Journal of Horticulture
ISSN: 2376-0354

Extended Abstract

Strawberry: A wonder crop suitable for Hydroponics

Nanhe Lal Saroj[1*], Shubham Singh[2], Shatrunjay Yadav[3]

[1*] *Assam Agriculture University, India*

[2] *ICAR-Indian Agricultural Research Institute, India*

[3] *Babasaheb Bhimrao Ambedkar University, India*

Abstract

The technology hydroponics and aeroponics plays very crucial role in 21st century in soilless culture in commercial food production. In this technology natural media is helpful to grow the plants. The main principle involving the use of sprayers, nebulizers, foggers to create a fine mist of solution of deliver nutrients to plants roots. Plant roots are suspended above a reservoir of nutrient solution or inside a channel connected to a reservoir. Currently hydroponic cultivation is gaining popularity all over the world because of efficient resources management and quality food production.

Keywords: Hydroponics, strawberry, soil-less culture, Growing media, Nutrient film techniques (NFT).

Introduction

Soil based agriculture is now facing various challenges such as urbanization, natural disaster, climate change, indiscriminate use of chemicals and pesticides which is depleting the land fertility. Various hydroponic structures viz. wick, ebb and flow, drip, deep water culture and Nutrient Film Technique (NFT) systems; crops like tomato, cucumber, bell pepper, strawberry and leafy greens and water conservation by this technique have been grown successfully.

Several benefits of this technique are less growing time of crops than conventional growing; round the year production; minimal disease and pest incidence and weeding, spraying, watering etc, can be eliminated. Commercially NFT technique has been used throughout the world for successful production of leafy as well as other vegetables with 70 to 90% savings of water. Leading countries in hydroponic technology are Netherland, Australia, France, England, Israel, Canada and USA. For successful implementation of commercial hydroponic technology, it is important to develop low cost techniques which are easy to operate and maintain; requires less labour and lower overall setup and operational cost.

History of soilless culture

Origin of soilless culture methods Although soilless cultivation technology came into existence since ancient times, the first known publication was in 1627 by Francis Bacon in his book *Sylva Sylvarum*. In 1699, experiments on soilless culture (water culture) of spearmint were reported by John Woodward. Soilless culture gained its popularity in the 20th century when W. F. G. Berkeley (1929) used solution culture for production of agricultural crop. He also introduced the term hydroponics in 1937 from Greek words 'hydro' = 'water', and 'ponos' = 'labour' meaning culture of plants in water. A preliminary success of hydroponics culture was identified on Wake Island, where this technique was utilized for growing vegetables for travelers. W. J. S. Duglas during 1946 started hydroponics in India and established a laboratory in Kalimpong area, West Bengal and also wrote a book on *Hydroponics The Bengal System*. In India, crops such as potato, tomato, green bean, carrot, cucumber, etc. were successfully grown by soilless culture. NASA has recently developed controlled ecological life support system (CELSS) based on extensive hydroponic research historical steps of soilless agriculture as it was remembered in introduction, soilless agriculture was used and recorded in several ancient civilizations but no information was recorded about it. However, the earliest published work on growing terrestrial plants without soil was the 1627 book, Sylva Sylvarum by Sir Francis Bacon, father of the scientific method, which he nominated it "water culture". However, Robert Boyle, the Irish scientist, in 1666 had been described the first experiments on growing plants with their roots submerged in water. In 1699, John Woodward published his water culture experiments with spearmint and found that plants in less-pure water sources grew better than plants in distilled water. Mineral nutrient solutions for

Journal of Horticulture
ISSN: 2376-0354
Extended Abstract

soilless culture of plants were first perfected in the 1860s by the German botanists, Julius von Sachs and Wilhelm Knop through experiments conducted at 1842 and 1895 respectively. The first proposal for a commercial water culture system was made in 1929 by Professor William Frederick Gericke of the University of California at Berkeley. The term "hydroponics" was coined by Gericke 1937 to describe the growing of crops with their roots in a liquid medium. Moreover, in 1940 Gericke wrote the book, Complete Guide to Soilless Gardening The technology was first reported in scientific literature in 1600 (Weir, 1991).

Strawberry: A wonder crop for Hydroponics culture

The cultivated Strawberry (*Fragria* X *ananassa* Duch.) is one of the most important soft fruits of the world. It belongs to the family *Rosaceae* and has resulted from a cross between two wild strawberries: *faragaria virginiana* (Meadew strawberry) *fragaria chileonsis* (Chilean strawberry). It is a short, low growing herbaceous plant propagated through runners and all the cultivated varieties are octoploid (2n= 8x = 56). Strawberry cultivation gives good returns in the shortest possible time and is highly adapted in varied agro-climatic conditions. Widely grown under protected and open conditions in temperate and subtropical countries with maximum temperature of 22 ^{0}C to 25^{0}C in day and 7 ^{0}C to 13 ^{0}C at night. Hydroponics is perhaps the most intensive method of crop production in today is agricultural industry (Jensen, 2008). A hydroponics growing system for strawberry is represented (fig no-1). It uses advanced technology, is highly productive, conserve water and land, protects the environment and is often capital intensive of soil.

