



# Soilless Farming Techniques

## Introduction

- **Soilless Cultivation** generally refers to any method of **growing plants without soil as a rooting medium.**
- **Need of Soilless Cultivation:**
  - **Ensuring Food Security for the Increasing Population:** To ensure global food security to meet the demands under uncertainty as [COVID-19 pandemic](#) and increasing population, food production must rise by 60% by 2050.
  - **Depletion of Resources for Traditional Farming:** The natural prerequisites of agriculture, namely arable land and water, have been depleting with rapid urbanization across the globe.
    - To feed the increasing population, not only does the productivity of food crops need to be increased in the existing arable land, but alternative farming techniques need to also be encouraged.

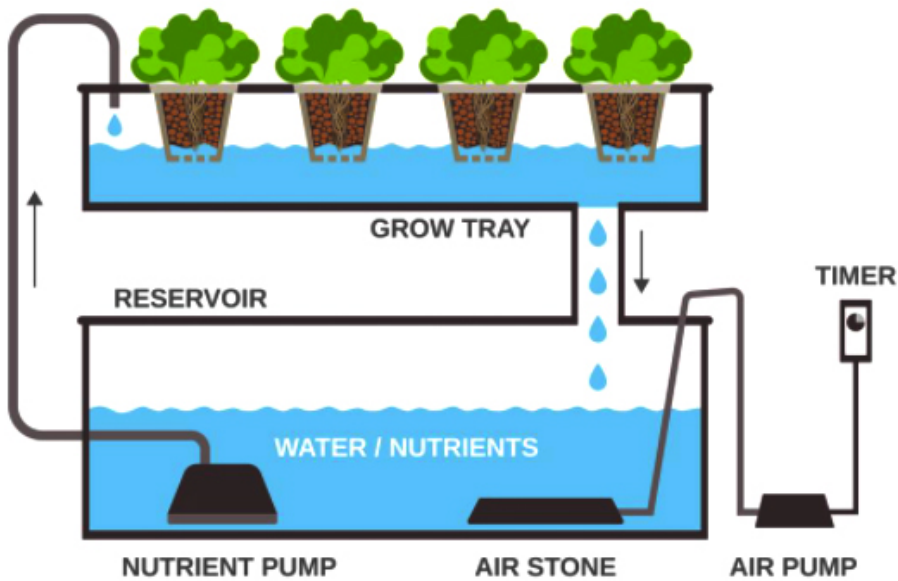
## Types of Soilless Farming

### Hydroponics

- **Definition:** Hydroponics is a method of growing plants in a **water-based, nutrient-rich solution.**
- **Methods:** In this method, the root system is supported using an **inert medium** such as **perlite, clay pellets, peat moss or vermiculite.**
  - The main purpose is to provide access to oxygen which is essential for proper growth.
- **Advantages:**
  - **Land and Water Efficient:** The hydroponic farming technology with closed water loop systems is a **viable option for farmers with limited access to land and water.**
  - **Suitable for Urban Areas:** The significance of soilless systems increases many folds when it comes **to urban and peri-urban areas where the arable land is polluted.**
  - **Lower Resource Consumption:** Lower and more efficient resource consumption allows this alternative farming technique **to be adopted by a variety of stakeholders.**
  - **Higher Yield:** According to the [Food and Agricultural Organisation \(FAO\)](#), the **vegetable yield of soilless systems is 20-25% higher** than in traditional systems as the number of plants per square metre is higher.
- **Drawbacks:**
  - **Much Time and Attention Required:** The **water needs to be replaced at regular intervals** as standing or recirculating water makes it easier for plant disease to spread if **pathogens enter the water supply.**
  - **Water and Electricity Intensive:** Water and electricity are the two major factors in Hydroponic farming, in **absence of adequate water supply or stable electricity,** the **Hydroponic system won't thrive well.**

# HYDROPONICS

## infographics elements



### Aeroponics

- **Definition:** Aeroponics is an environment-friendly way of farming in which the **roots are suspended in the air** and **plants grow in a humid environment** without soil.
- **Method:** It is a variation of hydroponics where both **growing medium and flowing water are absent**.
  - The roots of the plants, in this method, are sprayed with water and nutrient solution.
  - This technique enables farmers to **control humidity, temperature, pH levels and water conductivity** inside a greenhouse.
- **Advantages:**
  - **Decline in Water, Fertilizer and Pesticide Usage:** The **water usage in the system reduces by 98%** and **fertiliser usage by 60%**.
    - **Pesticides are fully eliminated** as the absence of soil reduces chances of diseases.
  - **Faster Yield:** The **aeroponically grown plants can be harvested three times faster** and the yields are more consistent.
    - As nutrients are sprayed onto the plants and roots, there's plenty of oxygen and other gases in the growing chamber for roots to absorb.
  - **Prevention from Climatic Impacts:** Farming in a confined space gives the farmer **control over pest and locust attacks and sudden heat waves**.
- **Drawbacks:**
  - **High Technology-Dependency:** Aeroponics is far **too dependent on technology**.
    - If any component of the system fails or breaks, it would render the entire system completely useless.
  - **Deep Understanding Required:** One has to be **able to set up and run the Aeroponic**

