

Rooftop Gardening an Opportunity to Ensure Organic and Quality Food in Metro Cities Under Climate Changing Situation in Future

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Abstract: - Life in urban is always demanding. Time devoted towards valuable relaxation also sometimes claims challenges. Nevertheless, the habit of human in spending time as a hobby has ever been in practice right from the period of civilization. Till date, amidst several hobbies taken up by people, gardening is always considered with explicit importance as beneficial for health, environment and society as a whole. As a substantial part of horticulture, it is also strongly related to a person's relaxing activity associated with value added benefits. As the rate of urbanization increases over time, food production sites should be increasingly located near main consumption centers. The combined issues of Population explosion, rapid urbanization and climate change are posing great threat to the Food Supply. Roof top gardening is a process of using innovative scientific farming techniques to produce high yield and high quality of fresh organic food in very limited metro areas like roof top, terraces and balconies, all year -round. It is seen to have many advantages including non- dependence on vagaries of Climate, use of recycled water from Sewage and treated Wet waste as compost, proximity of producers to consumers, reduction of carbon footprints etc. Roof top garden is a residential agricultural area devoted towards greenery production. This is widely popularized by urban dwellers in all parts of the world. It is a place where everyone in the family can come together, toil for the possibility of getting better in terms of good air, good food, refreshment and satisfaction contributing for a blissful living. The Experimental location was conducted at Lucknow, Uttar Pradesh, India from 2020 to 2022. It's situated at Latitude: 26.77068. Longitude: 80.95178 above sea level 123M.

Key Words: *Agriculture, Food security, Natural resources, Rooftop farming, Urbanization, Climate change, urban farming, Ecosystem, smart city, sustainability, land value, Solid waste, and sewage management.*

I. INTRODUCTION

A terrace garden is an excellent option for anyone who lives in a Apartment, flat or house with no courtyard. Terraces & balcony receive a lot of sunlight. They are simple to maintain

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and are ideal for growing organic vegetables and fruits as well as establishing a flower. Rapid population growth and migration to cities increased the demand for food, shelter, water, and other basic necessities among city dwellers. Growing poverty, a lack of formal employment opportunities, hunger, demand for food produce, proximity to markets, and the availability of cheap resources such as organic wastes and wastewater in cities.

India has nearly 46 million-plus cities, with Lucknow, Mumbai, Delhi, and Kolkata having populations over 10 million. There are 54 urban agglomerations in India with a population of one million or more according to 2011 census against 35 in 2001 (www.censusindia.gov.in). So, urbanization has become a common phenomenon in India. Further, it is going to increase at an incremental rate. Thus, we are losing our agricultural land

every hour and the population is growing by leaps and bounds and also no. of buildings simultaneously. It means we will have less horizontal land to grow food and as a consequence, the problem of food supply in terms of quantity, quality and affordability will be high amongst the citizens as more mouths to be fed than produce. This alarming situation poses a greater challenge for our future generations. To cope up with this situation, we have to increase the productivity per unit area. So, rooftop farming is found to be a sustainable option.

