



## Vertical Farming: Can It Really Feed the Future Cities of India?

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Dwindling land area, overuse of harmful pesticides, rising Indian population and surging health consciousness among consumers have paved way into a booming concept of vertical farming, in the modern era. Infact, vertical farming is no more a futuristic concept. It was practised 2500 years ago in the ancient Babylon. Plants were grown vertically on tiered terraces in the hanging garden. In the following article, we are going to explore in detail about vertical farming and unfurl answer to the question "Can Vertical Farming Really Feed the Future Cities of India".

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### Vertical Farming - Simplified

So, what is this vertical farming all about? Vertical farming is the art of growing crops in vertically and horizontally stacked layers. This concept more likely incorporates controlled-environment agriculture, by adopting soilless farming techniques such as hydroponics, aeroponics and aquaponics. Vertical farming can be practised in structures such as buildings, shipping containers, underground tunnels and even abandoned mine shafts. The modern concept of vertical farming was proposed in 1999 by Dickson Despommier, Professor of Public and Environmental Health at Columbia University. Despommier and his students came up with a design of a skyscraper farm that could feed 50,000 people. Although the design has not yet practically come into existence, it laid a strong foundation for revolutionizing present-day agriculture. As a result, farming which was once practised by less literate laymen, is now being taken as progressive startups by graduates with technical know-how. Agripreneurs could reap lakhs of turnover, not with the possession of acres of land, but even within a limited space. And this has been made possible only with the advent of the vertical farming concept.

### Vertical Farming Vs Conventional Farming: What Sets Them Apart?

Unlike traditional farming which is performed in an open field, vertical farming differs from it in certain ways. Here's the magic that happens inside:

- **Stacked Growing Racks :** Plants are grown in multiple layers as that of a cake slice. Consequently favouring an increase in productivity about 10-20 times per square feet, compared to conventional farming.
- **Mimics Natural Growth Factors :** Vertical farming allows systematic control of abiotic factors such as temperature, relative humidity, light intensity, nutrient delivery and CO<sub>2</sub> concentration. This ensures year-round production, whereas produce cultivated through conventional farming is hindered by aberrant weather phenomena.
- **Soil-less Production :** Unlike traditional farming which uses soil as a medium for nutrient and water delivery, crops are grown in vertical farming via hydroponic or aeroponic systems. Nutrients are delivered in the form of enriched solution directly to the roots in hydroponics, whereas in aeroponics, crops are misted with fine droplets.

- **LEDs as an Alternative to Sunlight** : Red and Blue spectrum LEDs are used in vertical farms, which is ideal for plants to perform photosynthesis.
- **Sensors and IoTs for Automation** : Thanks to the technology which allows easy monitoring of nutrient levels, water flow, pH, EC and plant health, to achieve maximum productivity. Indian farmers are slowly adopting AI and IoTs in their farms for automation, reducing human drudgery.

### Green Towers' Produce - Crops Suitable for Vertical Farming in India

Until now, procedures are standardized for growing only high-value vegetable crops and greens in the premises of vertical farms. Crops which possess shorter cycles, high market demand and premium prices are well-suited for commercial production in stacked layers. Crops which are best suited for growing in vertical farms are as follows:

- Lettuce
- Spinach
- Basil and Herbs
- Coriander and Mint
- Chillies
- Microgreens
- Tomatoes
- Strawberries



A frame vertical farm

### Strategic Benefits Driving Vertical Farming in India

- **Fresh Grown Produce within Cities** : Logistics and Supply chain can be narrowed down, as the produce grown in vertical farms of metropolitan cities such as Delhi, Mumbai, Bangalore and Chennai can reach consumers within hours of harvest. This ensures longer shelf life as well as higher nutrition in food produce.
- **Zero Pesticides** : As the environment is completely controlled in vertical farms, crops are produced absolutely pesticide-free, making them safer and healthier to consume.
- **Year-round Production** : External weather factors such as monsoon failure, drought, flood, cyclones, heat waves and erratic distribution of rainfall do not influence vertical farms. Hence, it favours year-round production of good quality produce.
- **More Produce Grown in Less Space** : Indeed, vertical farming has the privilege of producing 10-20 times more yield than conventional farming due to its efficient space utilization.
- **Minimal Utilisation of Land and Water** : Unlike traditional farming which requires vast land area and surplus water for irrigation, vertical farming uses 99% less land and even upto 95% less water. Hence, runoff and soil degradation can be prevented.
- **Subdued Carbon Footprint** : As vertical farming favours production of crops locally, it nullifies long-distance logistics from rural farms to urban cities. This ultimately curtails fuel usage and carbon emission.

### Hidden Hurdles of Scaling Vertical Farming in India

Despite vertical farming poses several advantages, it faces certain challenges in the Indian context:

- **High Capital Requirement** : Crafting a vertical farm right from scratch with racks, hydroponic systems, lighting and automation requires substantial investment.
- **Technical Know-how** : Operating a vertical farm requires clear-cut knowledge in plant science and controlled-environment agriculture viz., hydroponic systems, nutrient formulation and management, climate control and intelligent farm automation. Hence, training farmers in technical aspects of vertical farming is mandatory.

- **Elevated Energy Expenditures:** LED lights used in vertical farms consume a considerable amount of electricity. Unless renewable energy is integrated, high power costs can significantly reduce profitability of the farms.
- **Limited Consumer Awareness:** As vertical farming is slowly penetrating into India, most of the Indian consumers are new to the concept of pesticide-free hydroponic vegetables. This can potentially affect demand for hydroponically-grown produce in its initial stage.
- **Confined Crop Varieties:** Staple food crops such as paddy, wheat, pulses and millets cannot be cultivated profitably in vertical farms. Thus, they cannot completely replace traditional farming methods.

### Is Vertical Farming the Food Engine of Tomorrow's Indian Cities?

Well...vertical farming can substantially contribute to feeding India's urban population, but we cannot say it can completely replace conventional agriculture. Indeed, vertical farming can bring out the following positive changes in future India:

- Provide fresh leafy greens, herbs, microgreens, tomatoes and strawberries
- Ensure nutritional security to the Indian population
- Lessened spoilage of produce due to shorter supply chains
- Diminished dependency on rural farms for perishable vegetables
- Guaranteed year-round supply of vegetables, despite unpredictable climate scenario

However, crops requiring vast open fields such as paddy, wheat, maize, pulses and large root vegetables are not suited to be economically grown in vertical farms.

### Conclusion

Vertical farming is not just an escalating trend. Infact, it is a feasible approach to India's urban food challenges. Although it cannot replace conventional agriculture, it definitely has the potential to reshape how cities source fresh and nutritional vegetables. Indeed, vertical farming can feed the future cities of India, if facilitated by right technology, investment, government subsidies and consumer awareness.

### References

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