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Terrace Garden: The New Era of Green Future Review

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ABSTRACT: Terrace gardening offers a promising solution by utilizing rooftops for growing plants, vegetables, and herbs. This practice provides numerous benefits, including improved air quality, reduced urban heat island effect, and increased food security. Additionally, terrace gardens can serve as a stress-relieving oasis, promoting mental well-being and community building. The paper discusses the advantages and challenges of terrace gardening, including load-bearing capacity, waterproofing, and wind protection. It also highlights the potential of terrace gardens to contribute to sustainable urban development, food security, and environmental sustainability. By adopting terrace gardening practices, individuals can create green spaces in urban areas, promoting a healthier and more sustainable lifestyle. This review aims to provide insights into the benefits and challenges of terrace gardening, emphasizing its potential to create sustainable and resilient urban ecosystems.

KEYWORDS: Terrace garden, Climate change, Food security, Green future, Sustainable.

I. INTRODUCTION

The global population is anticipated to reach approximately 09 billions by 2050, with a substantial proportion (around 70%) expected to reside in urban areas. Developing economies, particularly in Asia and Oceania, have experienced rapid urbanization, with the urban population increasing from 43.3% in 2011 to 50.00% in 2021. Similarly, India's urban population has witnessed significant growth, rising from 27.07% to 36.04% over the past two decades, and is projected to reach 52.08% by 2050. This accelerated urbanization trend has resulted in considerable strain on urban healthcare systems and nutritional infrastructure, underscoring the need for strategic planning and investment in these critical sectors. (singh and patel, 2025)

Urbanization change climatic conditions & pollute environment which aren't suitable for better future for next generation so we use the open spaces for sustainability like terrace garden. (Poornima rao, 2016).

The practice of gardening has a storied past that stretches across a minimum of 4,000 years of human history, intricately linked with the development of human culture, encompassing advancements in science, artistic expression, and literary works. (Misra, 2011)

Urban regions continue to grapple with significant nutritional challenges, despite exhibiting slightly better outcomes compared to rural areas. According to the National Family Health Survey-5 (NFHS-5), a substantial proportion of urban children under five years of age experience malnutrition, with 27.03% being underweight, 30.01% stunted, and 18.05% wasted. Moreover, 13% of urban adults aged 15-49 have a body mass index (BMI) below 18.5 kg/m², indicating under nutrition, whereas 33.2% of women and 29.8% of men in this age group are obese. The prevalence of anemia is also concerning, affecting 64.2% of children aged 6-59 months, 53.8% of women aged 15-49 years, and

20.4% of men in the same age group. Furthermore, urban populations are disproportionately affected by non-communicable diseases (NCDs) such as diabetes and hypertension, underscoring the need for targeted interventions to address these pressing health concerns.(singh and patel, 2025)

The starkness of large concrete structures can be mitigated by well-designed landscaping, which enhances their visual appeal. However, urban density often limits available space for gardens and green areas around buildings, underscoring the need for creative landscaping solutions.(Randhawa and Mukhopadhyay,1986)

The scarcity of arable land is a pressing issue in both developed and developing nations. The pressures of population growth, environmental stresses, and the high economic value of land and water resources make it challenging to expand cultivation areas. As a result, farming has become unprofitable and unsustainable, deterring many from pursuing it as a profession. Given the constraints on essential resources like land, water, and labor, a viable solution lies in cultivating high-value crops using space-efficient and resource-conserving methods.(Singh and Peter, 2014)

Gardening has a rich and storied history in India, with roots tracing back to the ancient epics of Ramayana and Mahabharata. The tradition continued to evolve, with notable accounts of gardens in Shudraka's Mrichchakatikam (100 B.C.). King Ashoka's initiative to plant trees along roadsides (margeshvriksha) (233 B.C.) further underscored the significance of gardening. The depiction of gardens and flora in ancient Indian art, such as the frescoes at Ajanta (A.D. 100 to 600) and the sculptures at Bharhut and Sanchi, testifies to the enduring importance of gardening in Indian culture.(Swarup,1967)

The idea of terrace gardens has been a recurring theme in our literary and mythological heritage, reflecting a deep appreciation for nature's beauty and tranquility.(Narkhede, 2009)

After 20th century mankind recognize value of greenery later emanate modern concepts like balcony garden, terrace garden, etc. Due to increasing urbanization surrounding temperature in urban areas have more 42.8F than village areas.(Jain and Janakiram,2016.)

Gardening has experienced a significant resurgence, with a substantial number of households expressing interest in starting or maintaining a garden. According to a survey, nearly half of American households either currently have a garden or plan to initiate one. The primary motivations for gardening include:

1. Access to fresh produce: Enjoying the benefits of homegrown vegetables.
2. Recreational activity: Finding gardening to be a fulfilling hobby.
3. Economic benefits: Reducing food expenses by growing one's own produce.

