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Recent trends hydroponics with special reference to Nutrient Film Technique

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Abstract

Hydroponics is a frequently used technique for growing plants in mineral nutrient mix solution without soil, providing for a considerable degree of mechanical support. Hydroponics cultivation is very effective in growing good quality products without getting affected by soil borne diseases. In soil-less/hydroponic the roots of plants are immersed in mineral nutrient solution to provide the entire essential nutrients which are required by plant to grow good. Hydroponics was derived from the Greek word's hydro' means water and ponos' means labour and confers water work. Various commercial and specialty crops can be grown using hydroponics with specifically utilizing Nutrient Film Technique including leafy vegetables, tomatoes, cucumbers, peppers, strawberries, with great advancements. Most hydroponic systems operate automatically to control the amount of water, nutrients and photoperiod based on the requirements of different plants and hence efficient for sustainable manner of high-quality vegetable production.

Keywords: Hydroponics, Nutrient Film Technique, soil-less, Photoperiod.

Introduction

Hydroponics is a method which stands up for the production of various high value vegetables crops such as tomato, lettuce, sweet-pepper and various medicinal plants (Makhadmeh et al 2017;Al-Ajmi et al 2008; Al-Tawaha et al 2016) Hydroponics is technique to cultivate quality food crops utilizing nutrient mixture with or without using substrate (Al-Tawaha et al 2016). The growing nature and intensive high-tech agriculture is encouraged by its high demand in the areas of water scarcity and also due to the high production and good quality food crops (Domingues et al 2012). The greatest advantage of the soilless cultivation is its nature as it can be practiced at any time of the year for many crops, reduces labour requirements, uniform plant production, reduction in the area required for production, rapid economic return, and high-quality products. The manipulation and establish the system requires skill, experience and financial investment to full fill the demand of green house (Kaiser and Ernst 2012). The factors like time of the day, plant height, plant size and season create impact on HP crops such

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as lettuce production (Gent 2011; Makhadmeh et al 2017). Hydroponics consists of general four different growing systems such as nutrient film technique (NFT), deep flow technique (DFT), dynamic root floating technique (DRFT) and substrate culture (Chairin et al 2017). Besides all NFT is the most commonly used method to grow green leafy vegetables as reported (Jones 2005)

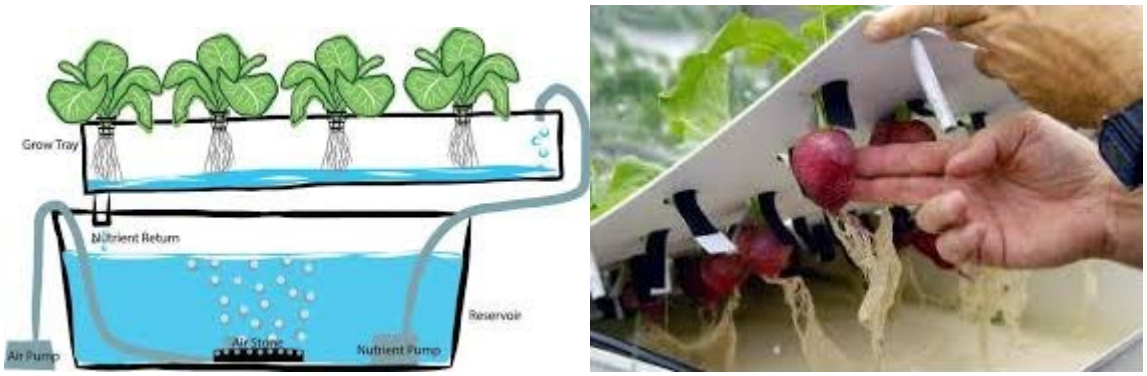


Fig. 1 Nutrient Film technique system under circulated method.

Nutrient Film Technique, or NFT, comes under closed/circulating method, is a popular and versatile hydroponics system. This system uses a pump to deliver fertilized water to the grow tray and a drainpipe to recycle the unused nutrient solution shown in Figure 1. The difference is that in NFT the nutrient solution is continuously flowing over the roots (Sharma et al 2018). Gravity is used to do this. The grow tray is angled to allow water to flow down towards the drainpipe, and a new solution is fed into the tube's high end on a regular basis. NFT is an active system, which means it works with moving parts. The nutritional solution spreads in a thin layer over the roots, watering and feeding them without totally soaking them. The thin coating keeps the upper section of the roots dry and allows them to get oxygen from the air (Domingues et al 2012; Sharma et al 2018).

