How soil tillage/cover crops technology, carbon amendments and nitrogen fertilisation affect the formation of the recalcitrant soil organic carbon fraction – MAOM

Introduction

Soil organic matter (SOM) plays a crucial role in regulating global carbon (C) and nitrogen (N) cycles, thus impacting climate change. Mineral-associated organic matter (MAOM) is vital for long-term C sequestration as a recalcitrant fraction of SOM. This study investigates the effects of different tillage/cover crop and fertilisation strategies, both organic and mineral, on C and N concentrations in MAOM. Understanding these interactions is key to optimising agricultural practices to improve soil fertility and mitigate greenhouse gas emissions (Spohn, 2024).

Approach

We analysed soil samples from a field experiments arranged in randomized blocks /split-plot design, comparing conventional and no-tillage systems (combined with cultivation of cover crops), carbon amendment (none, biochar, compost, and composted biochar) and mineral N fertilisation at 0%, 50%, and 100% of $CaNO_3$ standard dose (Darenova et al., 2022). C and N in MAOM were measured, and treatment interactions were assessed by means of statistical model.

Results

Preliminary findings show a significant interaction between tillage/cover crop strategy and organic amendment on soil C and N (Figure 1 and 2), in favour of no-till/cover crop practices enriched with carbon amendment based on compost and composted biochar. Compost and composted biochar, when combined with no-till/cover crops and mineral N fertilisation, significantly increased C and N in MAOM in comparison to other treatments.

Conclusions

No-till/cover crop systems, combined with carbon amendment and mineral N fertilisation, enhance soil C and N storage (particularly in recalcitrant form of MAOM fraction) , offering sustainable agricultural practices that reduce environmental impacts and improve soil health.

Learning Objectives

Delegates will learn how no-tillage systems combined with targeted fertilisation can optimise soil C and N storage, enhancing both crop yields and sustainability in agriculture.

Spohn, M. (2024). Preferential adsorption of nitrogen- and phosphorus-containing organic compounds to minerals in soils: A review. In *Soil Biology and Biochemistry* (Vol. 194). Elsevier Ltd. https://doi.org/10.1016/j.soilbio.2024.109428

Darenova E., Findurova H., Holub P., Klem K. (2022). Soil CO_2 Efflux Response to Combined Application of Adaptation Technologies, Nitrogen Fertilization, and External Carbon Amendment in Wheat and Barley Field. In *Frontiers in Environmental Science* (Vol. 10) https://doi.org/10.3389/fenvs.2022.920247