Gardeners prioritize nutrition, health, and safety, seeking to avoid pesticide residues in their food. By growing their own vegetables, individuals can ensure the absence of toxic chemicals. Additionally, homegrown produce often surpasses store-bought options in terms of flavor and texture, with asparagus and sweet corn being notable examples. The rapid loss of sweetness in sweet corn after harvesting highlights the advantage of home gardening, allowing for optimal freshness and flavor.(Splittstoesser, 1990)

Gardening is a highly fulfilling activity that benefits individuals across all age groups and health spectrums. Moreover, the trend of using houseplants for interior decoration has gained significant popularity, as they bring a touch of elegance and sophistication to a home's architectural design and interior ambiance.(Swarup, 1969)

In apartment settings, plants have become a status symbol, reflecting owner's pride and enhancing aesthetic value of space. Additionally, balconies can be aesthetically enhanced with potted plants and hanging baskets, contributing to overall visual appeal to the apartment.(Banker, 2011)

In India, the concept of terrace gardening is emerging as a growing trend, particularly in metropolitan areas where urban dwellers are increasingly embracing rooftop greenery.(Rao, et.al,2022)

Public buildings like hotels and banks can incorporate rooftop and indoor gardens to overcome space constraints.(Randhawa and Mukhopadhyay,1986)

For homeowners with both ground and terrace spaces, a terrace garden can seamlessly extend the existing garden. For others, it serves as a viable alternative, albeit with certain constraints. Despite these limitations, a thoughtfully designed terrace garden can still yield a stunning outdoor oasis.(Trivedi, 1983)

Terrace garden can serve as an effective substitute for submissive cooling, reducing the need for mechanical cooling system & promoting energy efficiency. Also emphasizes importance of green spaces in urban areas.(Cairae, Avitesh,2023.

Terrace garden is also called as roof garden. Roof garden define as nature in the sky or environment in the sky. In roof top garden growing the ornamental plants, bushes, herbs. If growing vegetables replaced with ornamental plants so this garden called roof top vegetable garden.(Sahu and Satapathy,2021)

Terrace garden is nothing but the area of paving between the garden and house and it may be various size and attractive shapes.(Bose and Mukherjee,1977)

II. POTENTIAL OF TERRACE GARDEN

Comprise green spaces into building design, architects and engineers can reduce environmental impact of buildings and encourage sustainability.(Cairae, Avitesh,2023.)

A typical vegetable garden in the United States spans approximately 600 square feet, generating an average net return of \$600 tax-free, according to 1981 data from the National Garden Bureau, Inc. The financial success of a garden is contingent upon several key factors, including Initial investment in tools and equipment, regional growing season, crop selection and optimization, efficient succession planting. By carefully considering these factors, gardeners can optimize their vegetable gardens to achieve maximum financial returns.(Splittstoesser, 1990)

The ‘Towers of Silence’ in the Parsi community offer ample opportunities for beautiful landscaping. With their expansive grounds, these sites can be developed into serene gardens featuring lawns, shrubs, and flowering trees. A prime example is the ‘Tower of Silence’ near Bangalore, where a picturesque avenue of jacaranda trees creates a breathtaking spectacle when in bloom.(Randhawa and Mukhopadhyay,1986)

The scarcity of outdoor space in urban settings has led to a growing interest in container gardening, as individuals seek to cultivate plants for their aesthetic and environmental benefits. This shift towards pot culture enables people to indulge in their passion for gardening, despite spatial constraints. Furthermore, indoor plants have become increasingly popular for showcasing exceptional blooms or foliage, underscoring the importance of houseplants in modern gardening practices.(Dey,2003)

Educational institutions often neglect landscaping, resulting in uninviting environments. Well-planned landscaping can transform the aesthetic appeal of schools and colleges, while also fostering an appreciation for beauty in young minds.(Randhawa and Mukhopadhyay,1986)

Urban horticulture holds vast potential in India. To unlock its full benefits, investments in research, public awareness initiatives, and supportive policies are crucial. Collaboration between urban planners, local governments, and communities is vital for scaling efforts and ensuring sustainability. As India urbanizes rapidly, the demand for eco-friendly solutions intensifies. Urban horticulture presents a promising approach, transforming urban landscapes into thriving ecosystems. By fostering this movement, we can develop liveable, resilient cities that promote a healthier, greener future.(singh and patel, 2025)

