Carbon Fractions Associated with Silt-Size Particles in Surface and Subsurface Soil Horizons

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Information on the distribution and behavior of C fractions in soil particle sizes is crucial for understanding C dynamics in soil. At present little is known about the behavior of the C associated with silt-size particles. We quantified the concentrations, distribution, and enrichment of total C (TC), readily oxidizable C (ROC), hot-water-extractable C (HWC), and cold-water-extractable C (CWC) fractions in coarse (63–20-μm), medium (20–6.3-μm), and fine (6.3–2-μm) silt-size subfractions and in coarse (2000–250 μm) and fine (250–63 μm) sand and clay (<2-μm) soil fractions isolated from bulk soil (<2 mm), and 2- to 4-mm aggregate-size fraction of surface (0–25 cm) and subsurface (25–55 cm) soils under different land uses. All measured C fractions varied significantly across all soil particle-size fractions. The highest C concentrations were associated with the <20-μm soil fractions and peaked in the medium (20–6.3-μm) and fine (6.3–2-μm) silt subfractions in most treatments. Carbon enrichment ratios (ER_C) revealed the dual behavior of the C fractions associated with the medium silt-size fraction, demonstrating the simultaneous enrichment of TC and ROC, and the depletion of HWC and CWC fractions. The medium silt (20–6.3-μm) subfraction was identified in this study as a zone where the associated C fractions exhibit transitory qualities. Our results show that investigating subfractions within the silt-size particle fraction provides better understanding of the behavior of C fractions in this soil fraction.

Abbreviations: CWC, cold-water-extractable carbon; ER, enrichment ratio; HWC, hot-water-extractable carbon; ROC, readily oxidizable carbon; SOC, soil organic carbon; TC, total carbon.