

Vertical Farming in Future of Vegetables

A. Mamatha¹, P. Maneela², A. Soujanya² and Pavan Kumar G.N.²

¹Assistant Professor, Department of Vegetable Science, College of Horticulture, KLTSHU, Rajendranagar, Hyderabad

²M.Sc. Scholar, Department of Vegetable Science, College of Horticulture, KLTSHU, Hyderabad

SUMMARY

Vertical farming is a sustainable agricultural method that addresses urbanization and limited arable land by cultivating crops in vertically stacked layers. Techniques like hydroponics, aeroponics, and aquaponics maximize space, reduce water usage, and eliminate the need for soil, enabling year-round production of high-quality food. This approach reduces environmental impacts, including deforestation and carbon emissions, while offering employment opportunities and promoting urban green spaces. As technology advances, vertical farming is poised to become more energy-efficient and cost-effective, with government support crucial for its widespread adoption, especially in countries like India.

INTRODUCTION

Modernization and urbanization are driving people from rural to urban areas, leading to overcrowded cities and increasing temperatures due to the replacement of vegetated surfaces with concrete. In response, the importance of green architecture is gaining recognition in the 21st century. With limited space for horizontal expansion, vertical gardens, or "green walls," offer a solution by utilizing vertical space for landscaping. These green walls improve climate change adaptation, carbon capture and allow for efficient, year-round production of nutritious food without relying on skilled labour, fertile soil, or high-water use, while also enhancing sunlight, airflow, and pollination.

Scope and Potential: -

- It provides huge employment opportunities.
- Water can be used more efficiently.
- Less deforestation and land use. This means less erosion and less flooding.
- Crops will be protected from harsh weather conditions like floods, droughts and Snow.
- Reduction in vehicular transport as the crops produced is easily consumed.
- Less CO₂ emission and pollution by decreasing reliance on coal burning product.

Techniques of Vertical Farming: -

Hydroponics: -

Hydroponics is the term for the practice of growing plants without the use of soil. In hydroponic systems, plants' roots are supported by inert (chemically inactive) materials like gravel, sand, or sawdust while being submerged in liquid solutions containing macronutrients. The ability to enhance production per area and decrease water usage is two benefits of hydroponics.



Aeroponics: -

A liquid fertilizer solution is misted into the air chambers where the plants are hanging. In the 1990s, NASA pushed the use of aeroponics to discover effective means of cultivating plants in space. By far the most

environmentally friendly method of soilless production, aeroponics requires no replacement for the grown medium and uses up to 90% less water than traditional hydroponic systems.



Aquaponics: -

A closed-loop system that mimics nature and combines the creation of aquatic and terrestrial species. The nutrient-rich wastewater is filtered here by a solid removal unit and sent to a bio-filter, where hazardous ammonia is changed into nutrient nitrate. The plants subsequently absorb nutrients while purifying the effluent that is then recycled into the fish tanks. To conserve energy, the plants also absorb carbon dioxide from the fish, and the water heated in the fish tanks helps the greenhouse maintain its nighttime temperature.



Plants To Choose for Vertical Farming

The garden structure is in place, it is time to decide what plants we should grow in a vertical garden. Almost everything can be grown, including succulents, herbs, flowers, veggies, and perennials. However, you need to consider these greens' flexibility since you are growing them vertically. For example, vegetables like tomatoes or bitter melon are more suitable for vertical gardens than growing shrubs with rigid wooden stems. For the vertical garden, we suggest the following greens:

- Tomatoes (you may grow them by tying them to stakes) (you can grow them by fastening it to stakes)
- Bitter melon
- Summer squash
- Long Melon
- Peas (give them the required support by fastening it to stakes)
- Green beans (give them the required support by fastening it to stakes)
- Cucumbers
- Bottle gourd
- Long Beans

Plants grow differently in a vertical garden. Some plants need to be physically attached to structures, while others loop themselves around trellis openings. Plants grown in a vertical garden need more frequent watering and regular doses of fertilizers as they are exposed to more light and wind.

