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Soil health indicators in Technosols vegetated with Atlantic grassland species

J.A. Oliveira[1], P. Fernández[2], B. Vega[2]

[1]Plant Production Area, Organisms and Systems Biology Department, University of Oviedo, Asturias, Spain.
[2]Silvana Medioambiental y Forestal S.L., Pola de Siero, Asturias, Spain.

**Correspondence*: oliveira@uniovi.es

INTRODUCTION

Recovery of environments altered by human activities can be hampered by the lack of stockpiled soils, which are required for restoration work and planting. However, large amounts of by-products are produced during the treatment of solid urban waste and construction and demolition waste. Many of these secondary products can be recycled to create Technosols.
Typical soil fertility analyses often do not include physical or biological soil indicators that could provide insights into soil health, help explain problems related to crop growth and reduce the need to use synthetic fertilisers and plant protection products.
The aim of this research was to evaluate three soil health indicators in six types of Technosols sown with diverse Atlantic grassland species.

MATERIALS AND METHODS

Six different Technosols were created by mixing Recysoil (commercial substrate, Cogersa, Asturias, Spain) (70%) and stockpiled soil (TA) (28%) with 2% by volume of different organic amendments: T1=Recysoil(70%)+TA(30%); T2=Recysoil(70%)+TA(28%)+Biochar(2%); T3= Recysoil(70%)+TA(28%)+Sludge hydrochar(2%); T4= Recysoil(70%)+TA(28%)+Hydrochar organic fraction(2%); T5= Recysoil(70%)+TA(28%)+Hydrochar paper-cardboard(2%); and T6=Recysoil(70%)+TA(28%)+Worm humus(2%).
The experimental design was completely randomised, with the 6 Technosols replicated 3 times.
On 4/5/2023 the plots were sown with diverse (37 species) Atlantic grassland (6 g/m^2).
The following soil health indicators were analysed, in two replicates of the soils sampled (upper 20 cm layer): soil microbial respiration (CO_2-C, ppm), potentially mineralizable organic nitrogen (SLAN, ppm) and stability of soil aggregates to water (VAST, %) (Solvita Kit, Woods End Laboratories Inc., Mt. Vernon, ME, USA). An analysis of the variance was performed to check the effects of Technosols and sampling time.

RESULTS

The Technosols were characterized by neutral pH and high contents of organic matter and main nutrients.
There were no statistically significant differences between the Technosols in regard to the three soil health indicators assessed but there were differences between sampling dates (Figure 1).

Figure 1. Mean values of CO_2-C, SLAN and VAST at three sampling times (± SE). Bars with different letters (a>b) indicate significant differences at $p < 0.05$ (Tukey's test).

Technosol plots (3 m x 4 m) (26/5/2023)

The values obtained for soil microbial respiration were intermediate decreasing between first and third sampling time, potentially mineralizable organic nitrogen was intermediate-high increasing between first and third sampling and aggregate stability to water was low although it increased between the first and the third sampling.

DISCUSSION

The lack of significant differences between the Technosols may be due to the short time since establishment, so that the microorganisms had not yet been able to mineralize the organic matter present in the Technosols and form stable aggregates. Three soil health indicators will continue to be monitored every 2-3 months, until the end of June 2025, to enable calculation of an overall health and fertility index for each Technosol.

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ID: 36