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Carbon speciation and carbon isotopic characterization of agricultural soils in Emilia-Romagna Region (Northeastern Italy)

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The agricultural European Innovation Partnership (EIP-AGRI) Focus Group on Soil Organic Matter (SOM) content in Mediterranean regions highlighted the poor organic carbon (OC) content in the investigated soils, with some areas, especially in Southern Europe, showing low (≤2%) or even very low (≤1%) OC values. For this reason Emilia-Romagna Region (Northeastern Italy) invested heavily in the Rural Development Programme (RDP), which financed projects addressed to the needs of specific geographical areas. Among these, SaveSOC2 project (Save Soil Organic Carbon) aims to evaluate the quantity and quality of SOM in both conventional and organic farms from distinct pedo-climatic setting of Emilia-Romagna Region and with possible critical issues, in order to identify the best agricultural practices which could contribute to i) carbon conservation and sequestration in soil and ii) mitigation of SOM mineralization responsible for the greenhouses emissions. Here we report the data of the "Tassinari" organic farm located at Bondeno, near Ferrara city in Padania Plain, an area characterized by soil with very low amount of OC. In the selected organic farm, topsoil samples (0-15 cm and 15-30 cm depth) were collected from strawberry fields and orchards converted from conventional to organic production since 1992. The soils have loam and silt loam texture, they are subalkaline (pH: 7.9-8.7) and nonsaline (EC: 0.1-0.2 dS m^{-1}). To characterize the soil inorganic (SIC) and organic (SOC) carbon, for each sample, elemental and isotopic analyses were performed using the Thermally Based Separation protocol tested by Natali et al. (2018) with an EA-IRMS. As expected, the vertical distribution of carbon along each site showed a negative correlation between SIC and SOC contents, as IC slightly increase over depth while OC show a clear decline. Moreover, irrespectively of the sampling depth, the OC values (0.90-1.14 wt.%) are always lower than those of IC (1.04-2.50 wt.%). The relatively low negative $\delta^{13}C$ values of the total carbon (from -12.1‰ to -9.0‰) reflect the predominance of SIC in the investigated topsoils. The low storage of organic matter in this area is also confirmed by the OC stock value in the topsoils, which is on average 42.6 Mg/ha. A Soli TOC Cube® was also used to discriminate the labile organic carbon (TOC_{400}) and the residual oxidizable carbon (ROC) fractions, which are oxidized at temperature below and above 400°C, respectively. In all the investigated topsoils, the TOC_{400} values (0.60-0.84 wt.%) are higher than those of ROC (0.21-0.28 wt.%), indicating large amount of "fresh" organic matter, and low amount of residual organic carbon. The high relative presence of labile OC pools, probably due to the soil fertilisation with easy available

organic compounds, can be critical for SOM sequestration, preventing the accumulation of stabilised organic compounds.

Natali C., Bianchini G., Vittori Antisari L. 2018. Thermal separation coupled with elemental and isotopic analysis: A method for soil carbon characterisation. Catena 164, 150-157.