International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 7, July - 2014

Aeroponic Technology: Blessing or Curse

Gagandeep Kaur[1]
[1]Academic and Consultancy Services-Division, Centre for Development of Advanced Computing (C-DAC), Mohali, India

Dilip Kumar[2]
[2]Sant Longowal Institute of Engineering and Technology (SLIET), Longowal, India

Abstract:- Soil is main platform for pests and infections to grow results in infected vegetation growth leading to lower crop production. Aeroponic technology, a soil-less culture has capability to grow plants in a conditioned, pest and disease free environment. Enhanced disease-free yield leads India to be at top growers and exporters in near future. Aeroponic system has the potential to produce enhanced vegetative growth without use of any artificial hormones, pesticides or insecticide. This soil-less culture can overcome all the constraints that are present in soil culture production. Once the system is established, it lowers production cost.

Keywords:- Aeroponic, hormones, disease-free

I. INTRODUCTION

Agricultural land is reducing day by day due to growing population needs. It is a challenge for farmers to provide food to such a great population. By natural growing process, the crops cultivated are not sufficient. In order to increase the production rate, farmers use chemicals. No doubt the chemicals increase the productivity but on the other hand degrade the nutritious value of food. These chemicals lead to many skin problems and diseases to living being and disturb the entire food chain. To overcome this major problem, an aeroponic system may be used.

The term Aeroponics means to cultivate plants without using soil and water as medium; by maintaining all the parameters essential for growth of plants. The parameters are temperature, humidity, pH & electrical conductivity of nutrient solution etc. resulting in a conditioned environment. The benefit of using Aeroponics is plant's healthier growth and nutritious fruit by consuming fewer amounts of nutrients and water. By adopting this technique fresh and healthier fruits can be produced throughout the year. In the recent decade, Aeroponic system is used for growing potatoes and for potato seed production.

Under these circumstances, controlled environment has a strong potential to improve plants' developmental stages, health, and growth. In the recent decade, aeroponic system is applied intensively for the purpose of growing potato in order to produce disease-free potato seed and in order to have a pesticides-free cultivation environment.

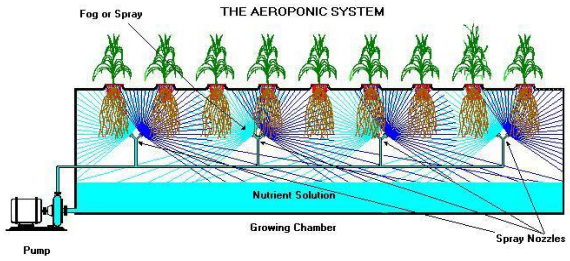

Figure 1: Basic Diagram of Aeroponic system

The aeroponic system has more advantages than hydroponic in terms of spraying high air content in the nutrient solution to provide oxygen to plant roots. The focus of attention
variables in the aeroponic system research are

- micro-environment (temperature, humidity, pH), and
- the effectiveness of nutrition (spraying /fogging)

Aeroponic system is an endless process in an confined space and therefore it cuts down
agricultural labour. A monitoring and control system intended for water and nutrients distribution has been designed to support the optimal application of aeroponic cultivation system for plant production.

II. BACKGROUND OF AEROPONIC SYSTEM

Soil-less planting techniques were first developed in 1920s by botanists. The main
purpose of their research was to study root- structure. Study was made easier due to the
absence of soil. Aeroponics is developed from a same technique called Hydroponics. In hydroponics, plant roots are immersed in nutrient-rich solution i.e. it acts as a growing medium for plants. This technique gain popularity in 1970s.

In 1990s NASA took interest in this technology. After research study and refinement of this technique, NASA funded a small project of aeroponics. Because of NASA's involvement aeroponic technique came into limelight.

In 1997, two identical aeroponic systems were tested by NASA. One system of Asian
bean was planted aeroponically at MIR space station and the other at earth. The only thing that separates the two systems was gravity. Amazing results were obtained from the test. Zero gravity crops grew better. This test results that food crops not only can grow but can flourish at zero gravity region. The research was of great importance for NASA because these aero systems can be used to provide fresh food to aeronauts during space missions.

In 2001, researchers of Arizona University studied two varieties of plants; echinacea and burdock. Echinacea variety suffered fungal and insect infections. The yield obtained from this was still compared to conventional growing method. Burdock variety yield was 1000 percent more than conventional growing method. According to researchers, harvesting becomes easier due to absence of plants.

This technology is useful for boosting profits. Due to cutting cost of soil, water, fertilizers and space requirements, small systems can compete larger growers of conventional systems.

