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Irrigation-induced changes in soil organic matter dynamics and soil aggregation in semiarid Mediterranean agrosystems

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Soil organic matter dynamics are of special importance for the sustainability of agrosystems, due to their role in soil quality, soil fertility and atmospheric C sequestration. Irrigation is known to influence organic matter dynamics, but this influence is not completely understood and may vary among different environmental conditions and crop and soil managements. An experimental field was set up in a *Calcic Haploxerept*in Navarra, NE Spain with the aim of evaluating the consequences of the transformation from dryland to irrigation in agricultural carbonated soils in semiarid conditions. The experimental field included four treatments: rainfed wheat (W-rf), irrigated wheat (W-irr), rainfed maize (M-rf) and irrigated maize (M-irr). The quantity of the crop biomass potentially added to the soil (non-harvested crops biomass) was measured during the two first growing seasons. Organic C storage, aggregation and organic C distribution among aggregate size-classes, and the proportion of maize-derived C incorporated from crop residues in M-rf and M-irr were measured on topsoil (0-10 cm) samples from year 0 (baseline) and two years after the initiation of the experiment. No differences were observed in the cumulative non-harvested biomass produced in the two years in M-irr and W-irr in comparison to rainfed treatments (M-rf and W-rf). No increase in total organic C stocks or distribution among aggregate classes among treatments was observed either. However, evidence of a change in organic matter dynamics in the soil under irrigation was found from ^{13}C data, which were used to estimate the proportion of maize-derived C in M-irr and M-rf. This proportion was notably higher in M-irr than M-rf, both in terms of total soil organic C from maize in the soil (13.4 $\pm$ 0.7% and 4.9 $\pm$ 1.4%, respectively), and in relation to the proportion of the non-harvested maize biomass incorporated to the soil in each treatment (up to 34 $\pm$ 3 % in M-irr for only 16$\pm$4 % in M-rf). The incorporation of organic C from maize occurred preferentially in larger aggregates (2-4 mm) in both treatments. A transfer from large aggregates to medium and smaller aggregates (0.25-2 mm and 0.05-0.25 mm) was observed only in M-irr, supporting the hypothesis that irrigation adoption changed the pace of the incorporation of fresh organic matter into aggregates. These results indicate that converting from dryland to irrigated cropland can have significant effects in organic matter dynamics in the short-term in semi-arid Mediterranean soils.