III. SELECTION OF CROPS

For green leaf purpose we can cultivate *Moringa oleifera*, *Chrysanthemum*, *Allium cepa*, *Chenopodium album*, *Mentha piperita*, *Spinacia oleracea*, *Amaranth viridis*, etc. For fruit purpose we can cultivate *Momordica charantia*, *Cyamopsis tetragonoloba*, *Kukumis sativus*, *Vigna sinensis*, *Solanum melongena*, *Brassica oleracea*, *Spring onion*, *Cucumis melo*, *Tricosanthes cucumeri*, *Dioscorea lata*, etc. For stem we cultivate *Allium sativum*, *Zingiber officinale*, *Curcuma longa*, etc. and *Ipomoea batatas*, *Colocasia esculent*, *Daucus carota*, *Sativus*, etc cultivate for root purpose.(Sahu and Satapathy,2021)

Sr.no.	Group	Vegetables
1.	Beans and peas	French beans, Broad beans, Garden pea
2.	Brassicas	Brussels sprout, Kale, Cabbage, Broccoli.
3.	Fruiting vegetables	Tomatoes, Cucumber, Chillies, Peppers, Sweet corn
4.	Herbs	Lemon grass, Parcel, Lemon balm, Savory.
5.	Onion family	Onions, Garlic, Leeks, Shallots.
6.	Root vegetables	Carrot, Beet root, potatoes.

(Buckingham, et.al, 2012)

IV. ADVANTAGES OF TERRACE GARDEN

Temperature control :- Greenery and vegetation in city area can help to alleviate the harmful consequences of the urban heat island effect, pollution, and global warming to reducing the temperature by absorbing heat and harmful solar radiation.(Anoop and Rajeev, 2021)

Compared to normal building wall in green wall a measurable heat loss, quantified as a heat flux of 03-08 Watt / meter square / day. This energy dissipation confirms that evaporative processes through the green living wall contributed to a notable cooling effect with in the interior space.(Shawn and Melissa, 2022)

Diminish cost of mechanical energy :- Green cover reduce electric energy consumption maintaining inner home temperatures cool in summer and warm in winter than normal environmental conditions.(rao, 2016)

Reduce co2 emission :- Urban area responsible for more than 70% pollution worldwide. Co2 emits mostly from human activities. Terrace garden absorb the co2 and release the o2 and make air healthy for human beings and also preserving the energy required to control green house effect.(Anoop and Rajeev, 2021)

Improve the air quality :- At the time of respiration & other metabolic activities plants absorb impurities from environment & refine the air.(rao, 2016)

Pollution control :- Strategic landscaping around public buildings can harness the air-purifying capabilities of trees, mitigating urban pollution by reducing particulate matter, absorbing gaseous pollutants, and attenuating noise pollution, thereby creating a healthier microclimate and improving overall environmental quality.(Randhawa and Mukhopadhyay,1986)

Crucial element for SDGs :- Urban horticulture emerges as a pivotal strategy for realizing the United Nations' Sustainable Development Goals (SDGs). By fostering sustainable food systems, urban horticulture makes significant contributions to various SDGs, including zero hunger (SDG 2) in which ensuring equitable access to nutritious food, thereby enhancing food security and resilience, good health and well being (SDG 3) in which Providing fresh, nutrient-rich produce that supports healthy living and well-being, quality education(SDG 4) in which offering opportunities for agricultural education, skill development, and consumer awareness, decent work and economic growth(SDG 8) in which generating employment opportunities and stimulating local economies, industry and infrastructure (SDG 9) in which promoting innovative, sustainable practices that support economic development, sustainable cities (SDG 11) in which enhancing urban sustainability, reducing carbon footprint, and creating resilient communities, consumption and production(SDG 12)in which minimizing ecological footprint through efficient production and reduced waste, climate change (SDG 13) in which reducing reliance on imported food, minimizing environmental impact, and promoting sustainable practices. By integrating urban horticulture into urban planning, cities can become more sustainable, resilient, and environmentally conscious, ultimately contributing to a better future for all.(Singh and Patel, 2025)

Relieving stress & mental wellness :- Terrace garden creates for a different types of reasons like playing and enjoying to children , for place in which we took peace after a long day hardworking period, for taking happiness and fulfill the hobbies of raising plants in own garden etc. (Bose and Mukherjee,1977)

To craft a serene and picturesque terrace garden, elements such as expansive lawns, fountains, water features, flower beds, and shade trees should be meticulously designed and integrated. A well-designed terrace garden incorporates these features in a way that creates a harmonious and tranquil atmosphere, perfect for relaxation and recreation.(Singh, 2017)

Ecological balance :- Plants on terrace charming biodiversity like love birds, beneficial insects, etc. Also creating fresh & clean environment for human beings.(Rao, et.al,2022)