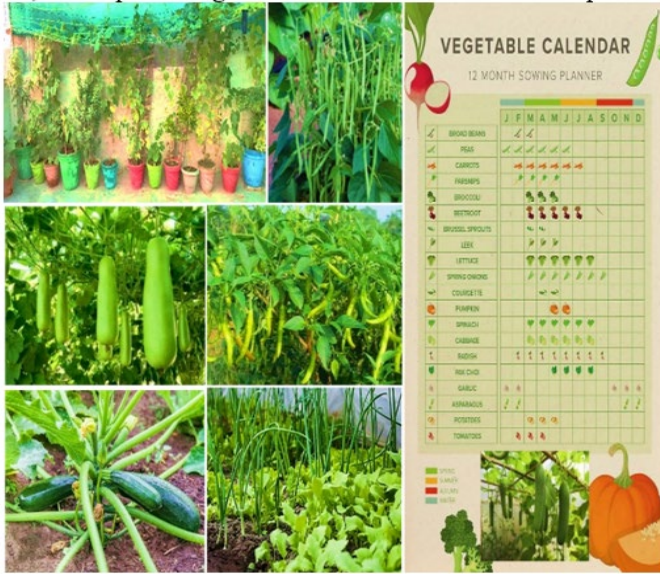


Fig.1. Vegetable Calendar

II. SCOP OF ROOF TOP GARDENING

I am a teen age (Under 16 years) girl with class 12th standard. I am belonging to farming community and nature lover. Currently leaving in city of Lucknow under Uttar Pradesh (India). Most of populations has no idea about plants/ grading, few peoples are visiting/walking including me also in garden for fresh air on weekend or holyday. So, I have come an idea and stablished garden on my roof top, planted many types of vegetables & flowers season wise. It was great experience for us. My grading approach is covered by “Navbharat Times” and “Dainik Jagaran” newspapers. Also apricated by Magic book of records as “Youngest Innovative Agriculture Award” and “Hariyali Award” Terrace gardening gives amazing experience in gardening along with some hand-grown fruits, vegetable with amazing sitting experience with fresh air. Apart from this, terrace gardening will protect our building from absorbing heat. Terrace gardens are very easy to maintain, you can grow all types of vegetables/fruits.

This is the innovative idea; more numbers of people can establish it. It will improve human health with quality foods. Green roofs alleviate the urban heat island effect by reducing surface temperatures through natural insulation. They also improve the air quality of the surroundings as plants remove the carbon dioxide in the air and release oxygen. Fruits and vegetables cultivated at home are free of pests and diseases, keeping us healthy. Rainwater harvesting is a modern urban concept, and the water so collected could be used for plant irrigation. The terrace garden not only provides vegetables for the daily food, but it also keeps the building cool.



Fig.2. Terrace Garden

पड़ोसियों को भी खिला रहे हरी सब्जियां

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औरंगाबाद खालसा के भगिरीची युवा से खल से घर की छत पर सब्जियां उगा रहे हैं। यह बताने हैं कि उनके पास 5-6 तरह की मिर्च, बरौंड, जौली, चणू, बैंगन, तरबूज, रोम जैसी सब्जियां उगाते हैं। ये खल में करीब 200 फिलो सब्जियां उगा चुकी हैं। युवा के साथ-साथ पड़ोसियों को भी खिला चुके हैं। खल बात यह है कि इन सब्जियों को उगाने में वो किसी भी तरह के यौतनसक या रसायनिक खाद का इस्तेमाल नहीं करते। पानीरसी बताने हैं कि पौधों को रोपना उगाती कली मिट्ट, बेटी हरिकार और बेटा रुपेश करते हैं।

हमें भेजें फोटो
आप अपनी छत, बाकानी या खल में सब्जियां उगा रहे हैं और मित्रम नेट से खाद बना रहे हैं तो अपने परिवार के साथ इसकी फोटो भेजिए। नभारत टाइम्स अपने ऑनलाइन पत्र NBT Lucknow और इंटरव्यू फॉर नभ, aarogya, vashika पर सबको बताना कि आप कैसे फलों को खल रहे हैं। घर में लगे युवा युनिवर्सिटी पढ़ाई करते हैं हम अखबार में भी प्रकाशित करेंगे। हमें फोटो स्कैन पूरी जानकारी 50 शब्दों में हिंदी में nbtread@timesgroup.com पर भेजें। क्वॉटेशन में इच्छा जतना देंगे। अपना मोबाइल नंबर लिखना न भूलें।

हरियाली के लिए अवार्ड

लखनऊ : लखनऊ पब्लिक स्कूल की 11वीं की छात्रा हंसिका गुप्ता को हरियाली अवार्ड से सम्मानित किया गया है। हंसिका ने छोटी सी उम्र में सब्जियों की बागवानी कर मिसाल पेश की है। हंसिका कहती है कि उन्हें पर्यावरण से लगाव है। हरी सब्जियों के पौधे लगाने का शौक है। इसी दिशा में किए जा रहे प्रयास का नतीजा है कि एक बड़े क्षेत्र में हंसिका ने हरी सब्जियों को तैयार किया है। (वि.)

