

Green Manuring in Urban Agriculture for Enhancing Soil Health in Cities

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INTRODUCTION

With urbanization growing, cities have an escalating demand for sustainable food systems. Urban agriculture such as rooftop gardens, community gardens, vertical farming, and backyard growing is proving to be a valid solution for local food production. Yet, most urban soils suffer from poor fertility, compaction, contamination, and nutrient losses as a result of construction activities and industries. Green manuring consists of growing high-growing leguminous crops such as Sesbania, Sunhemp, Cowpea, and Dhaincha, which are then plowed into the ground prior to maturity in order to enhance soil fertility and structure. The practice is a traditional method in rural communities but has vast potential in urban farming. Green manures can easily increase soil organic carbon, microbial life, and water-holding capacity in city soils due to limited availability of chemical inputs and composting space.

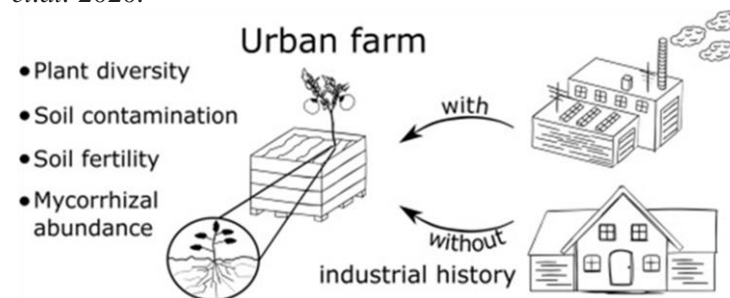
2. Importance of Soil Health in Urban Agriculture

Soil is the basis of all plant life, and in urban settings, soil deterioration is generally acute due to:

- Construction waste and substandard topsoil
- Pollutants such as heavy metals and oil residue
- Compaction due to pedestrian traffic and low green cover
- Absence of organic matter and microbial diversity

Soil maintenance is vital to support crop productivity, food security, and environmental equilibrium in urban areas.

Techniques to recover soil structure, nutrient replacement, and organic matter build-up are important to make urban agriculture a success. Green manuring provides a low-cost, scalable, and natural means to revive urban soils. Salomon *et.al.* 2020.



Source: Science Direct.com

3. Contribution of Green Manuring towards Urban Soil Health

Green manuring plays a vital role in supporting urban soil health in the following ways:

3.1 Organic Matter Enrichment

Introducing green manure crops in urban soils considerably increases soil organic matter. During decomposition, the biomass raises soil organic carbon, enhancing soil texture and tilth. It enhances aeration, water-holding capacity, and root growth, particularly essential in compacted or manufactured soils widely utilized in urban gardening environments such as grow bags or containers.

3.2 Nitrogen Fixation

Legume green manures like Cowpea, Sunhemp, or Sesbania carry Rhizobium bacteria within their root nodules. The bacteria fix nitrogen from the air and convert it into a usable form for the plant. The natural process curtails the demand for synthetic fertilizers, allowing sustainable nutrient management in rooftop gardens and urban areas.

3.3 Microbial Activity Boost

Green manure decomposition provides nutrition for soil microbes, diversifying biological life and microbial mass. An active microbial population enriches nutrient cycling, degradation of organic matter, and disease control—processes that are critical in small urban ecosystems where soil inputs tend to be low.

3.4 Weed Suppression and Soil Cover

Green manures create a dense cover that shades the soil surface, preventing weed emergence. The living mulch also serves as a cover against soil erosion, compaction, and temperature changes, providing a stable micro-environment for plant roots.

3.5 Soil Detoxification

Some green manure crops have phytoremediation value, either absorbing or immobilizing heavy metals and toxins. This proves to be valuable in urban centers, where industrial waste, emissions from motor vehicles, or construction materials may contaminate soil in urban areas, gradually restoring soil health.



