Suresh Gyan Vihar University International Journal of Environment, Science and Technology
Volume 5, Issue 2, July 2019, pp. 19-26

IMPACT OF HYDROPONICS: PRESENT AND FUTURE PERSPECTIVE FOR FARMER'S WELFARE

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Abstract
The soil less culture also known as hydroponics (aquaponics). It is the cultivation of plants in a liquid usually water with or without the use of artificial media (nutrient media). It will give growth to the plants under controlled atmosphere. In the last few years due to the avoidance of methyl bromide in the soil culture the hydroponic system has emerged. There are many advantages of growing plants under hydroponics compare to soil culture. There is no soil borne diseases, soil pest attack to the hydroponic cultivated plants. It also helps in temperature control; reduce evaporative water loss and protection against changing weather. The root and shoot length were significantly retarded due to the concentration of polluted water and duration of the plant exposure to it. In the future, hydroponics could be emerging techniques for the supplying of food to the world wide population.

Keywords: Hydroponics, Nutrient media, soil less culture, controlled atmosphere.

Introduction

As the world wide population continues to grow, the challenge is to produce more amount of food; due to this to maintain the sustainability the new modern technologies were introduced. In 2015, United state assumed that the world population will grow to 9.6 billion by 2050 and 70% of people

will live in the urban areas. More than 70% food is needed but 80% land is already in use for cultivation practices. Due to the development of human and social behavior the traditional method of cultivating crops facing the serious problem, Soil is the growing medium for the plant till the human being knows how to do cultivation in the land, soil losses its fertility due to the continuous cultivation of crops in the same method by applying the heavy dosage of inorganic fertilizers and pesticides to the soil (Raviv et al., 2002). Soil borne diseases also the serious problem for the cultivation of plants in the soil. In 1900 the world population is around 3 billion, during that time per capita land is 0.16 ha. By 2050 it was reduced in to 0.6 ha. To overcome these problems the new technique hydroponics has been introduced. According to Beibel et. al., (1960), the term hydroponics was derived from Greek word "hydro" and "ponos" which means "water" and "labour" respectively. John Woodward an English scientist is known as the father of our present day hydroponic system. In India the hydroponic system was developed in the year 1946 by an English scientist W.J. ShaltoDuglas. In Kalimpang, West Bengal he established a hydroponic laboratory for the first time. Countries like Abu Dhabi, Arizona, Holland, Iran, Italy, California, Belgium, Japan, Russia, Denmark; German they commercialized hydroponics in the year 1960 to 1970. In hydroponics system almost any terrestrial plant can be cultivated.

Review of literature

Different methods of hydroponics

There are many number of hydroponic techniques are used now-a-days, following are the certain factors to be considered for selecting the techniques, **1.** Available resources, **2.** Space, **3.** Expected productivity, **4.** Growing media, **5.** Quality of the product. Plant roots are suspended directly in a nutrient solution, it is also known as "liquid hydroponics". It consists of two methods. One is circulating method in which the continuous flow of liquid in the plant culture and the another method is the non-circulating method in which the same water is applied again and again. Circulating method includes Nutrient Film Technique [NFT], Deep Flow Technique [DFT]. Non circulating method includes root dipping technique, floating technique, capillary action technique. In NFT and DFT supplies a consistent nutrient environment for plant roots. These techniques are controlled automatically through machines. If solution flows stops its leads to the rapid plant

desiccation, so care should be taken frequently. But in non-circulating technique the process can easily carried out.

Different types of media culture

The most important thing in this hydroponic system is that what kind of media has been used for the plants. If nutrient media fails then the plant will not grow properly. There are different media are available in the market like sand culture, gravel or rock wool cultures are some examples of the nutrient media. Sub- irrigation and top-irrigation are the two main variations of those media.

Table 1: Different types of media culture

Problems	Soil based culture	Soil less culture (hydroponics)	References
Usage of land and its external effect	Limitation of different soil types Changing external environment affects the crop growth	Soil and external factors causes minimum affect to the plant Temperature, humidity, lightning time of the environment can be controlled.	Gibeaut et. al., (1997); Jones (1997); Noren et. al., (2004); Norstrom et. al., (2004)
Water	Water used for irrigation cannot be recycled or reused. Scarcity of water usage. Water holding capacity of the soil cannot be easily controlled. There may be a loss of nutrients in the soil due to run-off	Water used for irrigation can be recycled or reused. Sufficient water usage. Water holding capacity can be easily maintained by using different media. There is no loss of nutrients due to run-off in the culture media.	Midmore and Deng-lin (1989)

Nutrient solutions and fertilizers	There is no equal distribution of fertilizer in the land. There may be a more chance of excessive use of fertilizer. pH cannot be maintained easily due to external factors	There is equal distribution of fertilizer in the media. There is less chance of excessive use of fertilizer. pH can be easily maintained.	Rolot (1999); Resh (2013)
Quality and quantity of the crop	Crop production may vary regularly due to soil borne pathogens and pests.	Crop production is stable and depends on the types of media used.	Cornish (1992); Sarooshi and Cresswell (1994); Rolot (1999); Resh (2012).

