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Spectroscopic study of effects of spent coffee grounds addition on soil organic matter in two Mediterra-nean agricultural soils

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Soil degradation is one of the main environmental threats of our time. This problem is even worse in the Mediterranean region due to its arid climate and intensive agricultural practices. A possible solution to this problem is to restore the adequate levels of organic matter in the soil with the addition of organic amendments, also improving physical quality, chemistry and biology of the soil, and, therefore, their fertility. For this purpose, the use of spent coffee grounds (SCG), a byproduct that currently is not recycled could be an alternative. The addition of this byproduct has very different effects in soils including the increase of organic carbon, total N, available K and P. Furthermore, it has been demonstrated that the uncomposted sludge lead to quelation of many minerals in the soil, acting as a nutrient "warehouse" while composted sludge reduced the chelating effect and increased the free micronutrient content. However, the effect on soil organic matter has received very little attention and it is necessary to study the transformation of soil organic carbon after the soil amendment. The objective of this study was to characterize the organic matter quantity and quality in soils after an addition of SCG, by realizing an organic matter extraction and phase characterization following the IHSS procedure. Furthermore, humic acids were characterized by means of UV-Vis and mid-infrared spectroscopy. Soil samples of two agri-cultural soils developed under a Mediterranean climate (Vega soil, a Cambic Calcisol and Red soil, a Chromic Calcic Luvisol) were collected, and different amounts of SCG were added (0%, 2.5% and 10%). Results indicate that SCG addition not only increases greatly the amount of soil organic carbon and total extractable carbon (TEC) but also all fractions of organic matter, humins, fulvic acids (FA) and humic acids (HA). This increase is similar for both types of soil and it is related to the amount of SCG added. However, the increase is much higher for TEC than for evolved OM fractions (HA+FA), as showed by the humification index. Taking a further look to HA composition, UV-Vis results indicate a higher amount of HA partially (A4) and totally humified (A6) in Vega soils. A4/A6 ratio was lower in soils without SCG addition, indicating a greater evolution of HA when no SCG is incorporated as well as a greater evolution in Vega soils in comparison with red soils. Mid infrared band area of main peaks rein-forces these results: SCG addition increased the amount of aliphatic compounds (with absorption bands at 2920 and 2850 cm-1) and C=O bonds related to lignin (1543 and 1412 cm-1). All results clearly indicate that organic matter in Vega soil was more evolved and that addition of SCG increased total organic matter in soils, but in poorly evolved forms, very labile, not being the best option to generate an organic matter warehouse.