., 2009) and Kalanchoe by (Lee, 2010). We can improve the water distribution by the length of the wick (Lee et al., 2010, Son et al., 2001)**Aeroponic-** In the Aeroponic method, the plant's roots are more oxygenated than in any other system. In which, the plant's roots absorb the nutrition with the help of mist (fog) of nutrient solutions. According to Wikipedia "*Stoner 1986 becomes the first person, to market fresh aeroponically grown food to a national grocery chain*"

Aquaponic – In the aquaponic system Fish are cultured with the plants the nitrogenous waste is generated by the fish used by the plants and by the absorption of nitrogenous waste the plants become healthier and water is recycled in this system.

Nutrient Film Technique- Since the early twenties century, NFT has been used in the production of herbs (Morgan et al., 2012). In NFT System the water film solution moves downward and is collected in the gutter. This gutter transports the water back to the reservoir (Smith, 1999). NFT systems can promote the use of greenhouse areas (Santos 2010) with better quality and quantity (Lopes et al., 2007). Due to the good environment growth rate plants increase and the life cycle of plants becomes short (Martins et al., 2009 and Santos et al., 2010).

Material and method-

The study area selected for the present investigation is located in Bazpur. Location exists on Keso wala mod Bazpur. Bazpur is located in U.S. Nagar which is the Tarai region of Kumaun division in Uttarakhand. U.S. Nagar is the district of Uttarakhand state in northern India. The field of the village used for the hydroponic culture system is about 10 km away from the polluted area. Various monographs are drawn to Schematic illustrations of different types of hydroponic systems.

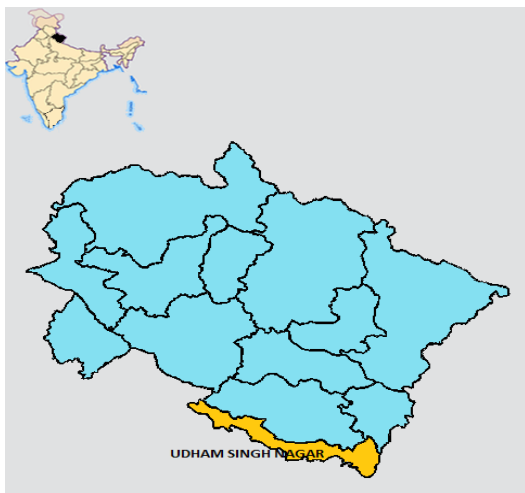


Fig: 1 Investigation location

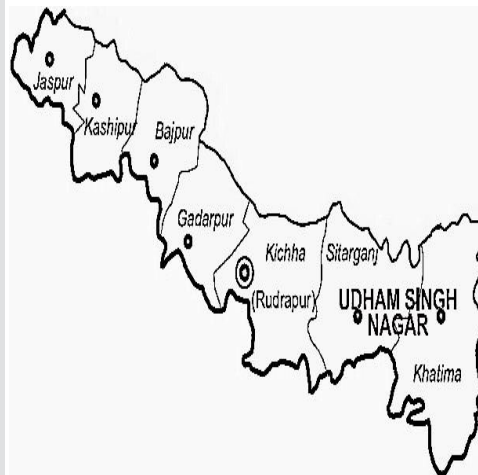


Fig: Map of U.S.Nagar

The climate of U.S. Nagar is warm and temperate. The average annual temperature of U.S. Nagar is 24.3°C. The average rainfall is 1302mm. according to climate data.org.in, the average temperature in September is 28.1°C, October is 25.1°C, and November average temperature is 19.7°C. The hydroponic system using NFT (Nutrient Film Technique) is established under poly-house for the comparative study with soil-grown plants. The soilless culture medium cocopeat was used for the germination of seeds in net pots. The seeds germinated within five days in the last week of September 2021. PVC pipes of 4-inch diameter were used in the formation of a hydroponic system, which is placed on the triangle-shaped iron frame. Below are the figures showing the design for the hydroponic system.



Fig: 3 & 4 Design of NFT Hydroponic System

Result and discussion-

There are different types of systems in hydroponic techniques. These systems are based on their structural setup, which determines how nutrition solution is provided to the plants. There are the following systems that are being used in hydroponics techniques. Ebb and flow, Drip system, NFT (Nutrition Film Technique), Aquaponic, Aeroponics.

Ebb and Flow - Ebb and Flow system is also known as the flood and drain method. In this, the nutrition solution directly flows on a growing area for 5 to 10 minutes and then the solution pores always as shown in the figure. The nutrition solution is stored in the reservoir which is just below the growing table. Ebb and Flow system is not usually in commercial production. In this system, the plant's roots are grown in a medium like clay pebble, rock wool, perlite, etc.

