

Vertical Farming

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INTRODUCTION

Vertical farming is cultivating plants in vertically stacked layers and vertically inclined surfaces. Gilbert Ellis Bailey coined the term “vertical farming” in 1915, and wrote a book titled “Vertical Farming”. In 1999, Professor Dickson Despommierin came up with a plan of vertical farming. This farming utilizes less distance for growing more food. In 2019, the vertical farming has been introduced in India. In vertical farming crops are protected from pests and diseases because crops are grown in a controlled environment.

Three systems used in vertical farming

1. Hydroponics

Hydroponics involves growing plant in nutrient solution that is free of soils. In hydroponic systems, the roots of plants are submerged in liquid solutions containing macronutrients and also, inert (chemically inactive) mediums such as gravel, sand, and sawdust are used as soil substitutes to provide support for the roots. The vital advantages of this method are that it reduces soil-related cultivation problems like soil borne insects, pest and diseases and have the ability to increase yield per area and reduce water usage.

2. Aeroponics

In 1990’s, the term aeroponics was coined by the National Aeronautical and Space Administration (NASA). In aeroponics liquid solution with nutrients is misted in air chambers where the plants are suspended. Aeroponics is certainly the most sustainable technique for soil-less production, using up to 90% less water than conventional hydroponic systems and requires no substitute of growing medium.

3. Aquaponics

The term aquaponics is coined by combining two words: aquaculture, which refers to fish farming, and hydroponics—the technique of growing plants without soil. It is a bio-system that integrates recirculated aquaculture with hydroponic vegetable, flower, and herb production to create symbiotic relationships between the plants and the fish.

Aquaponics is used in smaller-scale vertical farming systems.

The present scenario of vertical farming

Vertical farming involves increasing crops vertically in controlled atmosphere using technology like LED lighting, heating, ventilation and air-conditioning (HVAC) systems, sensors and smart software, drones, mobile apps to maintain total control over the environment. In urban areas, food crops can be cultivated simply by planting in vertically stacked layers in order to use minimal energy and to save space and water for irrigation. The National Aeronautics and Space Administration (NASA) researchers have seen a appropriate method for growing food in outer space as hydroponics. They have been doing well in producing vegetables such as onions, lettuce, and radishes. Association for Vertical Farming is working on its sustainability in Columbia. Vertical farming in India is restricted as at present the focus is mostly to produce only high value crops through vertical farms. The land availability is shrinking for crop cultivation in India and it is becoming difficult to feed the increasing population with the increase in population. Thus, scientists and entrepreneurs are working on the concept of vertical farms by growing crops in soilless condition where food crops can be grown in multi storied buildings of metropolitan cities of New Delhi, Mumbai, Chennai and Kolkata without the use of chemicals and pesticides. The Indian Council of Agricultural Research (ICAR) has been working with scientists from Kolkata on a

module to grow fruits and vegetables in multi storied building in 2013. Punjab also has succeeded in producing potato tubers through vertical farming. The scientists have also mentioned that growing fruits and vegetables in soilless condition and in a controlled environment will provide another advantage as most of the disease producing microbes come from the soil, therefore, the use of pesticides would be minimised. A Bengaluru based startup Greenopia is selling kits with smart self-watering pots, enriched soil and the right seeds.

Benefits

The first major benefit of vertical farming is producing extremely high yields per available land or area. Food is produced throughout the year without the risk of floods, heavy rains, uneven rains, hail and snowfall, drought, dry spells, extreme high temperatures, cold waves, epidemics of pest and diseases, *etc.*

70 to 95% minimum water is use, in comparison to traditional farming. There is no problem of pests and any other diseases in vertical farming because 90% or no soil is used in this method. Organic food is produced as it is free from pesticides and air pollution.

Drawbacks

Establishment cost in vertical farming is very high. LED light release enormous heat so it creates a problem of maintaining the temperatures in summer months especially. In vertical farming, properly dispose of waste is required. Skilled workers will be unavailable initially and will require to be trained.