III. METHODS

The first thing to consider before beginning a roof top garden is whether the roof surface can support the weight of the soil, especially wet soil, is much heavier than most people realise. The terrace should have sufficient drainage so that rain and irrigation water can drain quickly. If the plantation is to be done directly on the terrace floor, drainage cells and a geotextile membrane should be installed before the layer of soil is laid down. It is also a good idea to install a drip irrigation system rather than watering by hand. Installing a proper terrace drain-cell system can be costly. You can always arrange a series of soil-holding containers such as pots, boxes, troughs, tubs, drums, and so on. Find out more about container gardening pots and planters. These containers are placed over wedges or bricks to allow for proper drainage and air passage between them and the roof. Small flower beds can be built right on the roof. This can be accomplished by placing the soil between the parapet and an inner-side wall. Learn more about creating beautiful flower beds. Moisture-resistant wood shuttering, stones, or bricks can be used to construct the inner wall of the flower bed. Cultivated many more organic vegetables like Brinjals, Pumpkin, Ridge gourd, Zucchini, green chilies, red chilies, Ladyfingers, flat beans, Tomatoes and Capsicum with different types of seasonal flowers & fruits on my terrace garden. Also, can plant Antirrhinum, Stocks, Sweet peas, Pansy, Dahlia, Chrysanthemum, Marigold, Alyssum, Phlox, Dianthus, and Verbena, among others. A terrace garden, like any other type of gardening, should have a dominant focal point, such as a lawn, a water garden, a rock garden, or even a small tree. Plumeria, Bottlebrush, Christmas tree, Brassiaia, and so on the visitor's gaze tends to travel outwards in the horizon. As a result, the planner's effort will be to obstruct their view with a barrier of masses of bright colour and tall growing plants at the terrace's outer edge. Because gardening space on a terrace is limited, it is a good idea to encourage vertical gardening. This is why a terrace gardener should include more climbers and trailers in his garden. Some of which can climber over a supporting pillar or an ornamental arch, while others can rampantly spill over the top of the boundary wall and hand down the side of the building, camouflaging the brick and concrete. Railway creeper, Passionflower, Thunbergia, Bougainvillea, Climbing Roses, and other attractive creepers. Hanging baskets are an important part of the terrace garden. Various types of baskets containing either flowering or foliage plants can be displayed effectively in strategic locations.



Fig.3. Various types of baskets containing either flowering or foliage plants

IV. ESTIMATED COST

The initial cost of rooftop farming is high. But it will be compensated by the benefit. In general, the cost of cultivation will be around Rs. 25,000 to 35,000 per roof area of 1000 sq ft. The benefit will be up to Rs. 1.0 lakh with quality, organic foods and eco-friendly environments.

Space: Determine how much space we have - This is essential to determine the number of pots that can be accommodated.

sunlight: Ensure that weather in our terrace receives full to partial sunlight

Soil & Organic Manure: Should be rich in organic matter with good drainage. Ideal pot mix are sand, coco peat and compost 1:1:1 ratio (available in nurseries and in online stores). Top up the soil always with fresh compost at regular intervals to retain soil composition. Having our own compost from kitchen wastes is cheap and effective.

Seeds: Ensure the availability & Information of seasonal seeds and Seedling

Water: Make sure to have access to the water source on our terrace, with an appropriate medium

Shade & Net: It will protect the potted plants from superfluous heat and uncontrolled rains

Poles: Wooden planks, PVC pipes or bamboo sticks can be used as trellis to support creepers and climbers.

Containers: Polybags are the best container for terrace garden, for green leafy vegetables, small sized pots or even polybags will be perfectly suitable. Whereas climbers and creepers do require larger pots. Avoid using plastic pots if the plants are continuously exposed to sun and rain to avoid brittleness.

Garden Tools: Hand trowels, secateurs, hoe, gardening gloves, spade, fork, shovel, rake, rose can, hand spray, bamboo stakes, jute strings and a rack to store them.

V. BENEFITS OF ROOFTOP FARMING

Roof top gardening activities in urban and peri-urban residential areas are making significant contributions to sustaining and distribution of knowledge within the community of practice. There are also other benefits from them such as community building, management of green spaces, ecosystem service provision, including improvement of local climate Biodiversity and cultural services. Let us study some of the very successful urban farming initiatives taken up by Learned persons in our own cities with a view let their experiences guide us to determine the key principles involved for success and sustainability of Urban Farming. We have selected two individual Farmers, two voluntary farming communities and two groups of commercial farmers for our study.

