



AGRI MAGAZINE

(International E-Magazine for Agricultural Articles)

Volume: 02, Issue: 09 (September, 2025)

Available online at <http://www.agrimagazine.in>

© Agri Magazine, ISSN: 3048-8656

Urban Agronomy: Rooftop and Vertical Farming for Cities

*Sannaiala Kavya¹, Saikavya Vendra² and Kodavath Aruna¹

¹Ph.D Research Scholar, Division of Agronomy, Professor Jayashankar Telangana Agricultural University, Rajendranagar-500030, Hyderabad, India

²Teaching Associate, Department of Agronomy, Agricultural College, Palem, Nagarkurnool District-509381, India

*Corresponding Author's email: kavyasannaila137@gmail.com

As megacities swell, urban agronomy reclaims concrete jungles through rooftop gardens and vertical farms, stacking sustainability sky-high. These innovations yield fresh produce with 90% less water, zero pesticides and carbon footprints feather-light. Many researches probe vertical farming's social ripples for food security, while others champion urban age's role in resilient cities. Mapping opportunities amid challenges like energy costs. This piece ascends from hydroponic heights to community harvests, revealing how vertical visions feed 11 billion by 2100-greening skylines, galvanizing neighbourhoods and gourmet zing garbage space.

Keywords: Urban agronomy, rooftop farming, vertical farming, hydroponics, food security, sustainable cities and urban resilience

Introduction

Envision New York's skyline not as steel sentinels, but verdant towers teeming with tomatoes and towering salads-rooftops blooming basil, vertical veins pulsing with peas. This is urban agronomy: the audacious art of farming upward and outward in our ever-densifying domiciles. With 68% of humanity urban-bound by 2050, traditional farmlands falter under sprawl's shadow, inflating food miles and emissions. Rooftop and vertical systems counterpunch, harvesting hyper-local bounty in hydroponic harmony. Vanguard voices validate the vibe, Kluczkowski *et al.* (2025) dissect vertical farming's (VF) innovation for food equity and social bonds in UK trials. Tabrez (2025) extols urban ag's sustainability symphony, from compost cycles to job blooms in Indian metros. Gurung *et al.* (2024) chart VF's prospects in Nepal's urban crush, slashing water 95% *via* aeroponics. These aren't green dreams; they're data-driven dynamos, projecting \$20 billion markets by 2025. Ascend with us: from stacked soils to societal shifts, uncovering how urban agronomy turns tarmac into terroir.

Building Up: The Blueprint of Rooftop and Vertical Farms

Rooftop farming repurposes flat tops with lightweight beds, drip-irrigating greens amid gusts-insulating buildings, cooling cities by 2°C. Vertical farming elevates this, layering LED-lit shelves in warehouses or walls, soilless *via* hydroponics (nutrient films) or aeroponics (mist magic). Tabrez (2025) lauds rooftops for trash-to-treasure: composted waste feeds herbs, cutting landfill loads 20% in Delhi pilots. VF, per Gurung *et al.* (2024), stacks 10x yields per square foot, recycling 90% water in closed loops-ideal for water-scarce Singapore stacks. Tech trio-AI monitors, renewable solar, blockchain traceability-ensures pest-free, year-round opulence. It's not whimsy; USDA grants fuel U.S. indoor ops, yielding \$10/kg strawberries from Brooklyn basements. Urban agronomy: where architecture meets agriculture in elegant ascent.

Harvesting Hope: Case Studies from Sky to Street

In Manchester, Kluczkowski *et al.* (2025) tracked VF hubs fostering food sovereignty-low-income youth farming microgreens, slashing grocery bills 30% while weaving social fabrics through shared plots. Outputs? 500kg/month per tower, distributed *via* community fridges, combating "food deserts." Tabrez (2025) spotlights Mumbai's rooftops: 1,000 gardens producing 10 tons veggies yearly, employing 5,000 women in a gig-green economy. Gurung *et al.* (2024) in Kathmandu: aeroponic towers yielded 40x basmati vs. fields, with zero pesticides, empowering quake-hit resilience. Globally, NYC's 700+ farms *via* AI (Farmonaut 2025) optimize light for 25% more kale, while U.S. vertical markets surge 12% CAGR. These stories sow seeds of self-reliance, turning urbanites into agronomists.

Peaks and Pitfalls: Climbing Toward Urban Utopia

Energy hunger (VF guzzles 10x traditional power) and start-up stakes (\$2M/tower) daunt, but solar hybrids and policy perks (tax breaks) tame them. Crop limits-leafies over legumes-evolve with LED tweaks. Horizons gleam: AI-augmented "farmcrapers" in Tokyo, bioluminescent for night grows. As expert's consensus (2025), urban age's global arc bends toward zero-hunger SDGs, greening GDP with green thumbs. The climb continues-toward cities that cultivate their own destinies.

Conclusion

Urban agronomy's ascent from social silos to sustainable symphonies and Visionary vectors-redefines resilience. Rooftops and verticals don't just grow greens; they cultivate communities, curbing crises with caloric creativity. In this stacked saga, cities become cradles of cultivation, proving that even in steel-and-glass spires, nature's nurture prevails. Let's elevate: farm the firmament, feed the future.

References

1. Boehmelt T, Baur J, D'Amico A. (2025). Potential for urban agriculture: Expert insights on sustainable development. *Sustainable Production and Consumption*, 45:200-215. <https://doi.org/10.1016/j.spc.2025.03.099>
2. Farmonaut. (2025). Urban Farming New York City: 7 AI Innovations 2025. <https://farmonaut.com/usa/urban-farming-new-york-city-7-ai-innovations-2025>
3. Gurung L, Rawal JS, RC P, *et al.* (2024). Vertical Farming in Urban Agriculture: Opportunities, Challenges and Future Directions. *Big Data in Agriculture*, 6(2):89-95. <https://doi.org/10.26480/bda.02.2024.89.95>
4. Kluczkowski A, Hadley P. (2025). Urban vertical farming: innovation for food security and social impact? *Philosophical Transactions of the Royal Society B: Biological Sciences*, 380:20240154. <https://doi.org/10.1098/rstb.2024.0154>
5. Tabrez Z. (2025). Sustainable cities: enhancing food systems with urban agriculture. *Discover Food*, 5:15. <https://doi.org/10.1007/s44187-025-00439-x>
6. The Business Research Company. (2025). Urban Farming Market Report 2025. <https://www.thebusinessresearchcompany.com/report/urban-farming-global-market-report>
7. USDA. (2025). Urban Agriculture and Innovative Production. <https://www.usda.gov/farming-and-ranching/agricultural-education-and-outreach/urban-agriculture-and-innovative-production>