The BIOTECHNOSOL project: biological dynamics and functioning of a constructed Technosol at the field scale

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Abstract
Within the French National programme GESSOL and the GISFI consortium, the BIOTECHNOSOL project has been carried out. The purpose of the project aims to acquire information about the biodiversity of constructed Technosols that are used to restore brownfields. Results indicate an increase of biodiversity in the system within the two first study years.

Key Words
Technosols, soil biota, Brownfields.

Introduction
Technosols (USS Working Group WRB 2006) are soils, whose properties and pedogenesis are dominated by artificial or transported materials. In the case of industrial brownfield management, constructed Technosols can be used intentionally to reclaim ecosystem. These Technosols can be constituted from artificial materials, usually considered as wastes. Sponsored by the French National Soil Programme GESSOL, and within the GISFI (Groupement d'Intérêt Scientifique sur les Friches Industrielles), a consortium of soil biologists has been constituted to study a model Technosol ecosystem at the field scale. The main question of the project focuses on the capacity of the Technosols to allow essential functions of a natural soil, particularly vegetation development, which means restoration of physical and chemical fertility. Our hypothesis is that soil organisms, by their diversity and functional complementarities, are essential actors in the system for the main physical (aggregation, bioturbation) and chemical (Carbon and Nitrogen cycles) processes. In this context, our objective is to assess the colonisation dynamic of the Technosol by soil biota and their impact on several functions.

Material and methods
The Technosol is composed of a layer of green-waste compost (CDV) on the surface, a layer of a mixture of clean-up industrial soil and papermill sludge (50/50) (TIT/SPP) and a final layer of papermill sludge (SPP) (Figure 1). Two kinds of Technosol profiles are studied, differing by their water retention: the « éponge végétale » profile maintains water for vegetation, while the "confinement" profile limits water transfers to the substrate. The pedogenesis of these Technosols has been studied for several years demonstrating their capacity to perform basic soil functions (Séré, Schwartz *et al.* 2008). For that purpose a field of more than 1 ha, using this Technosol, has been established in October 2007, on a derelict Brownfield in the Lorraine Region. The working group is constituted of soil ecologist specialists of various biota (Bacteria and Mycorhiza, nematodes, microarthropods, macroarthropods and earthworms), agronomists, and soil bio-physicians. Sampling has occurred each year at spring time since 2008 (Figure 2).

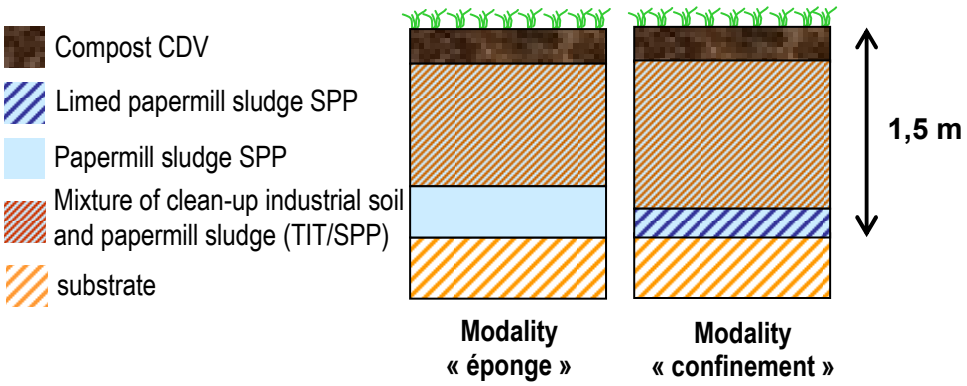

Figure 1. profiles of the constructed Technosols.

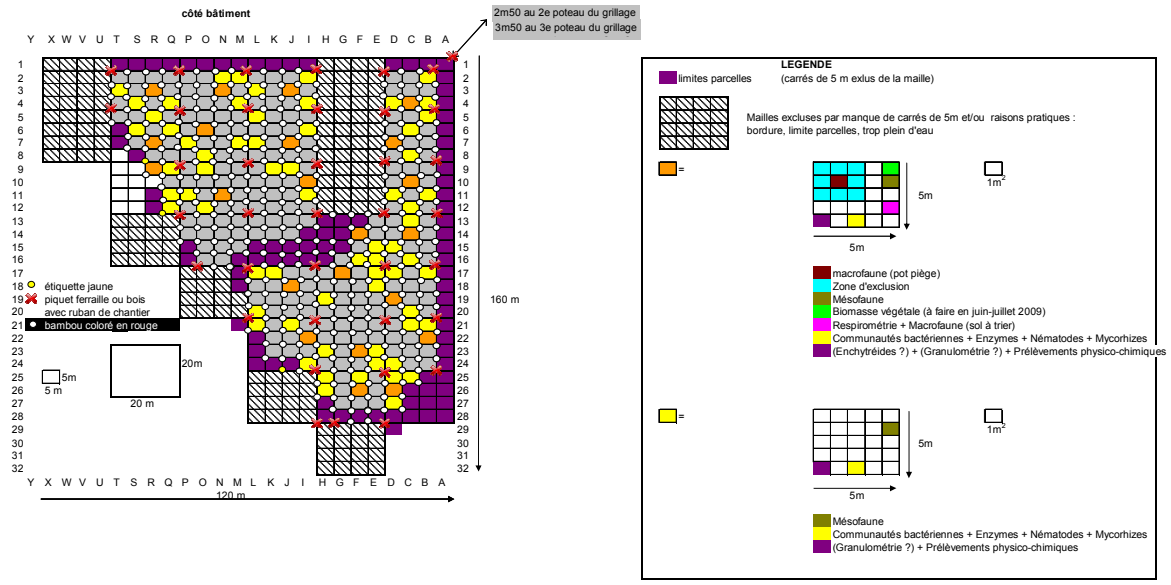

Figure 2. Schema of the sampling grid and sampling strategy on the field.

Table 1. list of the Collembola species sampled on the Technosol in 2008.

Species	Geotropism	Ecology
Cryptopygus thermophilus	Hemiedaphic	Compost
Hypogastrura manubrialis	Hemiedaphic	Compost
Proisotoma minuta	Hemiedaphic	Compost/pionner
Sminthurinus elegans	Hemiedaphic	Low vegetation
Isotoma viridis	Epiedaphic	Ubiquist
Parisotoma notabilis	Hemiedaphic	Ubiquist
Sphaeridia pumilis	Hemiedaphic	Ubiquist

Results

The first results (2008 and 2009 sampling) indicate that the system is typical of pioneer ecosystems, with the presence of bacterivorous nematodes and absence of macrofauna. Initial Collembola communities are largely influenced by the initial materials (particularly composts) and the borders of the field (Table 1), showing a centripetal colonisation during the first 2 years. However, an increase of species richness, particularly concerning nematodes, is observed between 2008 and 2009. Furthermore some significant differences appear between the two profiles, especially concerning plant species richness and soil respirometry.

References

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