

AEROPONICS: GROWING IN THE MIST

Anamika Walia

Division of Vegetable Science & Floriculture, Sher-e-Kashmir
University of Agricultural Sciences and Technology, Jammu

INTRODUCTION

Aeroponics is the technique of growing plants in an air or mist environment without the use of soil or an aggregate medium. The basic principle of aeroponic growing is to grow plants suspended in a closed or semi-closed environment by spraying the plant's dangling roots and lower stem with an atomized or sprayed, nutrient-rich water solution at constant intervals.



WHO INVENTED AEROPONICS?

The term aeroponics was originally coined by the Dutch biologist, Frits Warmolt Went in 1957 but, it was after 29 years the first aeroponically grown food was sold in a grocery chain by Richard Stoner. Stoner filed his first aeroponic patent in 1983 and went on to found Genesis Technology Incorporated or

GTI, which was the first to bring commercial-scale aeroponic systems into greenhouses for commercial crop production.

HOW IS IT DIFFERENT FROM HYDROPONICS?

The primary difference is the availability of oxygen to the roots. In hydroponics, one has to be sure to supply oxygenated water. Standing water, depleted oxygen, pH levels, and nutrients can trigger algae growth and fungal problems in hydroponics. In aeroponics, oxygen is surrounding the roots at all times. Dangling roots not only absorb essential minerals from the nutrient spray solution, but this also allows increased oxygen intake to fuel respiration and nutrient absorption. This accelerates growth +40% more than in soil, and adds the benefit of greatly reducing nutrient usage (-70%) & water usage (-90%) through scheduled spray-recycling.



HOW DOES AEROPONICS WORK?

Aeroponics works by using a sprinkler system to spray oxygen and nutrient rich solution on the plant roots. Aeroponics systems comprise of growing chamber with a lid. The plants are placed in a net pot into the holes with their roots suspended inside the dark chamber. A programmable cyclic timer is used to trigger the high pressure aeroponic pump to go on and it causes the nutrient solution from the nutrient reservoir to be sprayed as a fine mist in the rooting chamber. Fine root hairs develop that are capable of absorbing nutrients from the moisture. The oxygen intake is also increased as the chamber is filled with oxygen rich-nutrient solution mist. Because of the very small size of the spray particle, the wastage of nutrient solution is greatly reduced and root rot is completely avoided due to supply of well oxygenated solution.

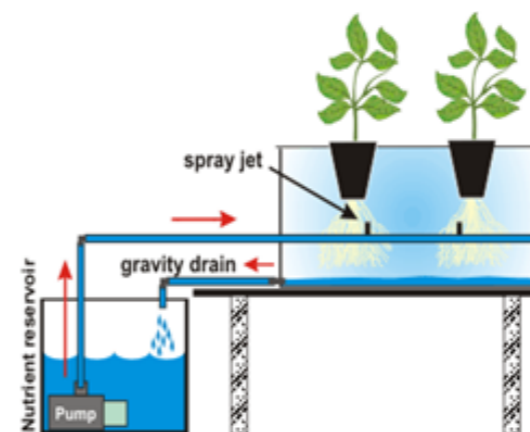


Fig 1.3 Aeroponic system (Basic layout)



WHAT CAN BE GROWN WITH AEROPONICS?

Only limited types of plants have been researched and grown successfully in aeroponic system. The broad category comprises of:

- Vegetable plants- Potato, tomato, peppers, brinjal, lettuce, cherry tomato, beans, beets, carrot, gourds, cucumber, spinach, Cole crops (cabbage, cauliflower and kale).
- Fruit plants- Melons, Strawberry
- Leafy greens- Wheat grass, basil, mint, amaranthus, chive.
- Flower plants- Marigold, pansy, Viola, calendula, dianthus, nasturtium.



