

3. The initial composition of waste constructed Technosols can affect the survival and behaviour of anecic earthworms (*Lumbricus terrestris*)

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Abstract:

Technosols (WRB, 2006) are soils with properties and pedogenesis strongly dominated by artificial materials or transported materials. In the case of industrial brownfield management, Technosols can be constructed intentionally to reclaim the ecosystem. These constructed Technosols can be constituted of artificial materials, usually considered as wastes. Here we study a model constructed Technosol, composed of i) an upper layer of green-waste compost (GWC), ii) a layer of a mixture of thermally treated industrial soil and papermill sludge (50/50) (TIS/PS) and iii) a layer of papermill sludge (PS) in the depth of the profile. The early stages of the pedogenesis of this Technosol have been studied for several years demonstrating its capacity to perform basic soil functions (Sere et al., 2008). However, few studies concern fauna activity, even though it has been demonstrated that soil fauna can greatly modify soil functioning and contribute to ecosystem services in "natural" soils (Loreau et al., 2001; Lavelle et al., 2006). Earthworms appear as key actors of global functioning of soil because of their direct influence on soil structure and on other organisms (e.g. mesofauna, microorganisms). Thus, introducing earthworms, especially endogeic and anecic species, in reclaimed lands has been largely studied (Butt, 1999; Scullion and Malik, 2000) and has demonstrated the capability for earthworms to improve soil properties.

The aim of this study is to assess the influence of the two materials of the constructed Technosol (GWC and TIS/PS) on the anecic earthworm *Lumbricus terrestris* survival and functional behavior. We used small microcosms constituted of few hundred of grams of soil and large microcosms (several kg) filled with five modalities: 100% GWC, 75% GWC-25% TIS/PS, 50% GWC-50% TIS/PS, 25% GWC-75% TIS/PS, 100% TIS/PS. Mortality, biomass and cast production were assessed on the small microcosms after 7 days, while the larger microcosms were used to study mortality, biomass, surface casts and galleries production after 14 and 31 days. Surface casts, C and N contents were analyzed. Some of these casts were subjected to ultra-structural characterization (Watteau et al., 2006). Tomography was performed to study galleries production.

Results showed a significant effect of the Technosol composition on earthworm biomass production. In the small microcosms, a decrease of body mass was observed with increasing proportion of GWC. In the larger microcosms, the growth rate became positive for TIS/PS content close to 50% after 30 days. A higher TIS/PS content had negative effects on the growth rate. Tomography showed that an increasing content of GWC induced a decrease of the total volume of galleries. Ultrastructural characterization pointed the fact that casts are made of a mixture of GWC and TIS/PS when GWC is present in cosms. The major conclusion of this study is that the initial composition of the Technosol affects the survival and behavior of *L. terrestris*. This could have consequences on soil functioning and pedogenesis in affecting the aggregation processes.

Keywords: Technosol, waste-constructed soil, soil fauna, earthworm, functional behaviour

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