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Particulate, mineral fraction and water extractable organic carbon in the soil and in the sediments transported by runoff

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Erosion is the most widespread process that cause land degradation. It produces changes in soil properties and contribute to the depletion of organic matter content as well as to the loss of nutrients. The changes have an additional effect on the infiltration and on water retention capacity, which all together influence crop productivity. Water erosion occurs due to natural forces rainfall. But in areas with Mediterranean climate, most of erosion losses occur in a reduced number of events of high intensity. In this research, the effect of high intensity rainfalls on soil carbon mobilization was analysed in a vineyard, which is maintained with scarce soil cover most of the year. The research was carried out under simulated rainfall in a commercial vineyard located in Raimat, Costers del Segre Denomination of Origin, Lleida, NE Spain). The soil type in the analysed plot is classified as Haploxeralf fluventic located in a gentle slope (about 5%). Soil samples from 0-2 cm were collected in two locations in the field, before the rainfall simulation for texture characterization and chemical analysis. Plots 1m length*0.5 m width were delimited in the field at each location and subjected to simulated rainfall using a rainfall simulator consisted, which had a dropper system placed 2.5 m above the ground. The rainfall intensity was fixed for the experiment in 60 mm/h. The simulations were done in triplicate. Runoff was collected every 10 minutes during 1h and the sediment transported by runoff was separated and weighted after dried. Total organic carbon (TOC) was analysed in the soil before and after the simulation. In addition, in the original soil and in the sediments recorded in each simulation, the particulate organic carbon (POC) and the mineral-associated organic carbon (MOC) (Cambardella and Elliott, 1992), as well as the water extractable organic carbon (WEOC) (Gigliotti et al., 2002) were analysed. The soils had 50.2 and 49.5% of silt, 25.5 and 23.2% of clay and 24.3 and 27.3% of sand, respectively. Runoff started between 4.5 and 7 min after the beginning of the simulations, and runoff rates were of about 50% after the first 20 minutes of rainfall. Sediment concentration in runoff ranged between 13 and 18 gL^{-1} in the three simulations. The TOC in the original soils were 14.09±0.67 gkg^{-1} and 13.56±0.8 gkg^{-1}, respectively, while after the simulation the TOC was near 10% lower. In the sediments, TOC were 12.29±1.13 gkg^{-1} and 12.84±1.19 gkg^{-1}, respectively in both soils. The POC and the MOC represented 24.7% and 75.3% of TOC in the original soil, and no significant changes were observed in the sediment transported by runoff (values ranging between 25.90 to 28.47 % for POC and between 71.5 and 74.1% for MOC). However, the WEOC fractions were higher in the sediment (7.7 and 7.5%) than in the original soil (5.26%).

References

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