AEROPONICS SYSTEM TYPES

1. Low pressure aeroponics- Most usual type and utilised for home gardening. The plant roots are suspended in the reservoir having nutrient solution. The low pressure water pump supplies the nutrient solution via PVC pipes via sprinkler heads to the roots.
2. High pressure aeroponics- The mist is generated by high pressure pump creating quite small size water droplets. Mostly used for high value crops to get more profits.
3. Ultrasonic Fogger aeroponics- Consist of high-pressure water and enhancements for prolonged plant life and harvest maturation. This system is commercially utilized.

VERTICAL OR HORIZONTAL APPROACH: WHICH ONE TO GO FOR?

Aeroponic systems can be designed both horizontally and vertically. Horizontally designed aeroponics systems are to be used, like a traditional planting bed. But vertical systems especially towers are increasingly popular - since the roots need to spread out and this is a clever way to save space. Vertical systems are also popular because the misting devices may be placed at the top, allowing gravity to distribute the moisture.

GROWTH BREAKTHROUGHS WITH AEROPONICS! HOW CAN IT BE ACHIEVED?

- Rapid Aeroponic Growth = Yield & Profits
- No Pesticides, No Pesticide Residue = Higher Quality
- Pure Water: No Heavy Metals No Pathogens, No Antibiotics, No Hormones = Just Great Taste!
- Automation Simplifies the Process - No Disruption, More Growing Time = Lower Cost
- Reduce Stress - Plants Start Healthier = No Mechanical Resistance From Soil & Create Greater Yields Faster
- Internal Methods Protected - Proprietary Nutrient Recipes, Irrigation Cycles, & Light Automation = Proprietary Advantage



AEROPONICS IN SPACE

For long-term space missions to be successful, crews need to produce some of their own food while in transit. Every bit of food produced and water conserved on a spacecraft reduces weight and opens up space for other cargo. So in the late 1990's, NASA in collaboration with Richard Stoner developed an inflatable aeroponic growing system that could be used to efficiently grow food especially vegetables either on Earth or space. Each Flex Aeroponic System can produce 1000 bunches of lettuce, herbs, and vegetables in less than 25 days. It utilizes 99.9% less water than hydroponics and grows the plant in a true aeroponic system of 100% oxygen found in air. The low-mass inflatable aeroponic food production technology has not yet been used in the space program. However, it has the potential for integration for lunar and Mars applications.



21ST CENTURY AEROPONICS

- **Contemporary aeroponics** - Modern aeroponics allows high density planting of many horticultural crops without the use of pesticides. Growing food crops in low gravity situations for future space colonization is also being studied. It could be the potential application for food production in those regions having vast parts of the nonarable land, small area and big population, and as well in desert regions.
- **Aeroponic bio-pharming**- It is the use of genetically modified plants to produce a wide range of pharmaceuticals and industrial products inside of plants. Plants such as tobacco, for example, can be genetically engineered to produce therapeutic proteins, monoclonal antibodies and vaccines to treat cancer & inflammatory diseases. As recently as 2005, Dr. Neil Reese applied aeroponics to grow genetically modified corn.
- **Large scale integration of aeroponics**- To produce the high quality and healthy seeds, ICAR-Central Potato Research Institute, Shimla has developed soilless aeroponic technology for potato seed production. This technology was also utilized for Vietnam's minituber potato production for certified seed potato production in 2006.

CONCLUSION

The aeroponics system is an emerging food growing system in sustainable agriculture for food security, especially in areas where soil and water are in critical condition. The future of aeroponics is exciting. Scientific research has proven the advantages of aeroponics, from the reduced water usage needed for misting the plants to increased growth of vegetables such as tomatoes and cauliflower. It is discovered while cultivating crops under soilless growing: there is reduction of use of water upto 98%, fertilizer use by 60%, and no use of pesticides and herbicides. Based on these statistics, it can be ascertained that aeroponics is a new type of farming which can fit the needs of food demand and supply under current depletion of property and its fertility. Much research is going on worldwide to make optimal condition for growth of various other types of crops by using this technology.

