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EFFECT OF DIFFERENT COVER CROPS ON SOIL ORGANIC CARBON FRACTIONS IN MEDITERRANEAN VINEYARDS

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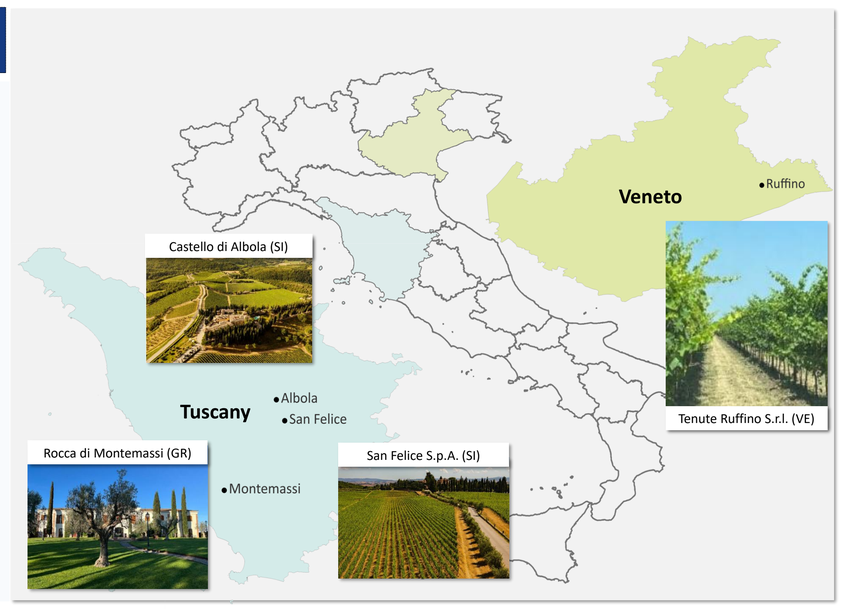
INTRODUCTION

Carbon farming (CF) practices aim to enhance soil organic carbon (SOC) levels to contribute to climate change mitigation. In vineyards, among the recommended CF practices, the use of cover crops (CC), is becoming increasingly widespread due to their ability to improve soil SOC levels by reducing the incidence of soil aggregates degradation and mineralization rates (Jiménez-González et al. 2023).
While numerous agricultural studies focus on total SOC content, the critical distinction between protected and unprotected carbon fractions is often overlooked. **Unprotected carbon** is more vulnerable to microbial decomposition and thus more readily released as CO_2, reducing its long-term potential as a carbon sink. In contrast, **protected carbon**, typically associated with clay and silt particles or stabilised within microaggregates, is less accessible to microbes and therefore more stable over time (Six et al. 2002). Recognizing and quantifying these fractions is fundamental for accurately assessing the capacity of agricultural soils to act as long-term carbon sinks.