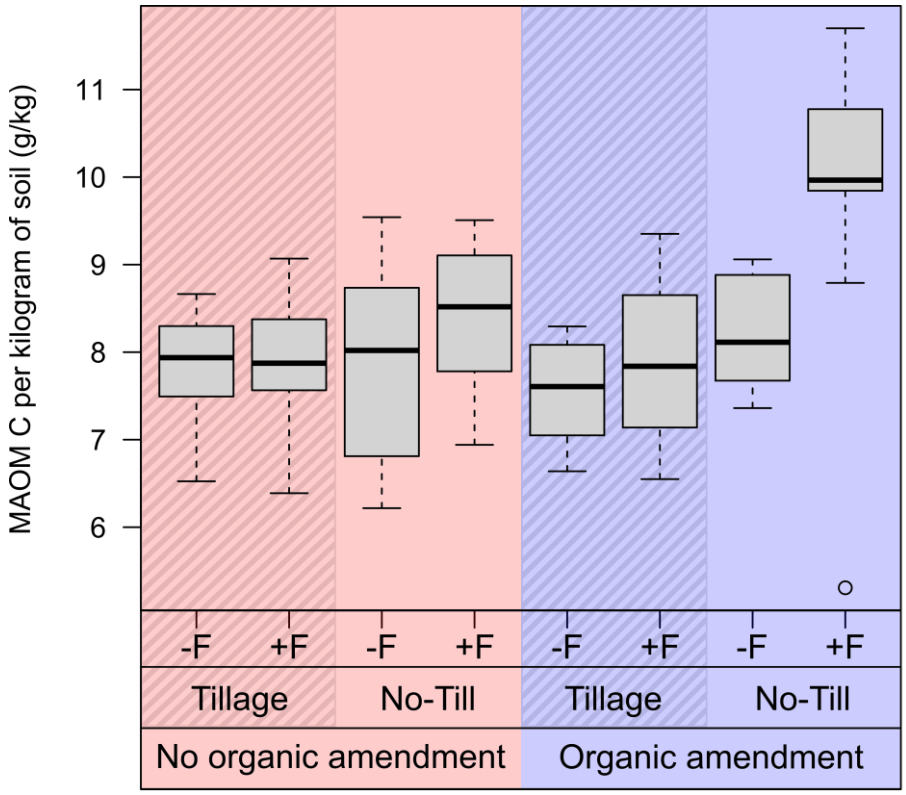

Figure 1 *Amount of C in the MAOM soil fraction in grams per kilogram of soil in combination with all treatments.* ***+F*** *is the addition of the mineral fertiliser* $CaNO_3$ *and* ***-F*** *is the absence of this fertiliser.*

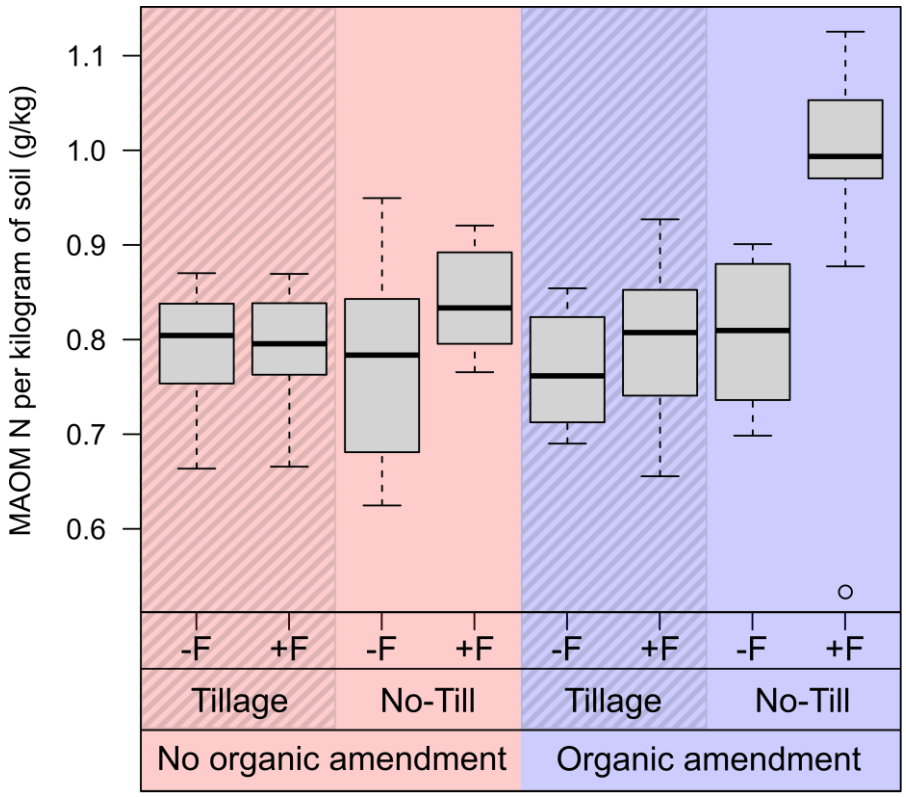

Figure 2 *Amount of N in the MAOM soil fraction in grams per kilogram of soil in combination with all treatments.* ***+F*** *is the addition of the mineral fertiliser* $CaNO_3$ *and* ***-F*** *is the absence of this fertiliser.*