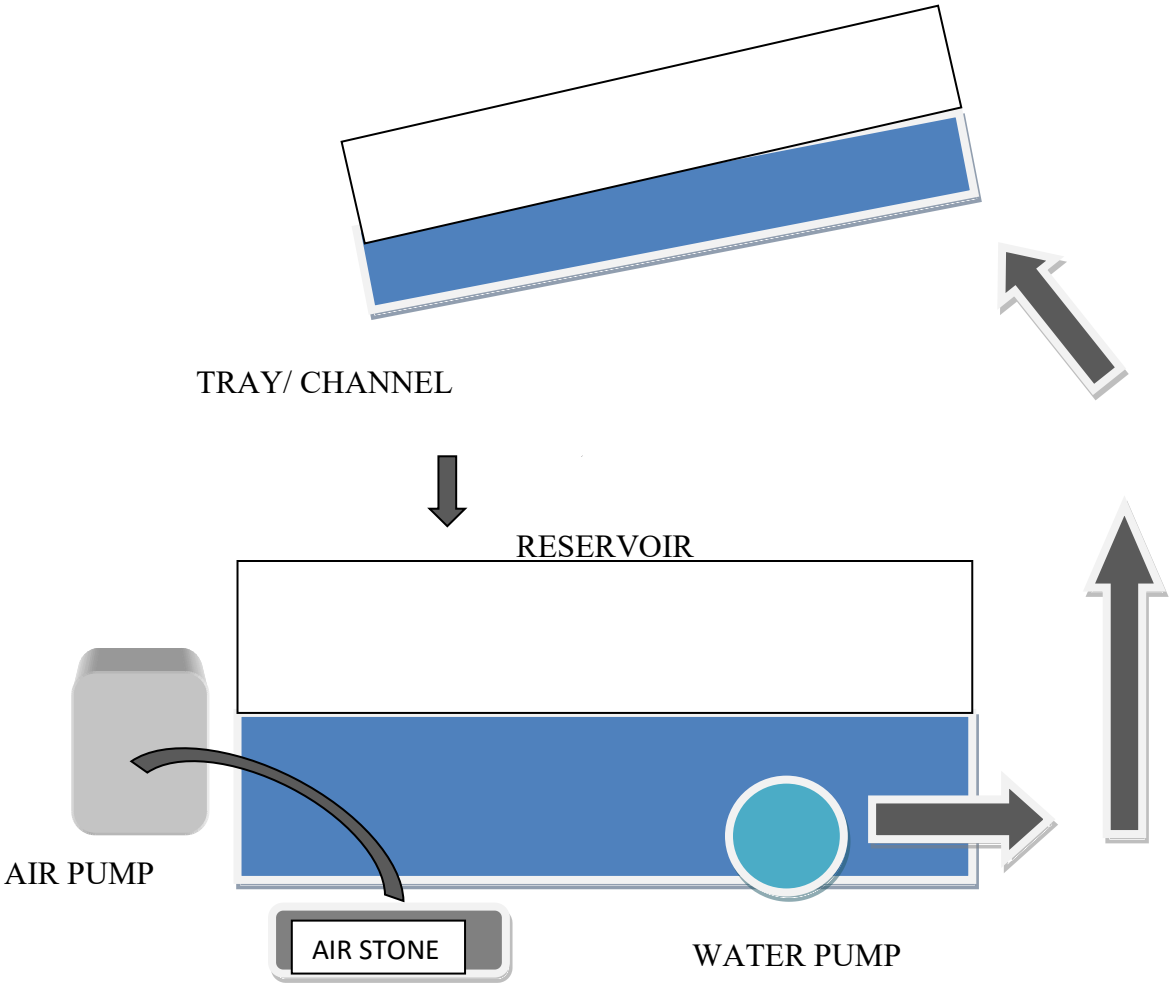
The main principle of the NFT is the principle by which nutrient solutions are re-circulated for crop production. The system is widely adjusted for a variety of crop production and is ideal for short term crops such as lettuce, leafy crops and herbs. Also, Larger NFT systems are used for long term crop production such as cucumbers and tomatoes. Economically hydroponic is very attractive and with such outstanding results it is ideal for protection of degradation of natural resources which makes the culture efficient (Manzocco et al 2011).

Beside traditional soil-based production systems, whether in open-field conditions or under protection structures (i.e., greenhouses or tunnels)

vegetables are cultivated also in soilless systems (i.e., hydroponics or aquaponics systems). Whereas, pictorial mechanism of working of NFT is described in **Figure.2.**

Fig. 2 *Mechanism in NFT consists of a re-circulating system is used in which a reservoir is containing all the essential nutrient which is required by plant will pumped up through the plumbing via water pump to gently flow into the top of tray/channel to travel over the root system of the plant and then drain back into the reservoir. Air pump is used to aerate the reservoir via an air stone.*

Mechanism: -



Nutrient film technology in conscience with advancements and efforts:

The technique NFT is not only restricted to the cultivation of lettuce but potato, garlic, cucumber, strawberry and beans etc. (Wheeler et al 1990; Resh 2013). Efforts have been made in

terms of intercropping such as growing of lettuce with tomato in hydroponics and aquaponics. (Al-Tawaha et al 2017) There are some crops like loose leaf, butter-head, and romaine (cos) are preferred to be hydroponically cultivated (Kaiser and Ernst 2012). Lettuce (*Lactuca sativa* L.) is most consumed leafy vegetables around the world. in Asia, North and Central reported that lettuce can be intercropped with other crops such as tomato in hydroponics and aquaponics. Furthermore, Hydroponics suitable for the production of lettuce (*Lactuca sativa* L.) As there is increased crop biomass production. Under HPS, many experiments were conducted for maximizing the yield of lettuce growing in NFT system. The objective of this study it is to evaluate the growth characteristics and the marketable yield of lettuce under different water flow rates in NFT conditions. (Tawaha et al 2018).

To avoid yield, lose with continued recycling of nutrient solution and continuous flow is maintained in Nutrient Film Technique in which flow is controlled (Zekki et al 1996). Various cultivars are grown under both open and close HPS to check which suites the best. After the quality and yield analysis in closed systems proven to be having the upper hand with better fruit cracking as reported (Maboko et al 2011).The various advanced systems of NFT are developed in which comparison have been done in terms of yield components and various quality parameters including nutrient management with advanced approaches using closed system hydroponics (Cho et al 2018). Various studies are reported in Lettuce. The comparison was also done with pepper by various researchers to find out the plant population its growth pattern and yield with respect to parameters. The combination analysis was done in hydroponics system using substrates viz. (vermiculite + sand, Peat + perlite, rock wool). In which, peat and perlite got maximum yield and growth (Majdi et al 2012). Besides the number of circulations and rate of flow observed to affect the nutrient concentration and absorption significantly while evaluating the in-vitro plant growth system (Hoang et al 2019). For the determination of rate of flow of nutrient solution was evaluated in context of identify its relationship with respect to growth and for its optimization, the HPS required proper design to get good contractibility of root and nutrition flow for nutrition absorption. Also, there are some hamper factors which effects it's efficiency. Viz beside tomato and pepper, cantaloupes also grown well in HPS. There are various studies described the relation of soil and water salinity effect on plant quality parameters and growth attributes including its effect on other attributes such as number of leaves, plant fresh weight, fresh weight of shoot, shoot dry matter percentage of shoot, fresh weight and dry weight of root dry weight, root dry weight percentage, leaf area and leaf area index, while

shoot and root water contents percentage, ratio of the shoot to root fresh weight and ratio of the shoot to root dry weight (Manzocco et al 2011; Costan et al 2020). The novelty adapted in the protocol i.e. utilization of Quartz porphyry (QP) i.e. treated solution consisting of substances that improves quality of water and outcomes showed the better and uniform growth of plants due to QP as it balances ion exchange (Azad et al 2009) Whereas. For many vegetables research was conducted, and variable parameters were tested viz. Nutrient content, pH, EC, oxygen exposure and algae growth. The stress was given upon the development of a designed model hydroponic greenhouse system to stimulate the hydroponic lettuce and celery production with shade covering of luscious green trees to test the economic feasibility of such a highly advanced growing operation. The various findings resulted suggested the governance of proper testing of pH and EC the nutrient content can be assessed efficiently in order to produce maximum growth in vegetables and fruits (Zang et al 2016).

Besides having great deal of scope and application in smart agriculture, the Nutrient film technology is like any other non-conventional approach of agriculture which has its own demerits such as contamination due to accumulation of heavy metals and polluting water bodies Remedial, measures points towards rhizofilteration that involves the removal of pollutants using plant root systems. But greater scope has been estimated for the assessment of removing pollutants and understanding the accumulation of heavy metals in root systems and its effects on plant. Various experiments have been done to estimate and understand utilization of different concentrations of lead in NFT system with recycling system of nutrient medium. The results conferred in the studies that accumulation is more in medicinal plants and restricting the accumulation from moving to upper parts other than roots of plants, which obviously considered as most efficient pollutant removers.

Conclusion: The utilization of hydroponics is great where demand of quality is more and to meet the food demand of increasing population requirement of non-conventional approaches is the urge of situation. The application parts include the better utilization of resources spatially and technically as various biotic and abiotic stresses act upon plant. Whereas, quality is assured in hydroponically cultivated crops. The advantages are not restricted to its better nutrition quality maintenance but also significant decline in residual effect as minimal use of herbicide and other chemicals to arrest insect-pest attack is there in hydroponics. The issues addressed as per the need of hour and climate change is one above all. The ease generated in terms of uncertain climate change can be mitigated utilizing hydroponics farming system.

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