



(RESEARCH ARTICLE)



## Aeroponics vertical indoor farming

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### Abstract

Aeroponics vertical indoor farming is a farming that involves growing crops in layers that are piled vertically. Aeroponics is a method of growing plants without soil. Vertical indoor farming is climate controlled so it can be done year-round regardless of environmental challenges. Emerging problems of food security, urbanization, farmland shortage, food miles increased greenhouse gas emissions focus on the need for vertical farming physiological constraints that occur within hydroponic systems. Today, agriculture especially in India to concentrate in some situation such as how to increase the productivity and profit. This paper presents a methodology for developing the plants are submerged in a nutrient-rich mist solution. This study challenges is cultivating the plant by organic farming natural nutrition.

**Keywords:** Aeroponic vertical farming; Indoor farming; Urbanization; Congestion; Organic farming.

### 1. Introduction

The Aeroponics is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. In other words, it is the whole plant, roots, and all, are suspended in mid-air. The word Aeroponics is derived from two Latin words “aero” (meaning air) and “ponic” (meaning labor). Aeroponics is an alternative for people with limited spaces to grow plants. An aeroponic system is defined as an enclosed air and water/nutrient ecosystem that fosters rapid plant growth with little water and direct sun and without soil or media. It is an effective and efficient way of growing plants for it requires little water (requires 95 per cent less water than traditional farming methods) and needs minimal space than even the most efficient system hydroponic system. Plant grown in these aeroponic system also been shown to uptake more minerals and vitamin, making the plants healthier and potentially more nutritious.. Aeroponics is able to produce large numbers of minitowers in one generation that can be harvested sequentially, eliminating the need for field production, thereby reducing costs and saving time. Aeroponics was used to produce tree saplings (*Acacia magnum*) with *arbuscular mycorrhiza* (AM) fungi inoculation. The well-aerated root environment of aeroponics was beneficial for root initiation and subsequent root growth in woody (*Ficus*) and herbaceous (*Chrysanthemum*) cuttings.

### 2. Existing system

The existing system for Aeroponic vertical indoor framing is a farming that involves growing crops in layers that are piled vertically. Aeroponics is a method of growing plants without soil. Vertical indoor farming is climate controlled so it can be done year-round regardless of environmental challenges. Emerging problems of food security, urbanization, farmland shortage, food miles increased greenhouse gas emissions focuses on the need for vertical farming physiological constraints that occur within hydroponic systems. This paper presents a methodology for developing the

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plants are submerged in a nutrient-rich mist solution. This study challenges is cultivating the plant by organic farming natural nutrients.