Wick system or Drip system - In the drip system, the nutrient solution is flushed by the drip cycle and on the growing medium. A drip system is used to grow long-term crops. There are drip emitters that are used to deliver the nutrition solution. The timing of the drip emitter is approximately 10 minutes in hours. It depends on the stage of development and the types of crops.

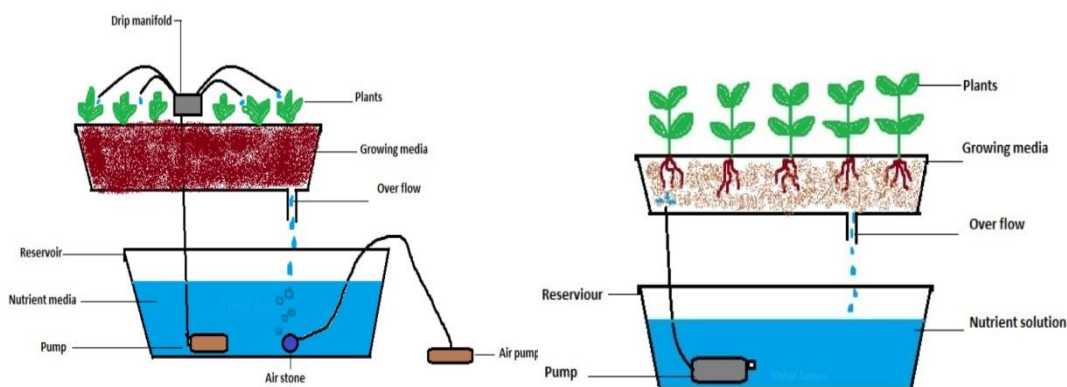


Fig: 5 Ebb and flow System

Fig:6 Wick system

NFT Nutrition film Technique -In the NFT system plants grown in gullies also known as channels. Nutrition solution is pumped throughout the reservoir in the channels as shown in the figure. The plant's roots are kept moisturized and receive the nutrition from the thin film of the nutrition solution. The roots at the bottom are exposed to the solution while the top parts of the roots have emerged in the supporting media. NFT was developed in the 1920s in China by Dr. Alan Zhang. The basic principle of the nutrient film technique is to keep the thin layer of nutrition solution, in constant flow through the tray of plant roots. NFT is the most commonly used system in a hydroponics system and many farmers are preferred to NFT for its advantages it consumed less area and easy to handle for the home gardener.

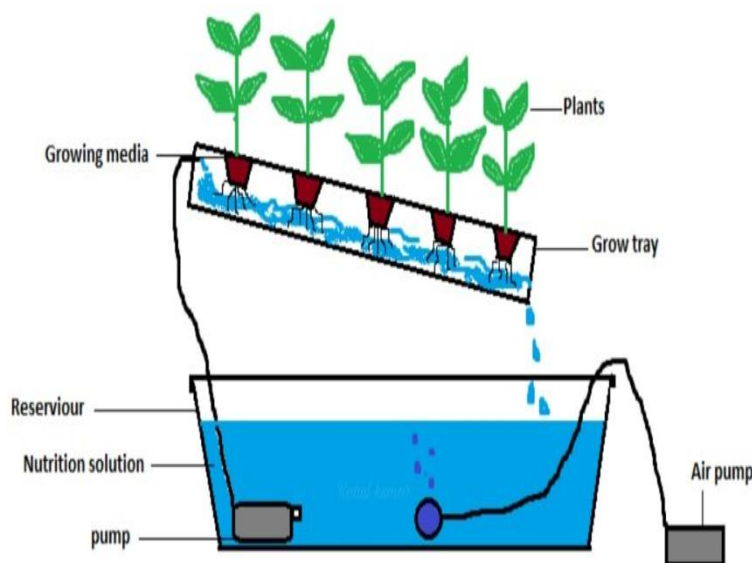
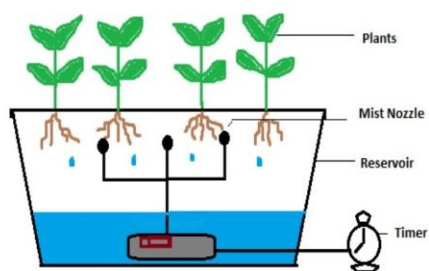
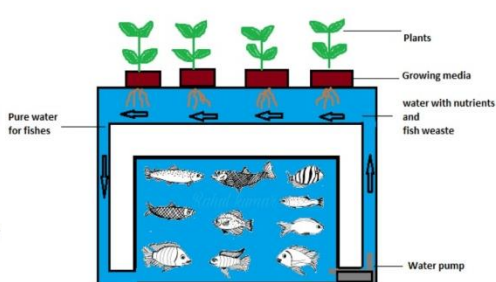


Fig:7 NFT Hydroponic system

Aquaponics- Aquaponics is the latest technique used in hydroponics in which plants are grown with aquaculture. The nutrient-rich wastewater from the fish tank is used as a nutrient solution. The nitrogenous ammonia waste is converted into nitrate by beneficial bacteria naturally occurring in water uptake by plants and on the other hand, plants are used as a water purifier for fishes

Aeroponic- In this system plant's roots are constantly connected with nutrient solution mist. This system included a frame designed with each side boards. Plant plugs are set on both sides with large-diameter Polyvinyl chloride pipe. It is unique and complicated.


