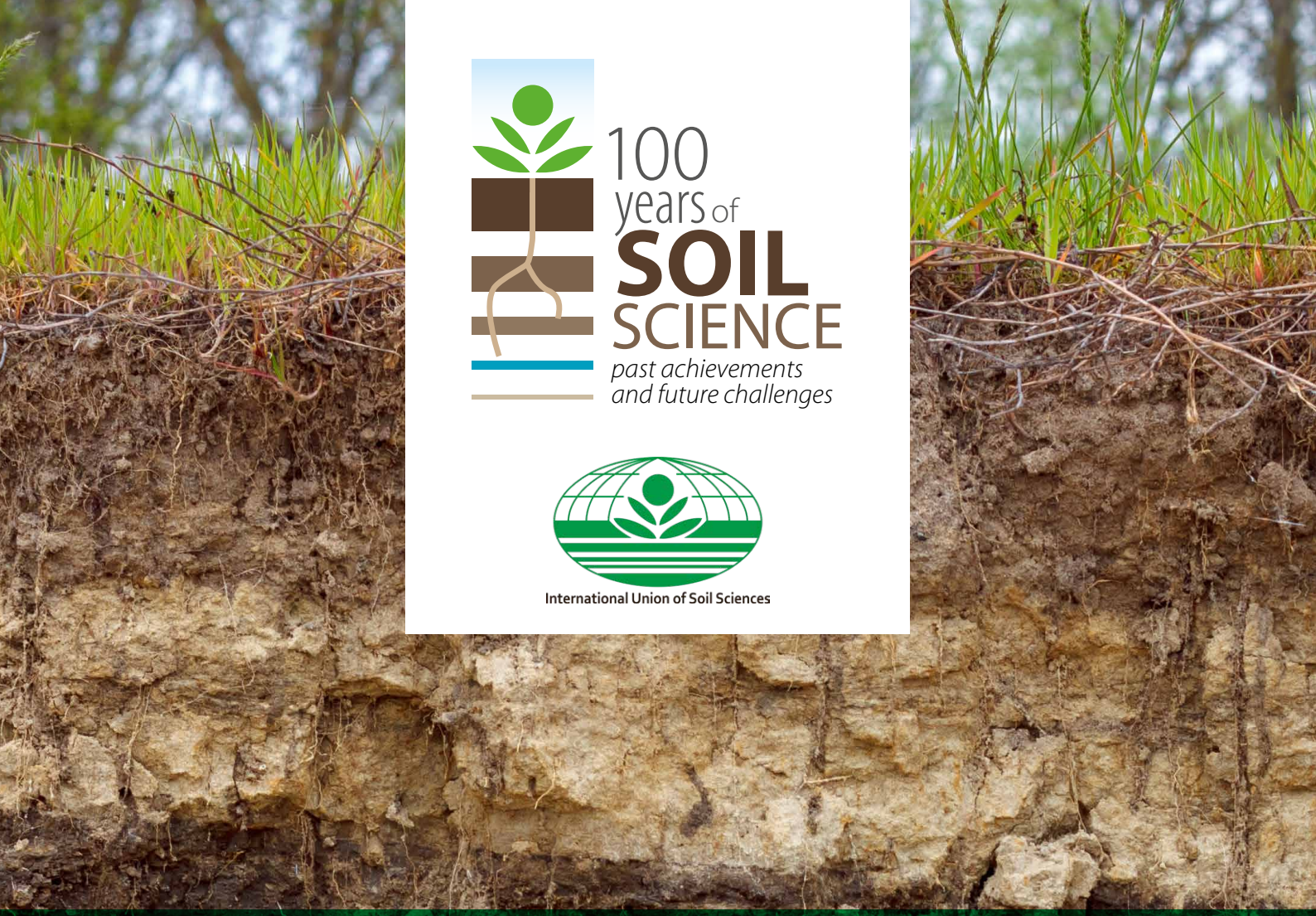

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Florence - Italy

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ABSTRACT BOOK

ID ABS WEB: 136034

4. Soil health in achieving the Sustainable Development Goals
4.04 131145 - Dynamics and functions of soil organic matter under new and traditional amendments