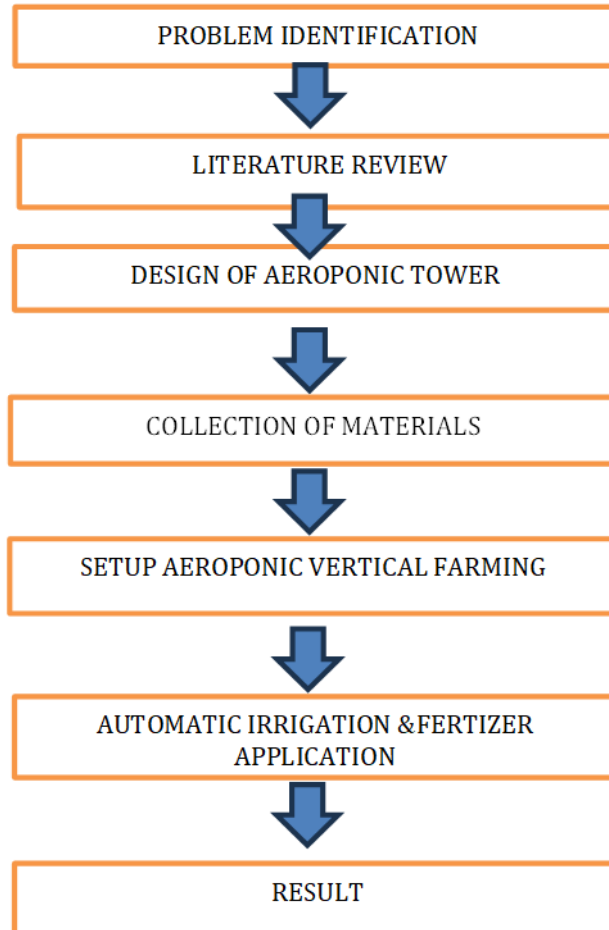
### Objectives

Vertical farming involves using controlled growing and nutrition systems, LED lighting, and layers of indoor plant growth.

This type of agriculture has the benefits of using less land to raise more food and avoiding chemicals.

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### 3. Methodology



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### 4. Design and analysis

We design aeroponic tower which utilizes the vertical space for reduce time requirement and labour cost.

#### 4.1. Collection of material

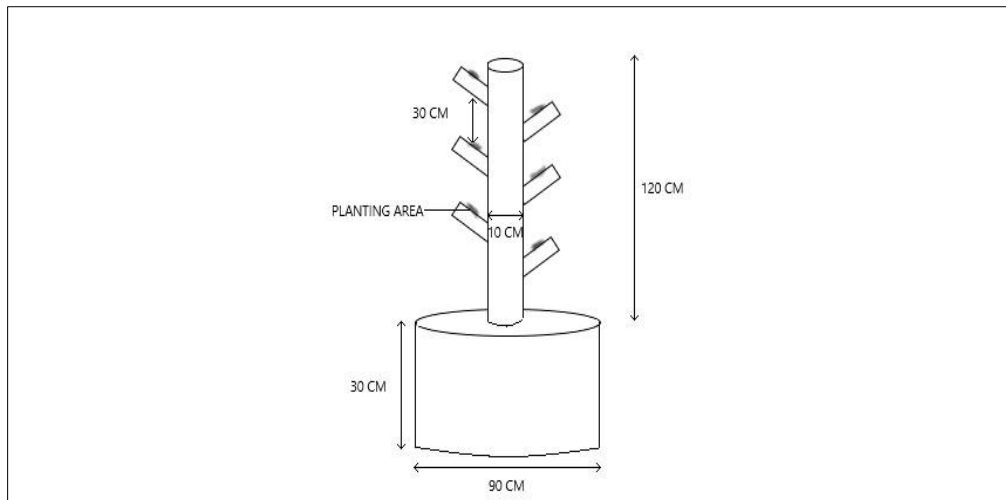
We collect the material Pre - Chamber, An automatic timer, High pressure pump, A nutrient solution tank, Spray nozzles, Supporting stand, Net pots, LED Light.

#### 4.2. Setup of aeroponic farming

Aeroponic farming equipment includes a range of specialized tools and systems designed to facilitate the growth of plants in an aeroponic tool.

### 4.3. Fertilizer application

In aeroponic system where water and nutrients are recycled, it is important to measure the acid/base or pH measurement to allow plants to absorb nutrients. Aeroponic using spray to nourish roots use much less liquid resulting in easier management of nutrient concentration with greater pH stability.



**Figure 1** design on Aeroponic tower

### 4.4. Problem Identification

- Hand- Clogged nozzles are one of the most common problems in aeroponics, but it's solved by simply cleaning filters, pumps, tubes, and fillings.
- Mister spray heads may also tend to clog and not produce mist when needed.
- High investment cost.

## 5. Literature review

Development many studies have clearly shown that aeroponics promotes plant growth rates through optimization of root aeration because the plant is totally suspended in air, giving the plant stem and root systems access to 100% of the available oxygen in the air. Droplet size and frequency of exposure of the roots to the nutrient solution are the critical factors which may affect oxygen availability.