Fig:8 Aeroponic system

Fig:9 Aquaponic system

Growing media –In hydroponics the growing media is used as soil to support the plants in the nutrient solution. Growing media absorbed the nutrient solution for plants. In soil, the plant's roots need to work hard for reaching nutrition but in hydroponics, the plant's roots do not need to work hard. Growing media are that substrate that provide the mechanical support to plants and moisturized their roots. The growing mediums we can use in hydroponics are as follows –Rockwool, Coco-fiber, Cocopeat, Perlite, Vermiculite, Rice husk, Clay ball, Growing stone, Sand, Gravels, Wood fibers, Sheep wool, Polystyrene, Pine bark

Crop selection- It is important to select a better crop for a suitable hydroponics system. Most of the vegetable herbs are grown in the hydroponics solution. The major difference between hydroponics and field growers is the quality of product and their yield. In the hydroponics system, premium-quality crops are grown. Following is the list of plants that can be advised for hydroponic solutions for commercial purposes.

Table1. List of crops that can be grown on a commercial level using soil-less culture

Types of crops	Name of the plants
Cereals	<i>Oryza sativa</i> (Rice), <i>Zea mays</i> (Maize)
Fruits	<i>Fragaria ananassa</i> (Strawberry)
Vegetables	<i>Lycopersicon esculentum</i> (Tomato), <i>Allium cepa</i> (Onion), <i>Raphanus sativa</i> (Radish), <i>Capsicum frutescens</i> (Chilli), <i>Beta vulgaris</i> (Beetroot), <i>Solanum melongena</i> (Eggplant), <i>Cucumis sativus</i> (Cucumbers), <i>Cucumis melo</i> (Melons), <i>Capsicum annum</i> (Bell pepper), <i>Phaseolus vulgaris</i> (Green bean).
Leafy Vegetables	<i>Lactuca sativa</i> (Lettuce), <i>Ipomoea aquatica</i> (kang kong), <i>Brassica oleracea var. capitata</i> (Cabbage), <i>Brassica oleracea var. botrytis</i> (Cauliflower).
Condiments	<i>Mentha spicata</i> (Mint), <i>Ocimum basilicum</i> (Sweet basil), <i>Petroselinum crispum</i> (Parsley), <i>Origanum vulgare</i> (Oregano).
Flowers and Ornamental plants	<i>Tagetes petula</i> (Merigold), <i>Dianthus caryophyllus</i> (Carnations), <i>Rosa indica</i> (Roses), <i>Chrysanthemum indicum</i> (Chysanthemum).
Medicinal crops	<i>Aloe vera</i> (Indian Aloe), <i>Solenostemon scutellarioides</i> (Coelus).
Fodder crops	<i>Sorghum bicolor</i> (Sorghum), <i>Hordeum vulgare</i> (Barley), <i>Cynodon dactylon</i> (Bermuda grass), <i>Medicago sativa</i> (Alphalfa), <i>Axonopus Compressus</i> (Carpet grass).

Table :1 Showing plants list suitable in Hydroponic culture

Conclusion-

According to the result, different types of hydroponic system affected the plant's growth. There are lots of benefits of the hydroponic system over the traditional soil system. The first benefit is that nutrition comes in direct contact with the plant's roots through nutrients solution that's why plants root does not do extra work for reaching the nutrient as in soil. In the hydroponic system, water is also conserved and the same water is recirculated in the hydroponic system that's why the chances of loss of water by evaporation are very less. Soil-born diseases in Chickpea by various causal organisms are also reduced. In the soil system, various weeds are dispersed by their seeds in the soil field, and these weeds after germinating in the soil field absorb all the essential nutrients from the soil that's why weedicides are used but in hydroponic, there is no need to remove and no need of herbicides. In the present study, we see that the plant's growth is higher in hydroponic. The plant's size, quantity, and quality of crops are also remarkably better. A higher yield can be obtained within a short period. Large numbers and quantities of biomass of plants can also be produced using the hydroponic technique. We can use better of our growing space and 60-70 plants can be grown per M² area. There is no need to carry the heavy soil. The soil is replaced by growing media which is used as supporting media in hydroponic like cocopeat is light and reusable. The major benefit of hydroponics is that we can grow plants according to our needs in extreme conditions whereas ground soil is less for crop cultivation hydroponic system is very much beneficial over traditional soil systems if we use it in suitable environmental conditions. The hydroponic system is a good alternative for urban farmers and urban home gardeners who face the problem of handling ground soil.

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