

INCREASING EFFECTIVENESS OF ROOFTOP FARMING AN ALTERNATIVE TO TRADITIONAL FARMING FOR URBAN SUSTAINABILITY

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Introduction

Rooftop farming, also known as rooftop gardening or green roofs, is such a sustainable practice that entails growing plants on building rooftops, terraces and balconies. The use of Rooftop farming alternative agricultural production systems has gained momentum in recent years in order to deal with the combined issues of limited agricultural land, population explosion, climate change, rapid urbanization etc. to ensure agricultural sustainability. It reduces food insecurity, enriches urban biodiversity and enhances various ecological services. However, this farming technique also faces challenges, such as structural limitations, higher costs, lack of support and other maintenance practices etc. which demand further research strategies and government initiatives.

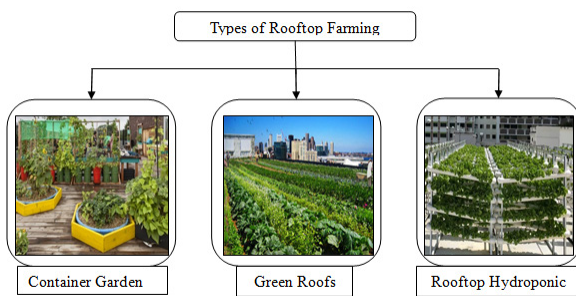
Presently, cities and towns are home to just over 50% of the worldwide population. According to a UN study, by mid-century this number is expected to reach 69%, wherein the population of the highly developed regions

will comprise of 86% of urban inhabitants, while that of less advanced areas will be 66%. Even in India, 40.76% of the population is estimated to reside in urban areas by 2030. Therefore, urban agriculture is promoted as a viable solution to provide enough food. The various steps of food supply chain including crop production, handling, storage, delivery, utilization and dumping off etc. are all executed within cities. Rooftop farming is a method of urban agriculture which simply means the practice of growing food on the rooftops of buildings. Lesser horizontal land to grow food and consequently, limited food supply with regard to quality, amount and affordability pose a greater challenge for our current and future generations. This food insecurity can be managed by producing fresh and healthy greens on the roof gardens which in turn lessens the expenses on buying them from markets. Apart from these economic and social benefits, it can also promote environmental sustainability through carbon sequestration, noise reduction,

and natural stormwater management leading to mitigation of global climate change. This creates significant pressure to maintain the ecological balance and harmonize the relationship between nature and man. The productivity per unit area should be increased to deal with this situation.

Types of Rooftop Farming

Generally, following three types of roof farming are considered-



1. Container gardening

Suitable growing media is filled in containers like ceramic/earthen pots, plastic bottles, buckets, drums or raised beds etc. to grow food items. Since these containers are lightweight, cost-effective, adjustable, and versatile, they are the most suitable and least difficult to use. They can be made from readily available materials like plastic pails, wooden pieces, old delivery boxes, sacks or large drums. City residents who do not want to invest extensively on roof modifications for commercial cultivation, prefer this method as it is considered enough to fulfil the needs of small households.

2. Green roofs

Direct producing green roofs cover the entire roof surface with vegetation and growing medium and are comparatively finer and expensive. These effectively enhance insulation, drainage and roof biodiversity. Further, green roofs are categorised into intensive and extensive green roofing. Apart from being aesthetically pleasing to the eyes, green roofs also aid in reducing city noises to about 40 dB.

3. Rooftop Hydroponics

It involves the cultivation of plants using liquid nutrient solutions and soilless porous materials like vermiculite, perlite, clay balls etc. as their growing media. Hydroponics is an ideal method for roof top farming because its containers even weigh less than containers which contain soil as their media. The structure used in this technique is extremely flexible. Lesser use of chemical plant protectants than traditional farming and fast growth of plants due to easy access to prepared supplements and water are the main benefits of this system.

Selection of plants for rooftop farming

Several factors including crop requirements, feasibility, market study, ability to withstand environmental and climatic adversities etc. determine the selection of plants cultivated in roof gardens.

Major crops suitable for rooftop farming	
Seasonal vegetables	Capsicum, tomato, okra, brinjal, chilli, onion, carrot, sugar beet, radish, broccoli, cabbage, cauliflower, cowpea, bitter gourd, bottle gourd and other cucurbitaceous vegetables
Leafy green plants	Lettuce, kale, spinach, mint, coriander, amaranthus
Spice crops	Turmeric, ginger
Medicinal plants	Aloe vera, periwinkle, holy basil
Ornamental plants	Rose, marigold bougainvillea, jasmine, hibiscus etc. can be grown for better pollination and to attract beneficial insects
Small fruit trees	Lime, dwarf amla, grapes, strawberry etc.

Benefits of Rooftop Farming:

- Availability of seasonal, fresh and better quality produce to city inhabitants
- Enhances food security through efficient use of vacant space
- Creation of natural habitats that support biodiversity in urban settings
- Temperature regulation in buildings by providing natural insulation that reduces cooling and heating costs.
- Improves air quality and reduces noise pollution
- Fosters a sense of community and cooperation along with being a source of environmental education for children raised in urban areas
- Promotes regular physical and outdoor activity; alleviates stress and anxiety leading to better physical as well as mental health
- Improves urban storm water management by catching and absorbing rainwater
- Improves the roof durability and increases property value.

Problems faced in rooftop farming:

- Lack of sufficient awareness and technical knowledge
- High initial cost and lack of government support (funds, subsidies)
- Heavy weight of the roof garden can strain overall building structures which can even result in collapse
- Not enough free time to set up and care for the roof garden
- Adverse climatic conditions such as strong winds, hailstorms, chilly temperatures etc. demand careful selection of cultivars and additional regular maintenance.

- A limited number of crops can be grown under rooftop farming and urban agriculture
- Lack of skilled and economical labour for commercial cultivation

Future prospects

Rooftop farming is an emerging practice that transforms unused urban spaces into productive and sustainable food systems. However, this practices face several constraints that need to be immediately addressed coupled with support from consumers, urban farmers, authorities and researchers. Hence, it is crucial to adopt strategies and policies that promote and protect urban greenery sustainably. Primarily, proper initiatives and regulations by the government are needed to enforce standards and guidelines for urban greenery. Financial incentives such as subsidies or grants for green projects should be given. With the intervention of NGOs or community groups, the government should conduct adequate trainings and awareness campaigns. The structural layout of new buildings should be made suitable from the initial phase so as to sustain the heavy load of the infrastructure. Most importantly, future research should be aimed at developing new technologies, optimizing the effectiveness of growth media, assessing economic feasibility, modified urban planning and designs etc. to integrate rooftop farming and other green spaces for achieving diverse goals of urban sustainability.

Conclusion

With the rapid urbanization and population explosion, the demand for food production and consumption has escalated which threatens global food security. At the same time, the

agricultural land is becoming scarce due to its conversion into residential or industrial areas. Under such circumstances, rooftop farming seems to be a feasible option. This concept of urban sustainability is not only limited to the production of fresh fruits and vegetables within the cities but also offers several economic, environmental and social benefits. Despite the prevalent challenges, there is still a significant chance for improvement. But its large scale implementation is not attainable without government assistance. Rooftop farming initiatives can be successful if these problems are addressed by structural analysis, meticulous designs, community engagement and collaboration with policymakers. Adopting these methods could lead to a future in which cities will become vibrant centres of agriculture and sustainability in addition to being hubs of industry and commerce.