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Using constructed Technosols for urban bio-intensive market gardening: Assessment of their habitat and food biomass production functions

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Abstract (max. 400 words)

Soil is an essential component of terrestrial ecosystems as it provides many functions and ecosystem services. Soil is the product of various physical, chemical, and biological processes that take place over thousands to millions of years. As a result, soil is a non-renewable resource on a human lifetime scale. In urban areas, soil undergoes many anthropogenic pressures resulting from land development, which sometimes leads to a degradation of its quality along with a partial or total loss of its functions and ecosystem services. Consequently, the areas covered by fertile soils in urban and peri-urban environments are decreasing as they are reclaimed. Urban land-use policy is evolving and aims to enhance projects that reconnect food production in urban areas. As cities have available unused materials, wastes and by-products, it seems interesting to consider using them for the conception of Technosols for urban vegetable production. Technosols are soils with at least 20% of artifacts, a geomembrane, or a technic hard rock.

In the present work, two constructed Technosols were designed and tested in a greenhouse experiment for market gardening. Their conception was based on the physico-chemical characteristics of soils known for their high agronomic potential for vegetable growing, as well as on the selection of available materials whose characteristics met the expectations (e.g., uncontaminated materials, locally available and sustainably supplied). During a one-year period, three aspects were studied to evaluate the capacity of the Technosols to ensure habitat (for specific soil fauna organisms selected regarding their ability to be suitable indicators of the quality of their environment) and food biomass production functions. First, the pedological component was examined by measuring the physico-chemical parameters of the Technosols; secondly the study focused on the characterization of the biological component, comprising several bio-indicator organisms of the soil fauna as well as eco-physiological indicators of the crops (photosynthetic and nitrogenous status) and their development; finally, the ecological engineering component was analyzed by studying the ability of an ecosystem engineer (*Lumbricus terrestris*) to improve the fertility of the Technosols.

After a few months, some pedogenetic processes were initiated (e.g., settlement, weathering of parent materials) and the indicators selected to evaluate the fertility of the constructed Technosols (physico-chemical and biological parameters) showed a good potential to support vegetable crops. Upon establishment of the constructed Technosols, some of the selected soil fauna bioindicators were also able to sustain their fitness, suggesting the initiation of a future trophic web.