The main problems arising from the soil are the presence of soil-borne pathogens at the start of the crop and the decline of soil structure and fertility due to its continual cultivation for the same or a related crop species. Horticultural production in most countries, especially in summers extremely difficult due to high rate of infection by the soil-borne diseases. Large-scale production of flowers and fruit crop especially in open fields in hindered by attacks by soil-borne diseases. Hydroponics has proved to be an excellent alternative to soil sterilization, especially in view of the fact that the use of chemical soil sterilant, as methyl bromide, are or will be forbidden in many countries, due to their high toxicity and their adverse effects on environment. Moreover, the cultivation of greenhouse crops and the achievement of high yield and good quality is possible with hydroponics even in saline or sodic soil, or non-arable soils with poor structure, which represent a major proportion of cultivation land throughout the world. Hydroponics is a technology for growing plants in nutrient solutions (water and fertilizers), with or without the use of artificial medium (e.g. sand, gravel, vermiculite, rockwool, peat moss, sawdust) to provide mechanical support.

Liquid hydroponics systems have no other supporting medium for the plant roots; aggregate systems have a solid medium of support. Performance of strawberry at fruiting stage in hydroponics is represented (fig No-2). Hydroponic systems are further categorized as open i.e., surplus solution is recovered, replenished, and recycled (Jensen, 1997). Vertical farming (VF) can be judged as an extended form of indoor farming, which is exercised in multistoried buildings of urban or peri-urban areas. **Mr. Gilbert** discussed the utopian concept of vertical farming and introduced the notion of underground vertical farming; presently followed in Netherlands. The concept facilitates the cultivation of fruits, vegetables, medicinal, fuel producing plants and other plants in vertical stacks in cities where the shortage of arable land strips is the major cause of concern. VF also assists to reduce transportation cost, cuts the emission of greenhouse gases and utilizes small tracts of land efficiently and further, it promotes the reduction in food prices and the consumers may get fresh fruits and vegetables at their door step in mega cities. Vertical farming includes Indoor farming is an open secret and the concept is greenhouse-based farming has been in practice for years and various herbs, food plants, such as strawberries, raspberry tomatoes, cucumbers, Gerbera, Rose, Orchid, Anthurium, Marigold, Carnation, Chrysanthemum, Lily etc. (Kumar 2019).

Basic Components of Hydroponics

Growing chamber (tray), Reservoir, Submersible pumps, Delivery tubes, Aerators or air pumps, Grow Lights etc.

Seedling Raising for Soilless Culture Requirement

- Protected structure
- High yielding hybrid varieties
- Soilless media

- Multicelled plastic plug-trays
- Fertigation system

The various elements required for plant growth in Hydroponics system

Certainly, about 160 years ago scientists determined that ten elements were required for plant growth. Three of these ten were provided by air and water: carbon (C), hydrogen (H) and oxygen (O). The others, nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S) and iron (Fe) were obtained by plants from the soil or other growing medium. Six additional elements have been determined essential for plant growth: manganese (Mn), zinc (Zn), copper (Cu), boron (B), molybdenum (Mb) and chlorine (C1). These six also are generally supplied through the growing medium. Contains all of these elements.

Soilless Culture Media or Growing Media

1. **Organic media-** Sawdust, Cocopeat, Peat, Woodchips, Pleece, Marc, Composted and Aged Pine Bark
2. **2. Inorganic media**

(I-) Natural media- Vermiculite, Gravel, Rockwool, Perlite, Sand, Glasswool **,** Pumice, Zeolite, Sepiolite

(II-)Synthetic media - Hydrogel, Floral Foam mates (Polyurethane), Oasis (Plastic foam)

Conclusion:

Progress has been rapid and results obtained in various countries have proved that this technology is thoroughly practical and has very definite advantages over convention methods of crop production. The main advantages of soil-less cultivation are the much higher crop yields people living in crowded city streets, without gardens, can grow fresh vegetables and Soilless cultures consider as a new developed technique for agriculture development but it is not simple technique.

However, there is lack of technical background of the new technique among growers and horticulturists in many countries and well trained employs are needed. Moreover, most substrates are internationally markets, so they are expensive. Therefore, it is better to look locally about not expensive good substrates. The growers can adept the soilless systems according to their needs, the place of the system and according to their potential cash. The system in any case need to take strong care and observation for the parameters needed for the good growth of the plants such as nutrient concentrations, light, oxygen around the plants root zone, water quality, pH, disinfection, temperature of the solution and more. In conclusion, one might say that, there is extensive advance has been made as of late in the improvement of monetarily suitable soilless systems and there is a generally wide business applications now in Countries that applied farming innovations.

References:

1. Bagale, K. V. The effect of electrical conductivity on growth and development of strawberries grown in deep tank hydroponic systems, a physiological study. J Pharmacogn Phytochem. 2018; 7, 1939-1944.

2. Linsley-Noakes, G., Wilken, L., and de Villiers, S. High density, vertical hydroponics growing system for strawberries. In V International Strawberry Symposium. 2004; 708: 365-370).

3. Caso, C., Chang, M., and Rodríguez-Delfín, A. Effect of the growing media on the strawberry production in column system. In International Symposium on Soilless Culture and Hydroponics. 2008; 843:373-380.