- ❖ Can feed fresh food to whole.
- ❖ Provide protective high nutritional plant food.
- ❖ Motivating kids to have right food from age.
- ❖ Garden work-out makes us to burn calories and stay fit.
- ❖ Eco-friendly exercise for the mind and body
- ❖ Gardening work harvest vitamin „D“ for us to fight against several illnesses.
- ❖ Develop concentration by routine pruning and pinching practices at garden.
- ❖ Chance to mingle with good antidepressant soil bacteria –Mycobacterium vaccine.
- ❖ Powerful stress reliever from our maddening everyday “s multitasking traffic work.
- ❖ Bring out positive mood swings through sights, smells and sounds of nature.
- ❖ Satisfaction through accomplishment of purposeful result through bountiful family farming.
- ❖ Promote relationship to stay connect with community!
- ❖ Spreading quality time with to lead a healthy happy contented life.
- ❖ Lower the indoor temperature by 6 to 8°C and save money on air conditioning.
- ❖ Lower overall heat absorption of buildings and insulate them against heat and cold.
- ❖ The ease of obtaining safe, pesticide-free, nutritious green and fresh fruits and vegetables.
- ❖ Promotes regular physical activity, clean air, and being in nature.
- ❖ Terrace gardens increase the amount of oxygen in the air.

- ❖ Enhancing Air Quality, the presence of any greenery around is always capable of absorbing dust and other airborne toxins, which are then washed away into the drains during rainy seasons. As a result, plants serve as natural filters for dust and other toxins.so, plants purify the air in and around the garden. [POORNIMA RAO. 2016].
- ❖ Green roof tops with living vegetation provide green spaces, reduce urban heat islands, conserve energy, improve air quality, and increase biodiversity. Balcony and terrace gardens provide pleasure to city dwellers as well as an opportunity to improve creativity and psychological well-being. Furthermore, they alter the visual appearance of the building, providing screening from neighbours and concealing an unsightly pipeline and unappealing scenery. [Prem Jose Vazhacharickal.2014.
- ❖ In rainy regions, green roofs aid in stormwater management; in urban areas, they reduce the urban heat island effect; and in hot regions, they reduce cooling loads and provide thermal comfort within buildings. Green roofs help to cool buildings in the summer and increase heat in the winter by increasing the thermal capacity of the roofs. [Chitra Chidambaram etal., 2020].

VI. CHALLENGES FOR STABLISHING

Roof Garden Weight and Structure: The structure and weight of a roof garden can cause problems for the overall building. Soil and planting pots are both heavy -- whether you create a soil planting bed in your roof garden or use pots, you are significantly adding to the weight placed on the roof structure. Patio slabs and furniture further add to the weight on the roof. Most building roofs will require proper reinforcement before a roof garden can be grown safely. High roof gardens may have problems with high winds damaging plants and young seedlings.

Water Supply: A roof garden places a heavier strain on a building's water supply. If no water outlet is available on the roof, you will have to either install water in the roof garden or carry water from inside the building. A traditional land garden can drain freely, but a roof garden will require a special and expensive drainage system. This system will make sure no water from the garden leaks into the building through wall cracks or crevices. Additionally, the drainage system will have

to ensure no water from the garden is dripping down the outside of the building.

Insurance And Safety: If your building has a roof garden, chances are that insurance companies will charge a higher premium than they would to cover the same building without a roof garden. Greater insurance costs represent another way in which a roof garden is often more expensive than a typical garden. Roof gardens may be more dangerous than typical gardens, due to the risk of falling. If you have or invite over children to your roof garden, ensure the edges of the garden are barricaded so nobody can fall from the roof.

Membrane Installation: If a roof garden has soil beds, a protective membrane needs to be installed between the soil and the building's rooftop. Installing this membrane is a specialist job and can be expensive. Roof garden membranes can become degraded over time or ruptured by screws, nails or the use of garden tools. A ruptured membrane can leak water and soil into the building structure. Renovating or replacing the membrane may necessitate complete removal of the roof garden, which sets you back to square one in terms of garden planning and plant development.

VII. CONCLUSION

With rapid urbanization and food adulteration, terrace gardening/balcony gardening is the most practical option for staying healthy with healthy food and preserving the ecosystem by incorporating green into one's life. After all, our children and grandchildren will be living on Mother Earth, and it is our responsibility to keep the ecosystem in good condition.

The rooftop gardening has an immense scope with a high range of diversity to meet the food security in urban areas. If government and other responsible organizations step forward to encourage the practice of rooftop farming, a sustainable green and smart city can be built by ensuring food supply. It also helps to meet the demand of fresh and hygienic foods and creates healthy atmosphere by improving air quality which lessening the impact of climate change. This farming is a better option for promoting organic production of vegetables.

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