

Aeroponics: A Modern Trend on Vegetable Farming in Kerala

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Abstract

Aeroponics is a cultivation technique for growing crops without using soil. The plant is not inserted into the soil or any other medium like conventional cultivation. In aeroponics, plant is grown in a mist medium. The roots of the plants are exposed to the air or in a container filled with nutrients. The roots get maximum oxygenation and moisture. Aeroponic farming ensures better aeration, effective water usage, less space, time consumption, disease free plant propagation seasonal independence and large scale plant production. The techniques used in aeroponic system are proved successful for the plant such as potato, tomato, leaf crops and microgreens. In Kerala it may use or consume only 95% less water as compared to the normal farming. It also conserves reduced land use and eliminating soil degradation. It also enables pesticide free organic cultivation and maximizes space efficiency. It is ideal for urban and eco-friendly farming.

Keywords: Aeroponics, Growing system, Soilless culture, Vegetables

Introduction

Earth population is expected to reach 12 billion by 2050. It requires additional 110 hectares of farm land for traditional farming needed to feed the additional population. It is considered that only 80% of land is suitable for agricultural farming. Another critical problem also comes into picture in the form of malnutrition for the growing population. For managing the greater quantity of land that to be obtained by destroying forest area and large scale use of water which is reducing day by day. Water for agriculture has less priority over human needs and a better management of resources is the need of the hour. To solve these, new farming methods have to be found out. Aeroponics, which is soilless cultivation which requires less quantity of water is a better solution for this problem.

Aeroponics is a modern way of cultivating plants without using soil as a medium, which helps to culture plants in limited spaced. The term aeroponic is obtained from the Greek word aero (air) and ponos (labour). In the aeroponic system, the roots of the plants have greater access to oxygen. This ensures healthier growth of plants, faster crop growth and increased yield. The aeroponic method of propagation is economically beneficial also. In this method, major vegetable

crops like tomato, potato, lettuce, yams and certain green vegetables can be commercially grown (Mangaiyarkarasi, 2020). Figure 1 show that needs of aeroponic system of growing cultivation of crops. At the current rate of growth of population, it may fetch 8.1 to 9.6 billion by the year 2050 and the demand for food is ever increasing. The agricultural land can be scarce and expensive by that have for meeting the food requirements.

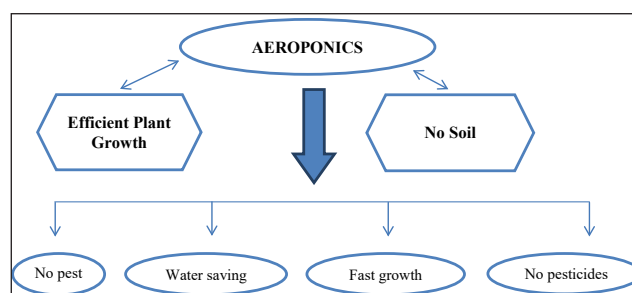


Figure 1: Needs of Aeroponics farming

Aeroponics is technologically forward from the cultivation method hydroponics. The hydroponics method has many disadvantages, which can be overcome by the implementation of the aeroponic system of cultivation.

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On traditional crop system, it is taking hours to soil, long time to harvest and sold at expensive price. The soil used for cultivation is becoming reduced quality due to decomposition of organic materials and increased usage of pesticides and harmful for human health. In a larger country such as India, it is essential to use the resources such as sunlight, soil, water and money with efficiency.

Kerala, as Southern-most state of India has a very distinct topography and land use patterns. The per capita land use in cropping pattern is very low. Also agricultural land is converted in to other uses. In addition to the decreasing availability of farm land, adverse climate changes also making challenges to crop production. Considering the high density of population, shortage of farm labour, low per capita holding, size Kerala and impact of adverse climate changes, the only solution to ensure sustained food security is adoption of high-tech, mechanized agricultural systems such as aeroponics.

Aeroponic System

1. Types of Aeroponics

Low Pressure Units

Commonly an aeroponic garden plant roots are hung above reservoir of nutritional solution. A low-pressure pump can delivers the nutrient solution *via* ultrasonic transducers and jets which usually drain the nutrients back to the reservoir. These machines back function such as debris removal, nutritional solution, purification and pathogen elimination. Normally these units are suitable for growing on a bench top.

High Pressure Device

In this type of device, high pressure pump is used to produce mist. Water, air, low-mass polymers, purification nutrient sterilization and pressure nutrient delivery systems are all part of this device.

Commercial System

This system includes high pressure device, as biological systems. The biological system used for an improvement in crop maturity and longer plant life.