## 6. Proposed design

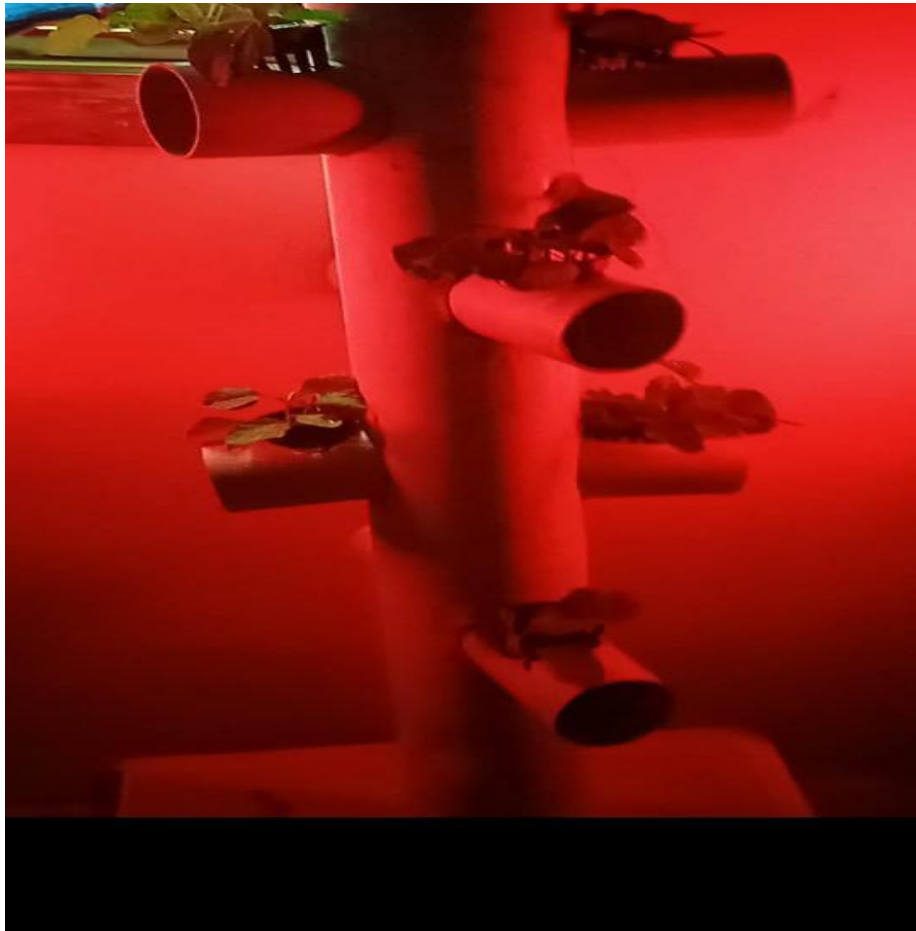
Design is aeroponics system uses nozzles and pumps as a lower pressure pump is utilized, this system must bring the water up from the reservoir before spraying. Nozzles that are fed water from a low-pressure pump spray water down onto the roots in a way to rain. The result is a very natural feeling water delivery system. The water that falls onto the roots then drips down into a pots and is fed back into the main nutrient reservoir to be used again to plants. The more simple systems that you can work with is a high-pressure aeroponics system. The main source of this system is a single reservoir with plants placed into a lid. An external pump is used to create a high-powered force. The reservoir bottom feeds a nutrient solution into a pump that pushes the water up into a line of spray nozzles aiming at the exposed roots of the plants. For plants that are meant to exist for their entire lives in the aeroponics system, be sure to position them at the end of the holder so they have a clear upward growth path. Alternatively, reserve your best to-be-transplanted plants for the top of the tower since there is no chance of stem bending in the plant. Plant holders inserted into the sloped sides of the pyramid might have plants in them that grow in a slightly slanted manner. For plants that are meant to exist for their entire lives in the aeroponics system, this is fine! If you are planning on transferring plants later, be sure to position them at the end of the holder so they have a clear upward growth path. Alternatively, reserve your best to-be-transplanted plants for the top of the pyramid since there is no chance of stem bending there.