Sustainable Vertical Farming in Vegetables: -

Trellises, stakes, fences, hanging baskets, and other types of structures make it easy to grow plants in vertical gardens.

Grow On Shelves

Because most vegetables can be easily grown in containers, shelves offer an ideal space for cultivating a variety of crops. You can place containers on shelves and build them as high as the available space allows. Choose

easy-to-grow plants like lettuce and spinach. Position the shelves to ensure your plants receive adequate sunlight. While any type of shelf can be used, slatted shelves are preferable because they allow for good air circulation and enable excess water to drain away, promoting healthier plant growth.



Grow in Hanging Baskets

Vegetables can be grown in abundance in hanging baskets, particularly those that can trail. Hanging baskets are a great place to grow herbs like basil, thyme, and oregano because they not only look lovely but also thrive there. However, because plants are more prone to drying out, you must constantly water these plants. Make sure the plants in these baskets aren't too heavy for the baskets.



Grow On Trellis

Vine cucurbits, when grown on the ground, take up extensive space with low yields. In vertical gardens, these vines are trained to climb trellises or nets, enabling higher plant density and productivity. Ideal for tomatoes, cowpeas, and beans, cucurbits include cucumber, bottle gourd, and bitter melon. Frequent harvesting ensures structural support.



Grow on PVC Pipes

Designing a PVC home garden can be interesting and innovative. A PVC pipe can be used as a main material that can make vertical and space will be saved, self-irrigated, fresh vegetables will be available like palak, bachali and broccoli.



The Future of Vertical Farming

Vertical farming enables continuous crop production in small spaces with controlled environments, maximizing yields regardless of climate. This method overcomes space and weather limitations, making efficient use of the 11% arable land available. Additionally, it addresses the challenges of water scarcity and climate change.

CONCLUSION

Vertical gardening addresses key issues in Indian farming by offering an alternative for food production, reducing pesticide use, and creating employment. It enhances land productivity, with yields up to 20 times higher than traditional farming, while lowering costs. Future vertical farms will likely focus on high-return, short-rotation crops like salad greens. Future advancements in technology are expected to enhance the energy efficiency and profitability of vertical farms globally. To make this farming method viable in India, the government should initiate awareness and skill development programs, including prototypes for hands-on training. Additionally, state and federal support through investment rebates can help expand vertical farming and protect farmers' interests.

REFERENCES

- Al-Chalabi M. 2015. Vertical farming: Skyscraper sustainability. *Sustainable Cities and Society* 18: 74-77.
- Alter, L. 2010. The Vertical Farm: Does it Make Sense Tree Hugger, 22 November. <http://www.treehugger.com/culture/the-vertical-farm-does-it-make-sense-book-review.html>
- Despommier, D. 2010. *The Vertical Farm: Feeding the World in the 21st Century*. New York: Picador
- Dorais, M. 2003. The use of supplemental lighting for vegetable crop production : light intensity, crop response, nutrition, crop management, cultural practices. Canadian greenhouse conferences, 9 October 2003.
- Laylin, T. 2012. "VertiCrop Processes 10,000 Plants Every 3 Days Using Vertical Hydroponic Farming." *Inhabitat*. Accessed 10 October 2016. <http://inhabitat.com/verticrop-processes-10000-plants-every-3-days-using-vertical-hydroponic-farming>.
- Morgan, K. 2009. "Feeding the City: The Challenge of Urban Food Planning." *International Planning Studies* 14: 341–348.
- Nitisapto, M 1993 vegetables cropping with vertical agriculture. Faculty of Agriculture, Universitas Gadjadara Yogyakarta (in Indonesian)
- Parkinson, E. 2016. "Agriculture Goes Vertical as Buildings Become the New Farms." *Australian Financial Review*. February 16. Accessed 24 October 2016. <http://www.afr.com/news/special-reports/industry-trends/agriculture-goes-vertical-as-buildings-become-the-new-farms-20160216-gmv7z8#ixzz4NPqIhB6o>.