2. Components of Aeroponic System

- i) Spray misters
- ii) Droplet size
- iii) High pressure water pump
- iv) Temperature
- v) Light
- vi) Nutrient reservoir
- vii) Misting frequency

3. Nutrients Used in Aeroponics System

Carbon, Oxygen and hydrogen are present in the air and the water. Water contains various nutrient elements like Nitrogen, Phosphorous, Potassium, Calcium, Magnesium Sulphur, Iron, Zinc, Copper, Manganese, Boron, Molybdenum, Cobalt and Chlorine. The optimal value of pH for plant growth ranges from 5.8 to 6.3. In aeroponic system, water and nutrients are recycled, which is essential to measure the

acidic or basic pH values. Nutrient absorption is vital for plants (Chowdhury *et al.*, 2020).

4. Aeroponics Growing System

Aeroponic principles are based on the cultivation of vegetables, whose roots are not inserted on the soil; however containers filled with the nutrients. Usually agriculture plants need sunlight for their first vegetative development. In aeroponic system, cultivation is possible with a non-step production cycle. Here the nutrients are supplied in a closed consumption, which one is limited to minimum quantity. This process saves the water usage considerably (Salma *et al.*, 2024).

5. Advantages of Aeroponics

- *Cultivation over the year*: In aeroponics, plants grown in a controlled environment. Hence, crops can be cultivated without depending weather or atmospheric condition.
- *Rapid plant growth*: Plants grow rapidly due to the reason that roots an access lot of oxygen.
- *Easy maintenance*: The system maintenance is much easy because of the number of system element is minimal.
- *Minimum quantity of water and nutrients*: Aeroponic plants needed minimum quantity of water and nutrients. The nutrient absorption rate is high and the plants growing with significant roots.
- *Mobility*: Plants, even the entire nursery can easily be moved around the world without effort.
- *Requires less space and high-yield*: Aeroponic plants could be stacked up as layers or vertical farms which consume less space than the conventional farming.
- *Good educational value*: Plants growth study conducted in laboratories are easier for researchers and students.
- *Good root growth*: In aeroponics, plant roots contain sufficient space for good growth. Hence, root wilt and stretch.
- *No transplantation shock*: In aeroponics, plants could be shifted to other growing medium without any kind of transplantation shock.
- *Good fruit harvesting*: Fruits produced can be easily harvested.
- *Disease free production*: Due to the sterile and clean growing conditions, the produced fruits are disease free.
- *Plant production at moon station*: Using aeroponics techniques, plants can grow at zero gravity condition even in moon station.
- *Healthier & nutritional fruits*: Homemade crops in indoors, root top *etc.* in home ensures potentially healthier fruits.
- *Nurseries usage*: Nurseries could propagate cuttings and seeds into harvestable, healthier, in short time duration.
- *Reduce water usage*: Aeroponics system needs marginally less water and consume less nutrients.
- *Power loss*: Power loss due to short time period will not cause any damage in the plants.
- *More cost effective*: Since less quantity of water and

nutrients are applied in aeroponics the cost of production also reduced to a great extent when compared to other conventional method of cultivation.

- **Reduced disease damage:** Since to plants are suspended, not sharing the common soil, hence, infection in one crop may not spread to other crops (Chittibomma *et al.*, 2023).

6. Disadvantages of Aeroponics

- Aeroponics is expensive for the long-scale production.
- Farmers may struggle to handle many sophisticated instruments used for aeroponics.
- Misbelief by people that aeroponically grown plants and their fruits are not nutrients.
- Maintenance of an aeroponic farm system is expensive.

7. Importance of Aeroponics in Vegetable Farming

Plant growing in soil is not a sustainable way of food production for 10 billion plus population. Crop increase yield can be 45% to 75% using aeroponic system efficiently. As nutrients are directly applied to the plant roots, ensures faster growth of the plant. Uniform growth among all crops also observed. Aeroponics is the major method for seed multiplication. Monitoring of nutrients and pH are easy (Pavan and Rathod, 2025).

8. Benefits of Aeroponic Vegetable Gardening

- **Increased yields:** Aeroponic plants develop three times quicker than soil-grown plants.
- **Year-round growing:** When combined with grow lights, can produce crops all year.
- **Use less water:** According to NASA scientists, aeroponic growing requires 98% less water than soil cultivation.

Conclusion

Water plays a vital role in world economy. Approximately 70% of water is utilised by human being for agriculture. Around 45% of this precious water is wasted due to gaudy irrigation techniques. If we use aeroponic systems, we can save 98%

of water by recirculatory system. Use of excessive fertilizers and artificial pesticides and insecticides are reduced to the minimum. This results in healthy, tasty, nutritious fruits and increased quantity of products. Rapid cultivation throughout the year is very beneficial for urban dwellers that live in apartments in particular. Aeroponics system farming in an efficient cultivation in future programmes for the increased production of fruits and vegetables. With less or soil strain on soil the system may be promoted for the survival of the population.

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