Hydroponics as the advanced technique for tomato cultivation using NFT system: An Overview

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Abstract

Agriculture plays a critical role in a country's economy and in meeting people's food needs. Farming has become a major challenge in recent years as land availability has decreased as a result of increased urbanisation. The loss of natural fertility and poor soil fertility as a result of continuous cultivation are major issues in agriculture. Many new technologies have emerged to address these issues. One of the techniques is hydroponics. The cultivation of tomatoes using the NFT system has been discussed in this paper. This paper discussed the installation process, growth monitoring, and the use of various nutrients to increase yield. If you have a small backyard, you will need a minimum amount of space to install the system.

Keywords*: Hydroponics, NFT, Micronutrients and Macronutrients*

1.Introduction

Hydroponics is a method of growing plants in which the plant roots are supported mechanically by nutrient solutions (water and fertilisers) with or without the use of an artificial medium (e.g., sand, gravel, rock wool, clay balls) similar to soil. There is no other supporting medium for the plant roots in liquid hydroponics systems; aggregate systems have a solid medium. Hydroponics systems are classified as either open systems, in which the nutrient solutions are not reused after reaching the plant roots, or closed systems, in which the nutrient solution is recovered and recycled (NFT). Hydroponics is a method of growing plants in which the plant roots are supported mechanically by nutrient solutions (water and fertilisers) with or without the use of an artificial medium (e.g., sand, gravel, rock wool, clay balls) similar to soil. There is no other supporting medium for the plant roots in liquid hydroponics systems; aggregate systems have a solid medium. Hydroponics systems are classified as either open systems, in which the nutrient solutions are not reused after reaching the plant roots, or closed systems, in which the nutrient solution is recovered and recycled (NFT).

Hydroponic tomatoes are grown in a nutrient solution rather than soil, and their roots are supported by a non-soil material. Growing tomatoes hydroponically allows the grower to raise them in a controlled environment with a lower risk of disease, faster plant growth, and higher crop yield.

1.1 Different Techniques in Hydroponics:

These days, a variety of hydroponic/soil-less culture techniques are available. However, when choosing a technique, the following factors must be taken into account:

1. Space availability
2. Expected productivity
3. Availability of suitable growing medium
4. Expected quality of the produce colour, appearance, free from pesticides, etc.

2.Tomato

Tomato is a member of the Solanaceae family. It is one of India's most popular vegetables. It's commonly used in salads and a variety of other dishes, as well as for culinary purposes. Tomatoes and tomato products are becoming increasingly popular due to their high vitamin A and C content. As a result, when compared to other vegetables, the requirement level is also high.

2.1 Nutritional Facts of Tomato:

Talking about tomato in particular yes it is possible to improve taste by using higher strength hydroponics solution. The main purpose of hydroponics is to produce highly nutritional products compared to conventional techniques. Through sophisticated process in the hydroponics greenhouses, not only push more nutrients into the plants and produce but also increases the strength of solution inside the plants, consequently raising the strength of other beneficial compounds such as sugar, organic acids and vitamins. A well grown hydroponics tomato does have a finer taste and nutrition benefit compared to those by other methods.

1.Primary source of lycopene
2. Low fat
3. Low calorie
4.Cholesterol free
5.High in vitamin A
6 High in vitamin C
7 Good source of potassium
8 Very low sodium

3.Materials:

You'll need high-quality hydroponic materials if you want to set up a hydroponic system. You can create a powerful hydroponic system for the growth of a clean and nutritious yield by using the right material.

Hydroponic germination cubes are extremely important in most hydroponic systems. Additionally, spectrum-controlled lights or fluorescent lights are essential for providing artificial light. Even though the yield is grown indoors, a certain amount of light is required, and the lighting system in hydroponic systems must be suitable for cultivation. Greentech manufactures high-end hydroponic materials such as hydroponic germination cubes and nutrition suppliers for hydroponic systems. Please contact our team to purchase the best hydroponic materials if you want to set up a productive hydroponic system.

- NFT (nutrient film technique) channel
- Submersible motor
- Net pots
- Clay pebbles
- Reservoir

- Nutrients
- End caps

3.1 Methodology:

While there are several methods for growing plants hydroponically, NFT is the only one that requires a continuous flow of liquid to feed the plants, with the plants' roots dangling down into the stream as if they were dipping their toes in a stream as it flows by.This may sound fancy, but actually it is not a particularly difficult hydroponic system to put into practice, and after learning a few basic principles NFT hydroponics is relatively simple to set up and to maintain.

