

Vertical Farming Sustainable or Not?

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SUMMARY

Vertical farming using CEA (controlled environment agriculture) technology has achieved its goal of producing more food per square meter. The soil-free techniques i.e., Aeroponics, Hydroponics, Aquaponics are its mediums. It is the practice of manufacturing food on vertically inclined surfaces. It was first introduced in Armenia. Crops like lettuce and herbs like basil etc are produced using vertical farming. It is surely superior to the traditional method of farming in terms of production and area, with certain cons like the abundant amount of energy requirement. India in the year 2019 has also adopted this technique and successfully grown different crops.

INTRODUCTION

Vertical farming uses vertically inclined surfaces to supply farming vegetables and other foods. The vertically stacked layers are inclined to different structures viz skyscraper, shipping container or repurposed warehouse. Indoor farming techniques, man-made controlled temperature, light, humidity, and gases are basic components of vertical farming. The natural sunlight in vertical farming is due to the metal reflectors and artificial lighting, making it different and parallel from the greenhouse. A brief on vertical farming is listed below for an improved understanding.

Who, When, and Where?

Vertical farming came into existence in 1915 by an American geologist Gilbert Ellis Bailey. At first, vertical farming was thought to be similar to rooftop farming. But to remain in mind the primary example of vertical farming dates back to Armenia in 1951. The now used concept of vertical farming was proposed by Professor Dickson in 1999. It wasn't seen as a key to feed population till the time prof. Dickson posed a difficult question to medical ecology.

It's Goals and Therefore the Way It Functions?

The primary goal of vertical farming is to provide more crops in exceedingly limited space. There must be towers filled with cultivated crops, additionally, a decent fusion of natural and artificial lights to remain up the correct light level within the realm. To boost lighting efficiency, rotating beds technology is commonly also used.

There are 4 critical areas by which vertical farming works

1. Physical layout, 2. Lighting, 3. Growing medium, and 4. Sustainability features.

- Firstly, the first goal of vertical farming is to produce more food per centare. To accomplish this goal, crops are cultivated in stacked layers in an exceedingly tower life structure.
- Secondly, an ideal combination of natural and artificial lights is employed to need the care of the right light level within the realm. Technologies like rotating beds are accustomed improve lighting efficiency.
- Lastly, the mediums used are different viz aeroponics, hydroponics, and aquaponics moss or coconut husks and similar non-soil mediums are quite common in vertical farming. Different sustainability techniques are used to lessen the use of energy for production proportionately reducing cost. Vertical farming uses 95% less water.

Types of Vertical Farming?

Instead of using soil as a medium vertical farm uses soil-less mediums those are -hydroponic, aeroponic, or aquaponic, below is the description of the above-mentioned mediums.

Hydroponics:

There is an alteration in the medium which is dominant, hydroponics does not involve the growing of plants in soil, nutrient solutions are made use to grow or produce crops. The plant roots are submerged within the nutrient solution, which is typically monitored and circulated to verify that the right chemical composition is maintained.

Aeroponics:

All the credit goes to National Aeronautical and Space Administration (NASA) to innovate aeroponics. The fascination of NASA in the 1990s, made them find better ways about how plants are grown in space and named it aeroponics in which plants are grown in air. It is unusual in the world of vertical farming, but it has attracted the interest of a lot of people. Also, keep in mind aeroponic system is much more efficient than other types of vertical farming, consumption or exploitation of water is less than 90% than many effective hydroponic systems. The crops which are grown in this method have been recorded to uptake a greater amount of minerals and vitamins proportionately helping plants to be healthier and making them highly nutritious for consumption.

Aquaponics:

An aquaponic system takes the hydroponic system one step further, combining plants and fish within an identical ecosystem. Fish are grown in indoor ponds, producing nutrient-rich waste that's used as a feed source for the plants within the vertical farm. All the responsibility of purifying the water is on plants, which is afterward lead to the Pisces ponds. Although aquaponics is used in smaller-scale vertical farming systems, most commercial vertical farm systems target producing just some fast-growing vegetable crops and don't include an aquaponics component. it helps in simplifying the issues related to production and increases efficiency. It might gain popularity once the standard of the hydroponic system has been raised. Vertical farming systems are further classified by the type of structure that houses the system.

Building-based vertical farms are often housed in abandoned buildings in cities, like Chicago's "The Plant" vertical the farm that was constructed in an old abandoned place. New building construction is additionally employed in vertical farms, just like the new multistorey vertical farm being attached to an existing car parking zone structure in downtown Jackson Hole, Wyoming.

These vertical farms use 40-foot shipping containers, normally in condition carrying goods in the world. Shipping containers are being refurbished by several companies into self-contained vertical farms, complete with 40-foot containers are used for shipping within the vertical farms, for carrying varieties of stuff within the world. All LED lights, drip-irrigation systems, and vertically stacked shelves for starting and growing a ramification of plants. These self-contained units have computer-controlled growth management systems that allow users to access systems remotely from a wise phone or computer.

