EGU2020-3155, updated on 25 Feb 2021
https://doi.org/10.5194/egusphere-egu2020-3155
EGU General Assembly 2020

Development of plant-available water in soil-like substrate derived from urban wastes and processed by earthworm Dendrobaena veneta

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Topsoil and peat are often taken from intact rural ecosystems to supply the urban demand for fertile soils and soil-like substrates. One way of reducing this exploitation is to recycle suitable urban wastes to produce Technosols and technogenic soil-like substrates. In this study we investigate the role earthworms can play in improving the hydraulic properties of such a soil-like substrate.

In a four-month microcosm experiment, the influence of the earthworm species D.veneta on the hydraulic properties of brick-compost mixture was examined. Of the ten boxes filled with ca. 11 dm³ of ground bricks (0.7 cm³ cm-3) and green waste compost (0.3 cm³ cm-3), five contained earthworms (W-boxes) and the remaining five were used as controls (C-boxes). The substrate was periodically irrigated and the weight of the boxes and of the drained water was monitored. At the same time, images were taken from the front of the boxes to quantify the activity of the earthworms by image analysis. Before and after the experiment, water retention curves were determined from disturbed samples of the substrate using the simplified evaporation method.

After six weeks, differences between the C- and the W-boxes were evident. Micrographs showed brick-compost aggregates only for the substrates processed by earthworms. The earthworm activity leads to reduced evaporation and an increased water content in the respective microcosms. The effect persists even after disturbing the substrate. The proportion of plant-available soil water is about 0.02 cm³ cm-3 higher for the substrate processed by earthworms (0.250 ±0.009 cm³ cm-3) compared to the control (0.230 ±0.008 cm³ cm-3).

This study shows that earthworms are capable of ingesting and processing crushed bricks together with compost. The earthworms produced aggregates which persisted after disturbance and had a positive influence on the water retention capacity of such a soil-like substrate constructed from waste.