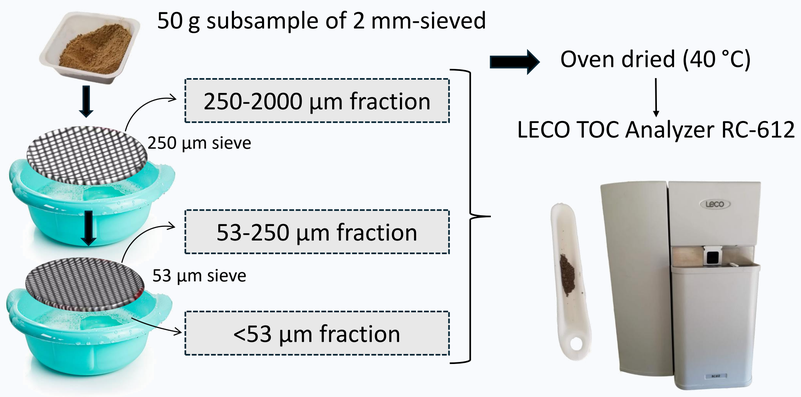


OBJECTIVES

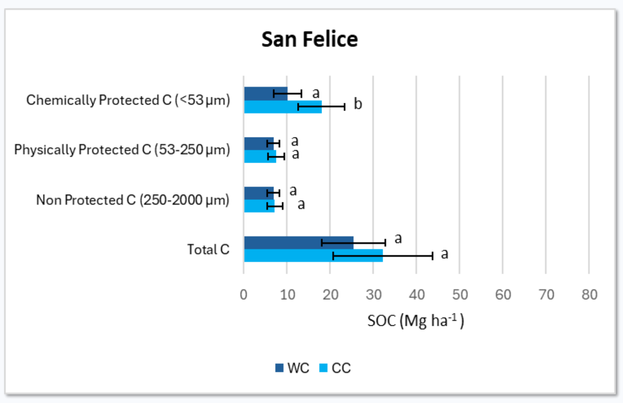
- In this study, we investigated the effects of two categories of agricultural practices on the distribution of SOC. The categories included (i) soil tillage in conventional management and (ii) the use of Cover Crop.
- Specifically, SOC concentrations were assessed in different soil fractions: **non-protected (250–2000 µm)**, **physically protected (53–250 µm)**, and **chemically protected (<53 µm)**, all of which are stable in water (water-stable aggregates - WSA) (Tisdall & Oades 1982).

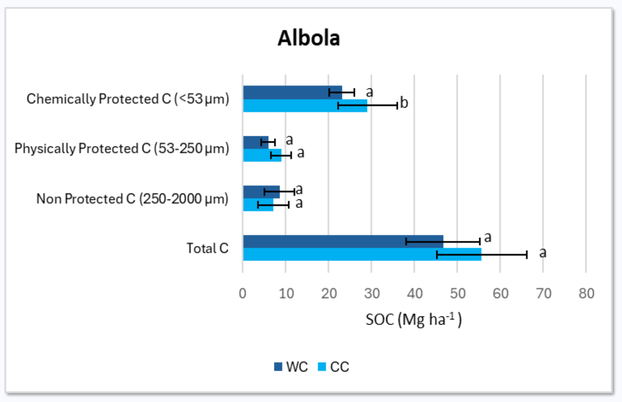
MATERIAL AND METHODS

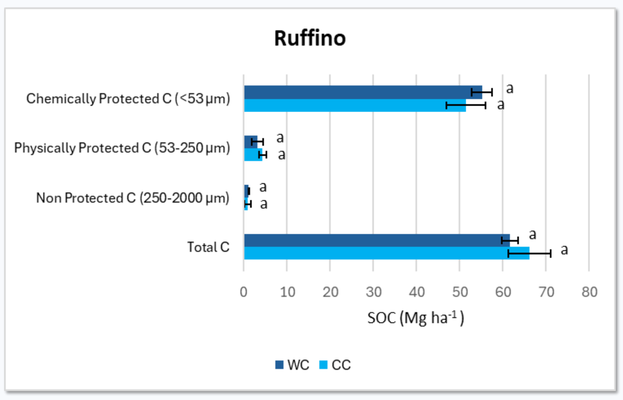
The study was conducted in vineyards of 4 pilot farms across Northern and Central Italy. Soil samples were collected randomly in spring 2024 from the topsoil (30 cm) in vineyards with CC and without cover crops (WC). The different soil fractions of WSA was determined by following and modifying, in some points, the wet sieving method prescribed by Elliott (1986) and described in Six et al. (2000). Total organic carbon (TOC g kg^{-1}) of all fractions, was measured using a LECO TOC Analyzer (RC-612 ,LECO Corporation, 1987) and its concentration was turned into SOC (Mg ha^{-1}).

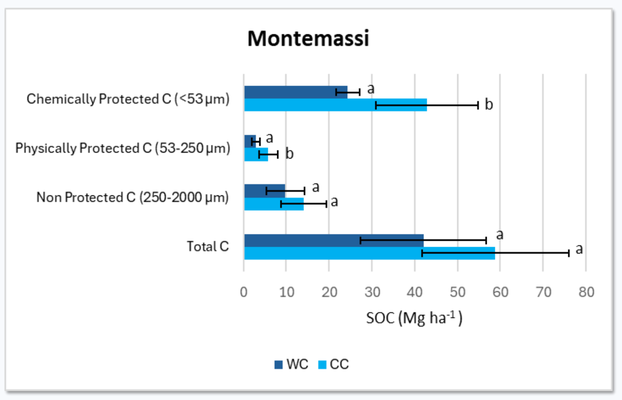


RESULTS









CONCLUSION

The results indicate that vineyard management practices incorporating CC lead to higher SOC concentrations compared to those WC. Specifically, CC management resulted in SOC increases ranging from 8% to 102% in the physically protected fraction, and from 26% to 76% in the chemically protected fraction, relative to WC. However, in the pilot farm of Ruffino, the CC vineyard exhibited a 7% decrease in chemically protected SOC compared to the WC vineyard. This reduction, however, falls within the range of the standard deviation, indicating that it may not be statistically significant.

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