Source: Project Regeneration

4. Suitable Green Manure Crops for Urban Settings

Not all green manure crops are suitable for urban spaces. Selection depends on space availability, crop duration, and biomass yield. Ideal crops include:

Crop	(Duration)	Benefits
Sunhemp (<i>Crotalaria juncea</i>)	Fast growth (6–8 weeks)	Rich in nitrogen
Sesbania (<i>Sesbania aculeata</i>)	High biomass (8–10 weeks)	Poverty-tolerant
Cowpea (<i>Vigna unguiculata</i>)	Dual purpose (6–8 weeks)	Food and green manure
Dhaincha (<i>Sesbania bispinosa</i>)	High N-fixation (8 weeks)	Salinity tolerance
Fenugreek/Methi (<i>Trigonella foenum-graecum</i>)	Fast growth (4–6 weeks)	Soil improving and edible

In urban gardens, they can be cultivated in containers, raised beds, or planted directly in rooftop beds, chopped, and incorporated into the topsoil.

5. Urban Agriculture Application Techniques

5.1 Intercropping and Crop Rotation

Green manures can readily be intercropped with vegetable crops in the urban garden in a bid to complement nutrient provision without augmenting pest pressure. Their incorporation augments soil quality and diversity as well as breaking the pest and disease cycles where practiced in rotation. For instance, after harvesting leafy greens, green manure such as Sunhemp or Cowpea can be sown in a bid to provide the soil with a chance to rejuvenate before sowing another food crop. Prajapati *et.al.* 2023.

5.2 Chop-and-Drop Method

Urban agriculture usually takes place in small areas such as containers or roof gardens, where plowing is not feasible. In these situations, green manure crops are chopped and left on the soil surface as mulch. This "chop-and-drop" method imitates natural forest littering, adding nutrients to the soil over time as the plant material breaks down and retains moisture and prevents weeds.

5.3 Raised Bed Incorporation

Gardeners may dedicate particular raised beds to the cultivation of green manure crops on a rotation basis with vegetables. They serve as nutrient banks, replenishing the soil for use in other beds and ensuring long-term soil productivity.

5.4 Rooftop Soil Enrichment

In rooftop plantings, green manures can be cultivated in grow bags or shallow beds and their biomass can be incorporated into the growing medium. This increases organic matter content, increases microbial life, and enhances water holding capacity in lightweight growing media.

6. Problems in Urban Green Manuring

Though advantageous, the adoption of green manuring in urban farming has some challenges:

- Limited space and time: Fast turnover in urban gardening can restrict time available for green manure crop growth between crops.

- Limited awareness: Urban gardeners lack knowledge of green manuring practices or its advantages.
- Soil depth problems: Roof or container gardens do not have adequate soil depth for root development of certain green manure crops.
- Composting infrastructure: Decomposition of green biomass needs appropriate moisture and microbial function, which can be unreliable in artificial media.
- Regulatory barriers: Structural issues or building codes might limit rooftop horticulture of dense green cover.

7. Policy Support and Community Initiatives

For fostering green manuring in urban farming, the following are suggested to be done:

- Training programs for urban farming that also include green manure training.
- Encouragement to sustainable soil activities under municipal farming or green infrastructure initiatives.
- Community-scale composting plants and decentralized management of biomass.
- Smart cities and housing societies incorporating green manuring into rooftop gardening hand books.
- Agricultural university support in creating green manure seed kits appropriate for urban areas.

Urban centers such as Bengaluru, Pune, and New York have begun incorporating green cover crops and composting into community garden initiatives, leading the way for environmentally friendly urban agriculture.

CONCLUSION

As urban agriculture grows into a crucial aspect of sustainable city living, soil health management is essential. Green manuring provides an easy, regenerative, and natural solution to several issues presented by poor urban soils. From fixing nitrogen to suppressing weeds, it helps build resilient food systems and environmental health. Using green manures in city farming practices—whether in backyards, rooftops, or community gardens—can convert urban soil into a dynamic living ecosystem that sustains healthy crops, minimizes the use of chemicals, and increases local food security.

Through proper awareness, research, and policy support, green manuring can be an important factor in city greening from the ground up.

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