3.2 Assembly of NFT system:

While much depends on your growing environment and how you set up your NFT system. If there is enough space, plants can grow around every part of the system. This means you'll need access to the structure from both sides and ends.Selecting the location

- Setting the channel
- Preparing the NFT reservoir
- Prepare seedlings for transplanting to an NFT system
- Choosing the right NFT water pump
- Assembling all the things

Fig 1: NFT channels on Iron racks

It's crucial to pick the right location. Temperature, light availability, and humidity are all influenced by the location where the hydroponics system will be installed. The setup of the NFT channels is the first step in the process. Drill holes in the PVC pipes to the desired length. Depending on the type of plant, the distance between each hole should be 6-8 inches. Then, as shown in Figure 1, keep these NFT channels on the frame.

Place the net pots in the NFT channels' drilled holes. Clay balls are placed in net pots to hold the seedling. The entire system is linked to a reservoir located at the base of the hydroponic system. Pipes are connected to the end caps to pump water from the reservoir to the NFT channels.

4.Seedlings:

It is preferable to use tomato seeds rather than seedlings. Because there is a higher risk of contamination when plants are brought directly from the nursery. From seed to seedling, tomato seedlings take about 10-14 days to germinate. Rockwool germinates them better than any other medium. The seedlings are transplanted to the hydroponic system after they have germinated from seed. From the seedling stage to the growing stage, it takes 4-6 weeks. Then it takes another two weeks to get from the growing stage to the flowering stage. It takes two months to obtain the fruit.

5.Nutrients Requirement:

Nitrogen, Phosphorous, and Potassium are the three most important nutrients for any plant. The required Nitrogen level for tomato, on the other hand, is lower. Micronutrients such as boron, carbon, molybdenum, manganese, and calcium are required. To avoid plant damage, nutrients should be given in proper proportions. The nutrients should be measured in parts per million (ppm) or milligrammes per litre (mg/lit). Nutrient deficiencies can have a variety of negative effects on plants, as well as a negative impact on the crop's fruit yield. Nutrient absorption is hampered when pH levels are too high. Excessive absorption is possible when pH levels are too low.

Nutrient	Element	Tissue Nutrient Level
Nitrogen	N	3.5-4%
Phosphorous	P	0.8-1%
Potassium	K	2-3%
Calcium	Ca	2.5-3%
Magnesium	Mg	0.5-0.9%
Sulphur	S	0.3-1.2%
Manganese	Mn	40-500ppm
Zinc	Zn	20-50ppm
Boron	B	25-75ppm
Copper	Cu	5-20ppm

Table: Nutrient requirement for tomato

Results and Discussions:

We've had the system up and running for two weeks now. Plants show signs of visible development. Growth can be aided by the addition of nutrients at various levels. Sulfur, potassium, nitrogen, and carbon are macronutrients required by tomatoes, while boron, molybdenum, zinc, and copper are micronutrients. If the amount of direct sunlight available is insufficient, more light must be provided. To avoid water contamination, the PH should be checked on a regular basis. If the pH is higher than the recommended level, acids should be added.

Fig 2: NFT Channels on iron frame

Fig 3: Transplanted seedlings

Discussion:

By incorporating automated technologies into this hydroponic system, it can be further developed. When compared to traditional farming techniques, the yield can also be increased. One of the most important factors in the success of a hydroponic experiment is the health of the seedlings used. Instruments, seeds, and culture media must all be sterilised to reduce the risk of contamination and give the plants a good start before they are transplanted into the hydroponic system.

Conclusion:

In recent years, hydroponics has been viewed as a promising method for growing a variety of crops. Because it is possible to grow short-term crops like vegetables all year in small spaces with little labour, hydroponics can make a significant contribution in areas where soil and water are scarce, as well as for the poor and landless. The hydroponic industry in India is expected to explode in the near future. It is critical to develop low-cost hydroponic technologies that reduce reliance on human labour and lower overall start up and operational costs in order to encourage commercial hydroponic farms. Furthermore, this technique can aid in the protection of plants from diseases caused by soil-borne pathogens. Hydroponics has also been shown to increase production yield when all parameters are managed correctly. Tomatoes are a common ingredient in Indian cooking. Production can be increased with the use of new technologies such as hydroponics

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