What Crops are Grown in Vertical Farming?

Plants and crops which require less light to grown are suitable, also plants that have a fast cycle, and thrive at high planting density should be chosen to grow in vertical farming. The leafy greens, herbs, medicinal plants, and transplants have opted as they're usually 30cm or shorter in stature.

The crops that are usually grown are;

1. Lettuce
2. Chard
3. Cabbage
4. Rocket

Herbs are another popular choice for vertical farmers, gratitude to several of the identical reasons as salad crops. Again, many of them are 'fast-turn crops, meaning that the time between sowing and harvesting is relatively short, so you will be able to sell more products annually. Basil is extremely recommended for vertical farmers, as it's in demand all year round. It also needs relatively high temperatures. Basil does well when grown hydroponically because it completes up with the next concentration of oils, which intensifies the flavour. Common vertical farm herbs include

- Basil
- Mint
- Chives
- Parsley

You will be ready to also grow slow-turn herbs, like oregano and rosemary. While you won't have the utmost amount of product to sell, you'll charge more per kilo. The cannabis market has commenced in recent

years you will be ready to now find cannabinoids in everything from health products to face creams. because the expansion period is longer than salad, the worth tags are generally high, also they're well definitely worth the wait. They also need harvesting less frequently, which could reduce staffing costs. Cannabis plants are notoriously temperamental and want finely tuned growing conditions to thrive. In other words, they need a controlled environment, form of a vertical farm. And it's crucial to seem at that environment using high-tech sensors to reduce the danger of losing a harvest.

Comparing Traditional Methods and VF

According to the researchers, vertical farming on average produces 20 times higher crop yield while using 99% less land. Also, vertical farming uses 95% less water and 0 chemicals. The benefits seen here would lead many to conclude that vertical farming is superior to traditional farming. There's a crisis on the way that not many people are conscious of because the earth's population is increasing, so should the food production level. It's uncertain but the requirement isn't fulfilled, and that we notice that the remaining arable land i.e., 30% isn't being employed and won't be suitable to be used within the coming 40 years. One of all the solutions to the present problem is vertical farming.

Vertical Farming	Traditional Farming
<ul style="list-style-type: none"> • Zero pesticides and chemicals are taken into consideration thanks to the controlled environment. 	<ul style="list-style-type: none"> • Soil chemistry is a crucial aspect of crop production, henceforth the farmers began exploiting the chemical fertilizers to scale back the results of pests and diseases.
<ul style="list-style-type: none"> • 95% less water is needed for the production. So, those are i.e., redirected to the concerning areas. 	<ul style="list-style-type: none"> • Irrigations should be applied to the crop depending upon its necessity concerning its stages of life.
<ul style="list-style-type: none"> • If we compare, vertical farming one acre is like 30 acres of traditional farming. 	<ul style="list-style-type: none"> • If we compare, vertical farming one acre is like 30 acres of traditional farming.
<ul style="list-style-type: none"> • It has to be pollinated artificially, VIZ is pricey and not time-efficient more human to plant contact is needed. 	<ul style="list-style-type: none"> • Not everyone must be pollinated manually, hence, the human to plant contact is minimum and is time-efficient.
<ul style="list-style-type: none"> • As is grown in small places, like cities and warehouses so it's freshly available for consumption for the population living in urban areas. 	<ul style="list-style-type: none"> • The produce isn't freshly available as it must be transported from the place of production.
<ul style="list-style-type: none"> • Expenses of installation and management are high hence, makes it less accessible. 	<ul style="list-style-type: none"> • As it requires less capital to start, makes it affordable for poorer countries.

When And Where In India Was Vertical Farming Was Introduced?

Vertical farming was first introduced in 2019 in India. Bidhan Chandra Krishi Vishwavidyalaya in Nadia has successfully grown brinjal and tomato. Punjab also has a successful story of producing potato tubers by using the vertical farming technique. Ideal farms, an Indian design-in-tech company is producing vertical farms grow and is preferred because their food is organic, of a prime quality, and also the supply is predictable. Greenopiasis, a Bengaluru-based start-up sells kits that have self-watering pots, soil, and also required seeds. the pots have sensors that refill moisture in the soil when needed and also notify when there is a need for watering manually. Another example is the Mumbai-based start-up firm U-Farm Technologies which uses hydroponic gardening techniques for the customization of modular for an individual unit or a supermarket. More and more start-ups in vertical farming are arising in India.

CONCLUSION

Vertical farming is sustainable and we can't debate on that, certainly it produces more crops per square meter and is more efficient in terms of space. But it has its cons, those are, it needs more energy to produce to carry on the process of production. More energy means more investment, making it less affordable for developing

countries or poorer countries. The space requirement is very ample as compared to other methods of farming or traditional methods of farming. The water requirement is less comparatively. Metropolitan certainly can exploit this technique and use abandoned warehouses, malls, homes, etc to produce desired crops.

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