## 7. Result and discussion

### 7.1. Efficiency Testing

**Table 1** Efficiency Testing of Traditional and Aeroponic methods

S.No	Traditional Method	Aeroponic method
1.	Grown under climatic condion.	Grown under controlled conditions.
2.	A Risk management, resilience.	Able to cultivate plants out of the atmosphere.
3.	Traditional variety selection by farmers.	Aeroponic presents great advantages over traditional agriculture.
4.	Most farming damages the environment.	Minimal pollution and ecosystem degradation.
5.	Water usage can vary, but generally is higher.	Fewer water resources are used.



**Figure 2** Aeroponic method of growing plants.

Our project was farming through vertical aeroponics technique which is indoor farming. Our next step is to check the growth in this medium, we aim to observe its growth with the goal of developing a cost effective technique. To evaluate the efficiency we compare it to the plant growing in the soil medium. From these results, the yield in vertical aeroponics technique is double the plant grown in the soil medium. Its global adoption reveals its potential to revolutionize modern agriculture and contribute to meeting the zero-hunger goal of the sustainable development goals, especially in urban areas where traditional farming might be challenging. This shows the technique is very efficiency and significant. This method can be very useful to all. This can be lead to high income to farmers and shows high results.

## 8. Conclusion

The Aeroponics vertical indoor farming growing allows plants and crops to grow without the use of pesticide and thus it will be disease free. The crops will grow in a healthy manner as the aeroponics system is very similar to nature environmental condition. Aeroponics is conducted in air combined with micro- droplets of water, land and nutrients, so the aeroponics system is the way of future, making cultivation of crop easier. The need for soil-based farming is being largely challenged by new high tech cultivation techniques such as aeroponic. When its comes to growing crop production, vertical farming is becoming increasingly popular. Soil and water constrained areas and the poorest and landless can benefit greatly from vertical farming, which allows crops prefer coriander, green leaves and short-lived crops like vegetables to be grown year-round in very small spaces with no labour requirement. Overall, this technique leads to increased productivity, cost savings, and better outcomes compared to soil cultivation.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

### Author's contributions

All authors contributed equally to the conception and development of the work

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## References

- [1] Aeroponics Soilless Cultivation System for Vegetable Crops P Gopinath\*, P. Irene Vethamoni and M. Gomathi Department of vegetable crops, HC & RI, TNAU, Coimbatore - 641 003 Chem Sci Rev Lett 2017, 6(22), 838-849 Article CS07204.
- [2] A smart aeroponic system for sustainable indoor farming Benedetta Fascioloa \*, Ahmed Awoudaa, Giulia Brunoa, Franco Lombardia a Politecnico di Torino, Corso Duca degli Abruzzi 24, Torino 10129, Italy 2212-8271 © 2023 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license Peer-review under responsibility of the scientific committee of the 30th CIRP Life Cycle Engineering Conference 10.1016/j.procir.2023.02.107.
- [3] Design and development of smart vertical garden system for urban agriculture initiative in Malaysia, Munirah Hayati Hamidona, Samsuzana Abd Aziza\*, Tofael Ahamedb, Muhammad Razif 82:1 (2020) 19–27 | www.jurnalteknologi.utm.my eISSN 2180–3722.
- [4] Hindawi Journal of Sensors Volume 2018, Article ID 8672769, Monitoring and Control Systems in Agriculture Using Intelligent Sensor Techniques: A Review of the Aeroponic System. Imran Ali Lakhari, 1 Gao Jianmin, 1 Tabinda Naz Syed, 1 Farman Ali Chandio, 1 Noman Ali Buttar, 1 and Waqar Ahmed Qureshi
- [5] Vertical farming: The future of agriculture: A review Mohd Salim Mir, Nasir Bashir Naikoo, Raihana Habib Kanth, FA Bahar, M Anwar Bhat, Aijaz Nazir, S Sheraz Mahdi, Zakir Amin, Lal Singh, Waseem Raja, AA Saad, Tauseef A Bhat, Tsultim Palmo and Tanveer A Ahngar.