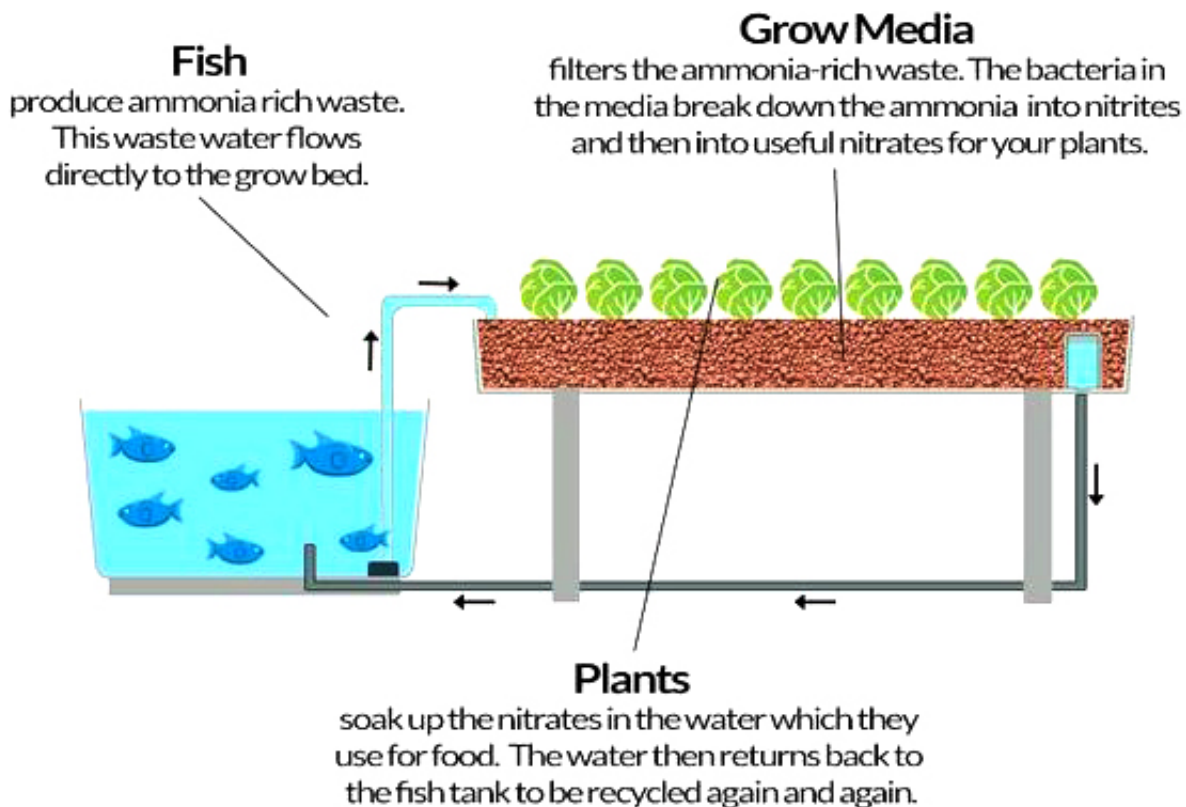
**System** and also be able to **create the perfect nutrient solution** for the plants otherwise the plant might die.

- **Expensive Technique:** Aeroponics is highly costly and hence not affordable for everyone, setting up such a system can cost around **Rs. 8 crore per hectare**.
- **Requires Constant Monitoring:** The plants must receive **constant attention to their pH levels** and nutrient density ratio as there is no growing medium available to do this work.

## Aquaponics

- **Definition:** Aquaponics is a system that **combines hydroponics and aquaculture** within a closed system.
- **Methods:** There are three biological components in the aquaponics process: **fishes, plants, and bacteria**.
  - The system represents a **symbiotic relationship** between the plants and the fishes; the fish feces is used as fertilizer for the plants, and the plants clean the water for the fish.
- **Advantages:**
  - **Environment-Friendly:** Two agricultural products (fish and vegetables) are produced from one nitrogen source (fish food).
    - Such a system also **prevents aquaculture waste from polluting nearby watersheds**.
  - **Organic Fertilizer:** Aquaponics farming doesn't involve pesticides or herbicides as these chemicals may kill fish.
    - In this system, the **fish feces is the nutrient-rich fertilizer for the plants**.
  - **Extremely Water Efficient:** Aquaponics can **result in huge water savings** contrasted with a garden grown on the ground (80-90% water savings).
  - **Space Efficient:** An aquaponics system **can be set on any scale**.
    - It can be as small as an aquarium and as big as a greenhouse commercial farm.
- **Drawbacks:**
  - **More Complex System:** Supporting **ideal environments for both plants and fishes** make aquaponics a more complicated endeavor than hydroponics.
  - **Limited Application:** It is **not suitable for tuberous plants and root vegetables** as they perform most of their growth within soil and aquaponics uses water as a substitute for soil.
  - **Multiple Points of Failure:** In aquaponics, the **conditions where the system can fail are more;** the fish can die if they do not have the right conditions and the plants are also susceptible to pathogens.

# How An Aquaponics System Works



## Way Forward

- **Encouraging Soilless Techniques for Food Security:** Strengthening food production and distribution systems is key to fighting hunger and tackling the burden of malnutrition.
  - The development of aquaponics and hydroponics embrace all dimensions of food security.
  - The government shall consider these methods as viable alternatives for traditional farming and **provide assistance in making these techniques affordable to a larger number of farmers.**
- **Providing Knowledge and Skills:** While these alternative techniques can be utilized by a variety of stakeholders, from household farmers and small- to large-scale farmers, **specific knowledge and skills must be developed** for safe, successful and sustainable implementation.
- **Facilitating Sustainable Farming:** In a country like India, there is a constant pressure on agricultural land and its conversion to other uses.
  - With Aeroponics and Hydroponics, the discussions around farming can move away from land constraints to **focussing more on sustainable farming techniques.**
- **Way Ahead for Schools:** Such systems are difficult but not impossible to maintain, the prerequisite is to have at least basic understandings of these systems.
  - Schools might also encourage students to **install Aquaponic systems at schools as their practical task for core [STEM](#) subjects like Maths, Biology, Chemistry, and Engineering.**

