Floating Roots, Thriving Shoots—Aeroponics Bears the Fruits!

Abhishek S*

BSc (Hon's in Agriculture) Punjabi University Patiala

Corresponding Author
Abhishek S
Email: abhishekabhishu@gmail.com

OPEN ACCESS

Keywords

Aeroponics, Soilless farming, Sustainable agriculture

How to cite this article:

Abhishek, S. 2025. Floating Roots, Thriving Shoots—Aeroponics Bears the Fruits! *Vigyan Varta* 6(4): 65-67.

ABSTRACT

Aeroponics is the technique of growing plants that are suspended on the air and grow in a humid environment under controlled conditions without soil. The basic principles of aeroponics is based on the possibility of cultivating plants whose roots are suspended and are not inserted into soil or a substratum , but in chambers filled with water and essential nutrients. With this technique the humidity, pH, temperature, water conductivity can be controlled under closed growing conditions like poly house. Since the roots are suspended on the air, it is possible to plant practically anywhere and cubic space can be used, and therefore, aeroponics can be applied in many different ways. The ideal conditions for moisture and oxygenation can be found by the roots in these chambers. These conditions enable more balanced and improved plant nutrition absorption, which leads to faster plant development. As the plants are kept apart, suspended in the air, and their roots are not submerged in soil or water, the aeroponic system is easier to utilize. Many food crops, including lettuce, tomatoes, potatoes, yams, and some green vegetables, are grown commercially using aeroponic systems (Boddu *et al.*, 2024).This technique has many advantages as compared to conventional cropping, crop harvesting is also easy.

INTRODUCTION

In the rapidly increasing population of earth the need for food security also increasing, but the land available for cultivation is reducing at the same rate. To meet the essentials of food security of the humans and animals more food has to be produced from the limited available land. This exerts pressure on the agriculture sector. To face these challenge techniques such as aeroponics can be used. The word aeroponic is derived from the Latin word 'aero' (air) and 'ponic' means labour (work) (Kumari & Kumar., 2019). By suspending plant roots in a nutrient-rich mist, aeroponics offers previously unavailable control over environmental factors and significantly boosts crop yields, in contrast to conventional farming techniques that depend on soil as a substrate for plant growth. The aeroponic technique is an efficient and effective technique for growing plants with less water requirement (95 percent less than traditional farming) (Mano *et al*., 2024) space requirement. The harvested products have superior quality and taste and also more nutritious, because the plants can uptake more vitamins and minerals making the plants healthier.

Components of Aeroponics system

1. **Spray misters:** The nutrient-water solution is introduced into the roots by spray misters. They atomize the liquid that is introduced to them at high pressure. The droplet size and discharge rate varies for different spray misters (Sahoo, 2020).

2. **Droplet size:** Droplets in the size range of 20-100µ(microns) are ideal. The air is saturated by the smaller droplets and also maintains the humidity levels within growth chamber. Droplets of 30-100 microns contact with the root (Sahoo, 2020). Spray droplets less than 30 microns tends to remain as fog in the chamber while droplets above 100 microns tend to falls down before contacting the roots.

3. **High pressure water pump:** Pump is used to pressurize the liquid to be sprayed through the nozzles, due to the pressure of liquid the liquid gets atomized and sprayer out. Generally, the diaphragm pump is used and is to be operated at 80 PSI to get droplets of 30-50 microns size (Sahoo, 2020).

4. **Temperature and light:** The optimum temperature of 15ºC to 25ºC is required for optimum plant growth. The growing area will be a close space to replace the sunlight artificial light has to be set up with florescent tubes of intensity 15000-40000 lux depending on the growth stage of crops (Sahoo, 2020).

5. **Misting Frequency and Nutrient Reservoir:** The spraying of nutrient-water solution to the roots can be continuous or intermittent. The aim is not to let the roots completely dry out to achieve this misting cycle of 1-2 minutes followed by 5 minutes off will prevent such problem (Boddu *et al*., 2024). The advantage of intermittent wetting is the operation cost can be saved, since the pump runs only for few minutes.

Aeroponics setup and working

The basic working principle of aeroponics is to grow plants without inserting the root into substratum or soil; instead, it is in a container filled with flowing plant nutrition by introducing the nutrient-water solution to the dangling roots with a sprayer as atomized particles. In these containers root is subjected to enough nutrients and oxygen. These conditions favour the plant for better nutrient uptake and utilization results in faster growth and development. Plant containers can be

placed one above the other in a vertical manner. Numerous plants can be accommodated in vertical columns within a greenhouse or poly house. Nutrients are allowed to trickle down the growth column, while which the roots absorb them. Plant containers are periodically displaced according to its growth stage because different growth stage has varied requirement for sunlight. During initial vegetative stage the containers are placed on the top most level of growth column. As the growth stages changes, they are lowered progressively. As the nutrient-water is given in a closed circuit only the required quantity is consumed by the plants, allows for substantial water savings. The excess sprayed solution can be collected back and reused it for next spray cycles. The production in aeroponics is a continuous cycle in a closed space it reduces the agricultural labour and also year-round production can be achieved (Sahoo, 2020).

Outcomes

Numerous benefits are provided by this soilless plant cultivation technique, which solves the problems with conventional farming methods. Aeroponics is changing agriculture through improved nutrient absorption, year-round crop production, adaptability to urban farming (Singh *et al*., 2024), it promotes faster and healthier growth due to improved oxygenation.

Limitations

Aeroponics has become well-known for its many benefits, but it also has drawbacks and difficulties. As with any newly developed agricultural method, the use of aeroponics systems has challenges, including high initial setup costs, the need for technical know-how to execute the system successfully, high energy consumption, and a restricted range of crops (Singh *et al*., 2024). To ensure wide success and acceptance, these issues need to be addressed.

CONCLUSION

Food production must move to urban regions as urbanization increases in order to meet the demands of urban societies for energy, water, transportation, and food. Because of its benefits over conventional planting techniques, aeroponics is set to play a big part in feeding the people living in these megacities. By adopting aeroponics for growing vegetable crops more yield can be harvested from very smaller area as compared to conventional farming. The plants can uptake plenty of water and nutrients making the plants healthy and thus the pesticides usage can be reduced. Aeroponics supports the conservation of water, land, nutrients so it can be considered as the future of farming.

REFERENCES

Boddu, V., Hemanth, D., Ch, K., & Kumar, S. (2024). Aeroponics in Vegetable Crops. *International Journal of Theoretical & Applied Sciences*, *16*(1), 74–78.

Mano, N. B., Arthi, N. B., Arthi, N. M., Asha, N. R., & None P Dhivya prabha. (2024). Aeroponics vertical indoor farming. *International Journal of Science and Research Archive*, *11*(2), 407–411.

Sahoo, D. (2020). Aeroponics System of Cultivation in Horticultural Crops, *just agriculture*, *1*(1), 32-39

Singh, P., Singh, S., & Upadhyay, A. (2024). Aeroponics: Innovations and challenges in modern farming technique. Dr. Devaraju, Dr. Chithra K, Smt. A. Mamatha, Dr. Shivaji Kallappa Duradundi, & Miss. Archana Upadhyay (Eds.), *Innovative Approaches towards Horticultural Sustainability*. Golden Leaf Publishers, 1-10.

Kumari, R., & Kumar, R. (2019). Aeroponics: A review on modern agriculture technology. Indian Farmer, 6(4), 286-292.