

The Future of Indian Agriculture with Aeroponic Farming

**S. Sheelamary*, K. Lakshmi, K. Dhanapal, R. Vivek Kumar, A. Ponselvan and
N. Vinith**

Division of Crop Improvement, ICAR-Sugarcane Breeding Institute, Veerakeralam, Coimbatore

Corresponding Author

S. Sheelamary

Email: sheelajoshkutty@gmail.com



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ABSTRACT

A promising soilless farming method for solving future food crisis is called Aeroponics. The new way of farming method to grow plants which is popular is the aeroponic farming system. Aeroponic farming is a type of vertical farming. Due to this farming system the root zone is controlled with nutrients and water content and also the environmental conditions. These inputs have complete access to the roots throughout the life of the crop. This aeroponic farming is superior to the conventional methods of propagation.

INTRODUCTION

Growing plants without soil, in the presence of air, or in a mist is known as aeroponics. Aeroponics is defined as "Growing in the air" in simple terms. An open root-zone environment, where the roots are suspended freely and have more access to oxygen, leads to healthier plants, noticeably faster crop growth rates, and higher yields. A medium is not needed in an aeroponic system. The ideal conditions for air, nutrients, and

water are provided inside the growth chamber by an aeroponics system.

Aeroponic system

Two components of aeroponic system are

- Roots: The roots beneath the plant are neatly divided by its supporting architecture.
- Canopy: The term canopy describes the crown and leaves of a plant, which are

often higher than the structural supports of the plant.

Aeroponics depends on hydroponics to fulfill this need. This is due to the fact that, should the aeroponics system malfunction, a backup plan must be in place to provide the plants with the nutrients they require. In high-pressure aeroponics, a 20–50 mm mist head is used to deliver nutrients to the roots via a high-pressure (80 psi) diaphragm pump. Aeroponics differs from conventional farming methods in that it uses a different method for controlling and delivering nutrients and ambient conditions, but it maintains the same physical growth process for the plants as hydroponics. Aeroponics, which aims to promote healthier plant growth, is practiced in a controlled setting where the grower has complete control over the system. Large vertical grow racks are used to store plants. Nitrogen, phosphorus, and potassium are among the essential organic liquid nutrients that are given to a big water reservoir. Updates are easier and faster when these organic nutrients are in their purest form because the plants can digest them more readily.

Plants nutrient is delivered directly to the root zone through mist. The lights for growing plants in indoor condition are optimized to fall within certain wavelengths to further promote plant growth. The temperature and humidity are controlled to a certain extent. With reduced stress on the plant itself, this technique optimizes nutrient absorption, resulting in a generally better crop. Aeroponic plants are superior in color, texture, and flavor, and they also have a higher nutritional value (Kumari and Kumar 2019; Boddu *et al.*, 2024).

Reason for Aeroponics

By providing a different method of growing greens and vegetables, aeroponics tackles challenges in contemporary farming. The

system has a number of significant benefits, including:

1. **Land requirement:** Because aeroponics employs both horizontal and vertical space, it requires 98% less land than standard agricultural techniques.
2. **Year round production:** Aeroponics falls into a family of practices known as “Soilless Controlled Environment Agriculture” (CEA). This term applies to all types of indoor plant cultivation in which the environmental conditions, including temperature and sunlight are controlled by the grower. Growing in a controlled environment improves a farm’s ability to predict crop timing, grow quality plants and maintain high food safety standards.
3. **Water requirement:** There is considerably less variability in a controlled environment, lending to less waste and lower cost. Although aeroponic systems use water based solutions to perform properly, they use about 95 % less water than standard farming.
4. **More efficient:** Growers design their systems and nutrient solutions to maximize the growth and production of their plants. Plants grown in these indoor gardens are known to grow as much as 3x faster than those in outdoor farms.
5. **Safer for the consumer :** A closed environment eliminates possible contamination from soil or crossover with Mother Nature, so there is no need for herbicides or pesticides resulting in a more organic product.

Advantages of Aeroponics

1. **Productive and Sustainable:** This method provides food production uses 80-90% when compared to soil-based farming. This

method utilizes less water. This method needs a less growing place and this will be helpful to grow more food, healthy plants and give more profit.

- Promotes Healthy and Rapid Plant Growth:** As it grows in the air with mist type of water, it is suited to promote rapid plant growth for any type of species. Hence, when compared to soil-based farming, this method grows more plants in less time.
- It Can Be Cultivated without Land:** To grow a food, we need a place where there is a less space and on the roof. It doesnot need a huge land area.
- Photosynthesis is promoted:** It provides the eco-friendly environment. It removes carbon dioxide from the environment and managing its concentration inside the system. It also provides oxygen.

Disadvantages of Aeroponics

- Training is necessary to start an aeroponics to keep the system clean.
- It will cause a total damage of the system if any one of the elements failed because many components make up this system.
- Maintenance of light and air supply is very challenging because of the vertical farming.

Difference between Aeroponic farming and hydroponic farming

Aspect	Aeroponic farming	Hydroponic farming
Definition	Plants are grown in a mist or fog environment, with the roots suspended in the air.	Plants are grown in nutrient-enriched water, eliminating the need for soil.
Cost	This tend to be more expensive to build due to the specialized equipment	Tend to be cheaper to build and easier to manage.

	needed.	
Resource usage	Uses less resources and tends to produce a better harvest.	Requires more water as plants are submerged in a liquid nutrient solution.
Yield	Offer faster plant growth, higher yields, and the ability to grow a broader range of crops.	Hydroponics allows higher density planting and higher yields per area than soil farming.
Risk	Any lapse can rapidly kill crops.	Needs high energy demands and startup costs.
Maintenance	Requires regular monitoring and maintenance of the system.	Requires regular monitoring and maintenance, but it's generally easier to manage.

Top five aeroponic farming companies in India:

- AeroFarms:** This Company has won many awards for its operations and uses its patented "aeroponic technology" to take indoor vertical farming to a new level of productivity with minimal environmental impact. AeroFarms uses proprietary aeroponics for better production and is a provider of soilless farming systems.
- Plenty:** Plenty is a vertical farming company that offers salads and vegetables. It grows its plants in tall towers inside a climate-controlled facility with LED lights.
- UrbanKisaan:** UrbanKisaan specializes in hydroponic methods of farming, which is a subset of hydroculture and is a method of growing plants without soil, using mineral nutrient solutions in a water solvent.
- Future Farms:** Future Farms focuses on the challenging areas of hydroponic farming, including the development of a domestically designed, low-cost



hydroponic system that can grow pesticide-free vegetables and herbs.

- 5. Triton Food works:** Triton Food works is another company that has made significant strides in the field of hydroponic farming.

(<https://timesofagriculture.in/top-hydroponics-companies-in-india/>)

CONCLUSION

Aeroponics refers to the technology of growing plants using air or mist with the help of media like coco peat, perlite, etc., and using nutrient solutions. Aeroponic farming is done in controlled temperature and humidity in protected structures. Due to this aeroponic farming requires very high initial investment costs. It produces higher yields and the produce will be of high quality which can have

premium prices. So if you are someone looking to start aeroponic farming, you should not think twice.

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