

Rooftop farming: an opportunity towards urban sustainability?

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Esther Sanyé-Mengual¹, Francesco Orsini², Jordi Oliver-Solà³, Juan Ignacio Montero⁴, Giorgio Gianquinto², Joan Rieradevall⁵

¹Institute of Environmental Science and Technology (ICTA) - Universitat Autònoma de Barcelona (UAB), ²Department of Agricultural Science (DIPSA), Alma Mater Studiorum University of Bologna, ³Inèdit innovació, ⁴Institute of Research and Technology in Agrifood Sector (IRTA), ⁵ICTA (UAB); Department of Chemical Engineering, Universitat Autònoma de Barcelona (UAB)

Rooftop farming (RF) is growing in popularity thereby increasing the area devoted to local production in available spaces on urban buildings. RF includes multiple models (private, community, commercial) and systems (from self-constructed systems to high-tech greenhouses). This study accounts for the environmental burdens and the eco-efficiency of RF systems to shed light on their potential for reducing the urban foodprint.

Two case studies were assessed: Rooftop Greenhouse (RTG) in Bellaterra (Spain) and community rooftop farming (RF) in Bologna (Italy). The life cycle assessment (LCA) and life cycle costing (LCC) methods were applied. The assessment was performed from a cradle-to-farm gate approach. Global warming potential (GWP) was used as indicator.

Substrate production of fruit vegetables was the most eco-efficient cultivation technique. Soil-less production of tomatoes in the RTG had similar eco-efficiency values as substrate leafy production in RF. The use of hydroponic techniques for leafy products was the least eco-efficient option for RF. In particular, the electricity use in Nutrient Film Technique (NFT) due to re-circulation increased both the environmental impact and economic costs of products. These results however are tied to an unheated production without energy requirements, such as for the Mediterranean area.

Soil-less production in a RTG in Bellaterra resulted in a GWP of 0.36 kg CO₂ eq. per kg tomato and 0.49 kg CO₂ eq. per kg lettuce. Compared to the conventional production in the study area (Spain), RTG products would be more environmentally-friendly than lettuces from further than 550km and tomatoes from further than 700km. However, RTGs can take advantage from the flows of the building, such as by using the residual heat from acclimatized areas. Tomato production could achieve a yield of 25 kg • m⁻², becoming then the best environmental option. On the other hand, soil-less production in the

community garden of Bologna resulted in a GWP of 0.07 kg CO₂ eq. per kg tomato and 0.32 kg CO₂ eq. per kg lettuce. Both leafy and fruit vegetables showed a better environmental profile than conventional ones.

Rooftop farming, both protected and open-air, could supply a local and fresh produce to Mediterranean cities, where unheated production can be performed. Substrate and soil-less production would be the most eco-efficient cultivation options. The potential substitution of imported food could boost the environmental benefits of RF thereby reducing the foodprint of cities.