

VERTICAL FARMING FUTURE OF AGRICULTURE

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By 2050, the world's population is expected to grow by another 2 billion people and feeding it will indeed be a huge challenge. Due to industrial development and urbanization, we are losing arable lands nearly every day. In recent researches, scientists have found that the earth has lost a third of its arable lands over the last 40 years. We are really unaware of the fact that how much more we are going to lose in the next 40 years. Demand for food is increasing and arable land is decreasing- one of the greatest challenges waiting to be tackled.

WHAT IS VERTICAL FARMING?

It is the practice of growing crops in vertically stacked layers. It is a multi-storey structure, in which large scale intensive agriculture production takes place, using stacked inclined surfaces to grow food crops and sometimes to raise livestock and fish. It often incorporates controlled-environment agriculture, which aims to optimize plant growth. It facilitates viable agriculture production inside buildings. Vertical Farming is basically a form of urban agriculture. The crops are grown on vertically inclined surfaces. This modern agriculture system uses indoor farming techniques. The growth is regulated by artificial control of temperature, light, humidity and gases. This is very much similar to green houses. The primary goal here is to achieve maximum crop yield in a limited space. Being indoors, the crops are not subjected to seasons and hence give high productivity year-round. Lettuces, tomatoes and green leafy crops can be grown by this method. The modern concept of vertical farming was proposed by Dickson Despommier. Japan has been one of the earliest pioneers in vertical farming. It holds the largest share in the global vertical farming market.



TECHNIQUES INVOLVED IN VERTICAL FARMING

It is a soilless cultivation which involves techniques like hydroponics, aquaponics and aeroponics.

HYDROPONICS

This practice refers to growing of crops without soil by using mineral nutrient solutions in an aqueous solvent [hydro (water) +ponos (labor)]. In the absence of soil, water provides nutrients, hydration and oxygen to plant life. This system fosters rapid growth, stronger yields and superior quality. Hydroponic innovations have proven that direct exposure to nutrient filled water can be an effective and versatile method of growth than traditional irrigation. It includes- Growing media Air stones and air pumps Net pots. The most common hydroponically grown crops are- Lettuce, tomatoes, peppers, cucumbers, strawberries, celery, water cress and some herbs.

AQUAPONICS

Aquaponics system takes hydroponics one step further. It is defined as a system of aquaculture in which the waste produced by farmed fish or other aquatic creatures supplies the nutrients for plants grown hydroponically, which in turn purifies the water. It is basically conventional aquaculture combined with hydroponics in a symbiotic environment. pH is an important part of aquaponics because it involves 3living organisms- plants, fishes and the microorganisms in the water. A neutral pH from 6.8-7.2 is good for aquaponic garden. The fishes used in aquaponics are freshwater fishes (e.g.- tilapia and barramundi), trout, snails and shrimps. Aquaponically grown crops include- lettuce, kale, watercress, arugula, mint, herbs, okras, spinach, tomatoes, cucumbers, cabbage, cauliflower, broccoli and beans.

AEROPONICS

It is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. The word aeroponics is derived from the Greek meanings of air and ponos (labour). This method differs a bit from other vertical farming. Aeroponics simply dispenses with the growing medium, leaving the roots to dangle in the air, where they are periodically puffed by specially designed misting devices. In this system, seeds are planted in pieces of foam stuffed into tiny pots, which are exposed to light on one end and nutrient mist on the

other. The foam also holds the stem and root mass in place as the plants grow. The basic components of this system include an enclosure to hold in the humidity and prevent light from reaching the roots and a separate tank to hold the nutrients solution.

TYPES OF VERTICAL FARMING

Based on structure, there are basically 3 types of vertical farming:

- 1) Building based vertical farms
- 2) Shipping container Vertical farms
- 3) Deep Farms

BUILDING BASED VERTICAL FARMING

It is constructed in abandoned buildings in cities e.g. Chicago's "The Plant" vertical farm that was constructed in old pork -packing plant. New building construction is also used in vertical farming such as the new multistory vertical farm being attached to an existing parking lot structure in downtown Jackson Hole, Wyoming.



SHIPPING CONTAINER VERTICAL FARMS

These farms use 40-foot shipping containers, normally in service carrying goods around the world. The shipping containers serve as standardized modular chambers for growing varieties of plants. They are being refurbished by several companies into self-contained vertical farms, complete with LED lights, drip irrigation systems and vertically stacked shelves for starting and growing a variety of plants. They include computer controlled growth management system that allows users to monitor all systems from a mobile or computer.

DEEP FARMS

It is vertical farm built from refurbished underground tunnels or abandoned mine shafts. Deep farms require less energy for heating as temperature and humidity underground are generally temperate and constant. Deep farms can also use nearby groundwater to reduce the cost of water supply. Despite low costs, a deep farm can produce 7-9 times more food than a conventional farm above ground on the same area of land[according to Saffia Riffat, chair in Sustainable Energy at the University of Nottingham] Coupled with automated harvesting systems these underground farms can be fully self-sufficient

ADVANTAGES

- » Reliable year round crop production
- » Unaffected by adverse weather conditions
- » No chemicals or pesticides
- » Environment friendly
- » Better use of space
- » Minimizes water use

At first blush these farms sound great, doesn't it? But there are many challenges to be overcome.

DISADVANTAGES

- Problems are created related to economic viability due to costs
- Possible environmental and energy impacts occur
- There is potential for disruption to the village and its communities
- The need for advanced technologies and complex processes
- The artificial environment can fail at any point

It is concluded that Vertical farms in urban areas are a relatively new phenomenon, but interest in this field is growing day by day because pressure on agricultural land from a rising global population is necessitating the maximization of food production per unit area of cultivation. Vertical farming approaches attempt to provide a greater crop yield per square meter of land. It is estimated that by 2050 the world's population will have boomed to 9.1 billion people. Consequently we are seeing the answer to this emerging problem in vertical farming.