Economic opportunities and social status :- Horticulture gardening offers benefits that extend beyond environmental and mental well-being, including community development and economic growth. Community gardens facilitate social interaction, promote cohesion, and instill a sense of ownership. Furthermore, urban farming projects in cities like Mumbai have converted underused areas into vibrant spaces, creating economic opportunities and employment.(singh and patel, 2025)

Best from waste :- Growing the vegetables, herbs, flowers in waste bottles, buckets, containers, poly bags, drums, pots which filled with growing media for plants. To the maximum extent recycled material could be used. Now many industries made garden pots from recycled waste like plastic, rubber.(Sahu and Satapathy, 2021)

Terrace life resilience :- The green plants and their growing media absorb heat and to keep the terrace cool and durable. The regular solar heat radiation terrace material expand and contracts thus weakened terrace life. Detoriation of colour, structure as well as the life span of terrace. Terrace garden protect roof from UV rays and heavy rainfall and resilience terrace life.(Anoop and Rajeev, 2021)

Food production & nutrients security :- Rooftops can be utilized for cultivating food crops in densely populated urban areas where gardening space is limited, enabling the integration of edible plants or plant parts alongside or in place of conventional ornamental plants in rooftop gardens.(Patel, et.al, 2019)

India's average daily intake of fruits and vegetables is approximately 46g and 130g, respectively, which falls short of the Indian Council of Medical Research's (ICMR) recommended daily consumption of 92g and 300g. Incorporating seasonal fruits and vegetables into one's diet is beneficial due to their diverse nutritional profiles. Fruits and vegetables with yellow and orange hues are rich in Vitamin A and carotenoids, while dark-green varieties are excellent sources of essential minerals and antioxidants. A significant shift in consumer preferences towards fresh and processed fruits and vegetables presents opportunities for substantial investment in the horticulture sector, particularly in areas such as diversification and value-added products.(singh and peter, 2014)

Urban horticulture mitigates micronutrient deficiencies by facilitating the local production of a wide range of nutrient dense crops, including leafy greens, root vegetables and fruit, thereby promoting dietary and enhancing public health outcomes.(singh and patel, 2025)

V. BOUNDARIES OF TERRACE GARDEN

Load bearing capacity :- Every building structure have definite load bearing capacity of terrace. This helpful for gardeners or landscapers to decide planters, media, design, size and position of garden. Beams and coloumbic structure of buildings have maximum capacity than wall structures.(Sahu and Satapathy, 2021)

Special shade arrangement :- Plants that thrive in full sun on the ground may require shading on a terrace due to intensified exposure to sunlight, heat, and wind. Unlike ground-level gardens, terraces lack natural shelters, necessitating alternative shading solutions. However, these solutions often require annual replacement and can be vulnerable to strong winds, highlighting the unique challenges of terrace gardening.(Trivedi, 1983)

Wind :- The major concern in wind exposed and rooftop gardens is potential for strong gusts to displace growing medium. To address this challenge, custom mesh screens can be installed to retain soil and safeguard plants from wind damage.(pedada and kumar, 2021)

Water seepage :- In high monsoon areas water proofing is mandatory practice should be done before the terrace garden. Proofing done with colouring or cement base material but according to modernization could be using multiple techniques replaced to it. In low monsoon areas only normal water proofing done.(Sahu and Satapathy, 2021) Rented flats with terrace gardens often pose challenges for gardeners, who are hesitant to invest in structural improvements such as flooring and drainage. Consequently, these gardens are typically limited to container gardening, restricting plant selection to species that flourish in pots.(Trivedi, 1983)

Climatic factors :- Environmental factors like wind speed, direction, climate of this urban area, temperature, humidity, bright sunshine hours are the affect on the greenery of terrace garden. According to that study selection of plants, growing media, planters are established. Some areas are regularly high temperature like Vidarbha region, some have cyclonic areas like Bhubaneswar. Due to this remarkable losses are seen in terrace garden. So before establishment study the proper climatic factors of location.(Sahu and Satapathy,2021)

VI. CONCLUSION

As the world grapples with challenges of urbanization, climate change, and sustainability, incorporating green spaces into building design has emerged as a crucial strategy for mitigating the issues. By harnessing the potential of terrace gardens, individual can not only reduce their environmental footprint but also contribute to creating healthier, more resilient communities. Moreover the benefits of terrace gardens extend beyond environmental sustainability to encompass economic, social, and mental well-beings. As we move forward, it is essential to prioritize urban horticulture and integrate it into our urban planning frameworks, fostering a greener, more sustainable future for generation to come. By doing so, we can unlock the full potential of terrace gardens to transform our cities into thriving ecosystem that promote human well-beings and environmental stewardship.

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