III. BENEFITS OF AEROPONIC TECHNOLOGY

Aeroponic technology has several advantages as shown below:-

i. Aeroponic technology gives high yield with less space requirements.
ii. Plants can be grown close together.
iii. Fruits produced from the system are easier to harvest.
iv. Using this technique, fruits can be grown at zero gravity i.e at moon stations.
v. Local food production can cuts down transportation costs.
vi. This technology saves water as it cuts down water consumption by 98 percent.
vii. Fresh and healthy plants can be grown at homes; indoors or at roof top.
viii. Nurseries can propagate seeds and cuttings into healthy, harvestable plants in a fraction
of time of traditional methods.
ix. Plants and root growth study in laboratories is easier for students and researchers.
x. Plants consume more oxygen under aeroponic conditions; more oxygen equals more
plant growth.
xi. Planting and harvesting can be done throughout the year.
xii. Due to clean and sterile growing conditions, plant diseases and infections reduce up to a
great extent.
xiii. In aeroponic system, plant roots have proper space to grow well. So they don't stretch
or wilt. Plants can be shifted to any growing media system without any transplantation
shock after root development.
xiv. Aeroponics systems can reduce water usage by 98 percent, fertilizer usage by 60
percent, and pesticide usage by 100 percent, all while maximizing crop yields.
xv. Aeroponic plants are potentially healthier and nutritious.
xvi. Power loss for a small period do not cause any damage to plants.

IV. DRAWBACKS OF AEROPONIC TECHNOLOGY

Like every coin has two sides, similarly every technology has major benefits as well as some negligible effect limitations. These limitations of aeroponic system are as follows:-

i. Power loss for a long time period may cause irreversible damage.
ii. Initially some training is required for system maintenance.
iii. Sanitary conditions are required to be maintained regularly.
iv. Initial cost of system is high.

CONCLUSION

Total agricultural water consumption by human beings is 70 percent of total consumed water. Out of that 45 percent is wasted due to gaudy irrigation techniques. By using aeroponic systems, we can save 98 percent of total water because of recirculatory system. Fresh, clean, healthy, efficient and rapid food production can be obtained from aeroponic systems throughout the year. Due to clean and sterile growing conditions, plant diseases and infections reduce up to a great extent.

With technology like this, jumping over the moon won't be reserved for fairy tales.

REFERENCES

[1] Chiipanthenga, Margaret, et al. "Potential of aeroponics system in the production of quality potato (Solanum tuberosum l.) seed in developing countries." African Journal of Biotechnology 11.17 (2012): 3993-3999.
[2] FAO Statistical Yearbook 2013. World Food and Agriculture. http://www.fao.org/docrep/018/i3107e/i3107e.PDF (accessed 27 May 2014).
[3] Howard M. Resh, Plant culture, "Hydroponic Food Production", 7th revised edition, 2012.
[4] Farran, Imma, and Angel M. Mingo-Castel. "Potato minituber production using
aeroponics: effect of plant density and harvesting intervals."*American Journal of Potato Research* 83.1 (2006): 47-53.
[5] Idris, Irman, and Muhammad Ikhsan Sani. "Monitoring and control of aeroponic growing system for potato production."*Control, Systems & Industrial Informatics (ICCSII), 2012 IEEEConference on*. IEEE, 2012.
[6] Jayapalan, Manjusha, and NP Kumari Sushama. "Constraints in the cultivation of bitter gourd (Momordica charantia L.)."*Journal of Tropical Agriculture* 39.1 (2001).M. King and B. Zhu,

"Gaming strategies," in Path Planning to the West, vol. II, S. Tang and M. King, Eds.
Xian: Jiaoda Press, 1998, pp. 158-176.

[7] Nugaliyadde, M. M., et al. "An aeroponic system for the production of pre-basic seed potato."*Annals of the Sri Lanka Department of Agriculture* 7 (2005): 199- 288.

[8] Ritter, E., et al. "Comparison of hydroponic and aeroponic cultivation systems for the production of potato minitubers."*Potato Research* 44.2 (2001): 127- 135.

[9] Rolot, J. L., and H. Seutin. "Soilless production of potato minitubers using a hydroponic technique."*Potato Research* 42.3-4 (1999): 457-469.

[10] Aeroponics in Potato Seed Prodiction. http://taga.co.in/writeups/4.html (accessed 4 December 2014).

Gagandeep Kaur received her B.Tech. (Electronics and Communication Engineering) degree from Sant Baba Bhag Singh Institute of Engineering and Technology affiliated to Punjab Technical University, Jalandhar in 2012, and presently she is pursuing her M.Tech (Embedded Systems) degree from Centre for Development of Advanced Computing (CDAC), Mohali and working on her thesis work.

Dilip Kumar received his PhD in Engineering and Technology from Maharishi Markandeshwar University (MMU), Ambala, India in 2010, ME in Electronics Product Design and Technology from PEC University of Technology (formerly Punjab Engineering College), Chandigarh in 2003, and BE in Electronics and Telecommunication Engineering from Army Institute of Technology, University of Pune, India in 2000. He is currently an Associate Professor at Sant Longowal Institute of Engineering and Technology (SLIET), Longowal, India. His research interests include wireless sensor networks, fault tolerance and embedded system. He has published more than 90 papers in international journal/conferences.