SHORT TERM EFFECT OF NOVEL BIOBASED FERTILISERS FROM FRUIT AND VEGETABLE RESIDUES ON SOIL FUNCTIONING

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The H2020 Rustica project aims to produce novel biobased fertilisers (BBF) from fruit and vegetable residues to reduce mineral fertilizer dependence, improve soil health, and tackle soil organic matter loss. The novel BBF are microbial biomass (MB) from microorganisms cultivation, insect biomass (IB) and frass (IF) from insect farming, and biochar (BI) from pyrolysis.
The application of such new materials can have undesired impacts on soil and, consequently, an exhaustive assessment of their effects on soil functioning is needed.
For this purpose, MB, IB, IF, and BI were applied at a rate of 0.5% to a soil and incubated in the laboratory for 30 days. CO2 and N2O emissions were measured continuously throughout the incubation. After 2, 7, and 30 days, soil samples were analysed for extractable NH4+, NO3- , P, organic C and N (EN), Olsen P, and soil microbial biomass C and N.
The percentages of added C mineralised after 30 days were 0.8%, 25%, 47% and 53% for BI, IF, MB and IB, respectively. The outstanding stability of BI supports its effectiveness to foster soil C sequestration. The different degree of degradability of BBF is supported by their properties in terms of oxygen uptake ratio, water soluble C and N. This is reflected by N2O emissions, with higher levels observed in soil treated with IB and MB.
Biochar and IF did not cause an increase in N availability. On the other hand, IB and MB caused an enhancement in EN compared to the control of 7% and 13%, respectively, suggesting their relevance as N fertilisers.
Soil microbial biomass was increased by MB and IB, and for a lesser extent by IF.
BBF showed large differences regarding their impact on soil quality. As such, they can be applied to exert different functions (mineral fertilizers substitution, soil quality maintenance, climate change mitigation). Moreover, results can be useful to identify management options to maximize BBF potential and avoid detrimental effects.

Keywords: biobased fertilisers, soil functions, exogenous organic matter, soil C cycle, climate change

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4. Soil health in achieving the Sustainable Development Goals
4.04 131145 - Dynamics and functions of soil organic matter under new and traditional amendments

MODELLING LONG-TERM IMPACT OF NOVEL BIOBASED FERTILIZERS ON SOIL ORGANIC MATTER STORAGE FROM LABORATORY SHORT-TERM C MINERALIZATION

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The growing emphasis on circular food economies and sustainable agriculture is driving the recycling of exogenous organic matter (EOM) through the production of biobased fertilizers (BBF). While this provides an opportunity to reduce reliance on mineral and synthetic fertilizers, uncertainty exists regarding the long-term impact of BBF application on soil organic matter dynamics.
This study aims to model the impact of novel BBF - such as microbial biomass, insect biomass, insect frass, biochar, and derived blends, produced in the framework of Horizon 2020 project RUSTICA - on long term soil C storage.
For this purpose, we used a modified version of the RothC model encompassing additional EOM pools. We calibrated EOM pools parameters, specifically pool size and decay rates, through inverse modelling of EOM C mineralization rates from amended soil. We performed one-month laboratory incubation experiments of soil amended with BBF and derived blends under controlled aerobic conditions (40% of water holding capacity and 20°C). Maximum likelihood estimates for EOM pools size and decay rates were inferred by a Bayesian inversion with Differential Adaptive Metropolis (DREAM) algorithm of EOM C mineralization rate. The modified RothC model with parameterized EOM pools was then used to predict the long-term effects (100 years) of BBF and derived blends on soil C stocks.
Results indicate the remarkable stability of biochar, supporting its efficacy in promoting soil C sequestration, even when blended with other BBF. Conversely, insect biomass, even in small amounts in the blend (16.7%), enhanced CO2 flux, leading to lower EOM C retention. This emphasizes the need for careful consideration when incorporating specific BBF into soil management practices.
In conclusion, our study provides insights into the complex dynamics of EOM pools decomposition of novel BBF, offering a comprehensive understanding of both short-term impacts and long-term implications. These findings contribute useful information to advise sustainable soil management practices aimed to recover and enhance soil organic matter storage.

Keywords: biobased fertilisers,soil C modelling,soil C sequestration,biochar,inverse modelling