



Vertical Farming- A Futuristic Approach for Crop Production

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INTRODUCTION:

Creation of concrete forests rather than the green forests by the people, climate change, expansion of urban areas, increasing the area of dryland, decreasing in the fresh water supply and population growth results in diminishing the per capita land availability frequently. FAO (Food and Agriculture Organization) reveals that per capita available land is forecasted to decrease by 2050 to one third of the amount available in 1970. World population is estimated to be 9 billion by 2050 this leads to growing the demand of food products while the area under cultivation is static one. Now a days greater than 50% of the people are living in urban areas and 80% of the available land is used across the globe. Overuse of natural nonrenewable resources results in diminishing the environmental balance. Ecosystem is altered and soil degradation is going on due to overuse of chemical fertilizers and other chemical substances.

All the above-mentioned problems have a bit solution named vertical farming. An innovative approach is vertical farming in which hydroponics (providing nutrient solutions to the crop root zones without soil system), aeroponics and cutting-edge greenhouse methods are used. These technologies are used with vertical farming as because the transportation of soil from ground to high building is very much hectic as well as expensive. Normally according to climatic condition of a particular area the crop is chosen for cultivation but in case of vertical farming it is not necessary as vertical farming associated with the controlled environmental condition and provide better quality of yield/produce though out the year irrespective of season.

WHAT IS VERTICAL FARMING?

The term Vertical Farming is coined by Dickson Despommier. It is a noble approach in which indoor growing of the crops combined with high rise multileveled design. Genetically improved varieties, short duration, more profitable and insect pest disease resistance are taken for vertical farm which definitely yield more produce with quality. It has some peculiar features such as use of recycled water, automatic temperature control, humidity maintenance, use of solar panel LED light illumination etc. for better crop growth. Shipping container, warehouses, waste plastic bottles, broken earthen dishes are taken as the container for plant growth medium. Mostly emphasis is given on use of pit moss and sphagnum moss as growing media besides soil. In advanced form hydroponics is used. LED is supply for giving the photosynthetically active spectrum of light to the plant in required amount. Humidity and temperature can be maintained according to the external environmental condition. Air conditioning done by supplying a balance rate of carbon dioxide and oxygen to the system. All the nutrients and water used in this system is recycled but never lost. Fertilizer, Pesticide, Herbicide requirement and transportation cost is measurable. It is not an imaginary concept; it is real one.

WHY THE VERTICAL FARMING IS NEEDED?

- ✓ To meet the food demand of over exploring population i.e.by obtaining more produce per unit area.
- ✓ To bring the sustainability and security in qualitative, nutritive food for future generation. Year round available of fresh produce and clean green gourmet (CGG) food.
- ✓ Expanding the agricultural land by adopting raising of the crops on high building.
- ✓ To conserve and efficient utilization of water, nutrients, energy, and other inputs. Reuse, recycle of harvested rainwater and nutrients and organic waste.
- ✓ To reduce the environmental stress/impact on the crops and protection from natural disaster.
- ✓ Maintaining the ecological balance and produce healthy foods for dietary purpose and resilient to climate change.

HOW THE VERTICAL FARMING WORKS?

Vertical farming is one of the modern farming technologies that uses controlled environmental condition during crop production to make most of the indoor farming techniques. This method involves controlling temperature, lighting, water, humidity artificially, all of these can be done indoors. The main purpose of this modern farming technique is to increase the crop production in a small space. Now if we want to understand how the vertical farming works, we have to consider the four essential aspects: physical arrangements, lighting facilities, growth medium and sustainable qualities.

The primary objective of vertical farming is to increase the food production per square metre. To achieve this target, crops are grown in tower-like living framework. Second, to maintain optimum light level in the space by combining natural and artificial light. Third, instead of soil, vertical farming utilises hydroponic growing materials like coconut shells, sphagnum moss and other non-soil media. Lastly, to balance the energy expenses of farming, vertical farming techniques incorporates several sustainable aspects such as aeroponics, hydroponics etc. In vertical farming, water consumption has decreased up to 95%.

Ways in which Vertical Farming can benefit our environment:

Vertical farming not only just increases the yield but also it offers the following significant ways by which it can benefit our environment –

- ✓ Vertical Farming is a space saving approach by growing staking layer of vegetation and increasing the yield of crop. Those who haven't access to backyard space, can grow their own produce to vertical farming.
- ✓ Controlled temperature, humidity and smart approach will help in decreasing water losses and consumption.
- ✓ Vertical farming allows us to cultivate multiple crops at once and increase our food production by maintaining the crop diversification.
- ✓ In contrast to the conventional farming, vertical farming enhances the crop's chances of success and decrease the crop losses caused by extreme weather conditions (temperature, rainfall, frost, wind), pest and diseases.



ADVANTAGES OF VERTICAL FARMING:

Vertical farming involves growing of crop plants in indoors, that's why this modern farming technique is also known as indoor farming. Obviously, there are some benefits of vertical farming. They are –

- ✓ It is an efficient and sustainable way of producing food as it needs less water than a traditional farm would need.
- ✓ Controlled environment of vertical farming reduces the external environmental impact.
- ✓ It is not reliant on the weather, that's why fresh produce can grow all the time throughout the year.
- ✓ There is a drastically increase in the crop production if full-year stability is maintained during production, by implementing efficient methods.
- ✓ Crop output per unit area of land is maximized through vertical farming.
- ✓ Protection from animals and invasive plant species.
- ✓ Maximization of profit as production cost is low.

THE FUTURE OF VERTICAL FARMING:

Vertical farming has been called “future farming” by many and definitely there is some good reason. According to the latest edition of the United Nations’ World Population Prospects, India is set to become the world’s

most populous country (1.515 billion in 2030) by the end of the decade, overtaking China (1.426 billion in 2030). So, we must feed such a huge population with the limited amount of arable land. In these aspects vertical farming can play a major role by efficiently utilising land and water and by increasing the crop production.

Supply chain strengthening, low production cost and access to new distribution channels are some of the reasons why a company might opt to vertical farming from the traditional farming. According to a report released by the World-Wide Fund for Nature (WWF), the vertical farming model has grown at an annual rate of more than 25% since 2018 and is expected to reach sales in the USD \$3 billion worldwide by 2024. USA is now the country with maximum number of vertical farms while this sector is blooming in many Asian countries including China, Singapore, Japan, Taiwan, and Thailand. So, in future there will be a huge scope of vertical farming in India for its ever-increasing population.

LIMITATIONS IN VERTICAL FARMING:

- ✓ For vertical farming, cost is a big hurdle.
- ✓ Buying an urban real estate to build a vertical farming can also be expensive.
- ✓ Expert requirement to set up a vertical farming project.
- ✓ Wrong set up could lead to a spread of pests and diseases.
- ✓ Only suitable for limited type of crops and some vegetables.
- ✓ Technology issues may cause huge problems.
- ✓ Pollination problems.

CONCLUSION:

Vertical farming is an emerging new technology aiming to increase crop yield per unit area of land in response to heightened pressure on agricultural production. New technologies such as hydroponic system, aeroponic system and pest free plant growth not only transformed the greenhouse industry but also has paved the new type of farming such as rooftop farming. This modern farming technique have numerous advantages over traditional farming, which includes more sustainability, adaptability, and efficiency, which is all made possible through controlled environmental system of vertical farming. In addition, vertical farming also provides new opportunities for architecture and urban designing. Furthermore, vertical farming is currently industry-led, with many independent start-up companies.