Hydroponics needs careful monitoring of the system because of nutrient buffering capacity. The frequency and volume of the nutrient solution applied depends on the **1.** Type of substrate used **2.** The crop which is cultivated **3.** Size of the container **4.** Irrigation system used **5.** Climatic condition (Singh and Singh, 2012). Best Timing for hydroponics is 6.00 am to 8.00 am to apply the nutrient solution. When the plants are allowed to a water stress then it will lead to the severe yield loss (Kreij et. al., 1999). The accumulation of the toxic ions in the culture can be prevented by maintaining the 20%-50% of the solution (Singh and Singh, 2012). The drained water can be reuse for the next time watering. In hydroponics p^H is changing constantly as the plant grows. The optimal p^H ranging from 5.5 to 6.5, but several can grow outside of this range to obtain a better yield (Raviv et. al., 1998). Sterile root zone environment should be maintained essentially for good plant vigour under hydroponics system. To minimize the plant pathogen in the root zone is very difficult (Raviv et. al., 1998). In hydroponic solution the most common diseases are wilt caused by the fusarium and

verticillum spp. There is no effective fungicide found to be used in the hydroponic system. In tomatoes root death caused by the pythium was overcome by heating the nutrient solution at 20-22 ºC (singh and singh, 2012) There are numerous advantages of cultivating plants under soil less culture as compared to soil based agriculture (Savvas., 2002). With very little effort we can produce a clean and healthy vegetables and fruits (Silberbush and Ben-Asher, 2001). The concept of hydroponic system supports the sustainability of food- water security, usage of land, and health.

Initially soilless production system was carried out by mimicking traditional methods based on production in soil or soil-based systems. Soilless culture can be the effective tool to increase the crop yield and, if closed irrigation systems are adopted could increase the water-use efficiency, also reduce the environmental impact of greenhouses and nurseries. By implementing the soilless cultivation system, some researchers yielded a better quality of agricultural products, which is expected to meet the consumer preferences. One of our concerns in determining the soilless cultivation system is an understanding of its benefits, which is a flexible growing method that lets the grower have full control over the growing environment, including the active root zone. These systems, which can increase the efficiency of water-usage while maintaining its quality, should be more intensively implemented in any scale to support eco-agriculture.

The driving force of future agricultural industry is to provide sufficient yield that satisfy the needs of consumers and meet their interests in terms of quality. Soilless cultivation is intensively used in protected agriculture to improve control over the growing environment and to avoid uncertainties in the water and nutrient status of the soil. Recently the type of soilless culture transformed from open to close-loop system. This system is known for better result in water use efficiency, while maintaining the quality of the yield. This study aims to describe the specific purpose of soilless culture specifically in close-loop system and how substrate nutrition produces the better quality of the yields. Hydroponics is a widely and frequently used technique for growing plants without soil, providing for a considerable degree of control of the elemental environment surrounding the root. The technique has an interesting history of development and use dating back into the mid 18th-century, although the growing of plants in nutrient rich water may have dated

back into the early history of man. The determination of the essential elements required by plants was discovered using solution culture techniques. This paper discusses the past history of solution culture as well as its importance and use today. During 20s hydroponics becomes the more organic food developer without any pollution and hazards. The available literature related to the present study has been reviewed under the following heads.

1. Basic Requirements of Hydroponics.

2. Nutrient Solution for Hydroponics and its managements.

3. Preparation of Nutrient Solution.

4. Review of Research work.

Basic Requirements of Hydroponics: These are Nutrient solution, Temperature, Air, Supporting materials, Water, Mineral nutrient, Light and most important Growing media like Saw dust, Bark, Chips, Straw, Gravel, Rockwool, Perlite, Sand and vermiculite etc.

Conclusion

Hydroponics is the effective technology for the places of the world having scarcity of infertile and arable land for cultivation of crops. Fresh products can also be harvested through hydroponics throughout the year as it is not like traditional cultivation practices. Growing plants in a nutrient solution offers a number of advantages such as Applying plant nutrients in fertilizers directly to the roots without the problems associated with the soil's composition or the fertilizer's inability to infiltrate into the root system; No need for heavy machinery to prepare beds for seeds or planting; Weeds and diseases can be controlled without spraying chemicals and no irrigation systems have to be installed for fertigation; Erosion of the soil by repeated cultivation is avoided.

Acknowledgements

Authors would like to extend our thanks to Prof. Sushil Kumar Sharma, for necessary guidance during the work and Suresh Gyan Vihar University, Jaipur for providing facility and support during manuscript prepararion.

Conflict of interest

The authors declare no conflict of interest.

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