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Addition of organic amendments contributes to C sequestration in trace element contaminated soils.

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Nowadays, the study of global C cycle and the different natural sinks of C have become especially important in a climate change context. Fluxes of C have been modified by anthropogenic activities and, presently, the global objective is the decrease of net CO_2 emission. For this purpose, many studies are being conducted at local level for evaluate different C sequestration strategies. These techniques must be, in addition to safe in the long term, environmentally friendly. Restoration of contaminated and degraded areas is considered as a strategy for SOC sequestration. Our study has been carried out in the Guadiamar Green Corridor (Seville, Spain) affected by the Aznalcóllar mining accident. This accident occurred 16 years ago, due to the failure of the tailing dam which contained 4-5 million m3 of toxic tailings (slurry and acid water).The affected soils had a layer of toxic sludge containing heavy metals as As, Cd, Cu, Pb and Zn. Restoration techniques began to be applied just after the accident, including the removal of the toxic sludge and a variable layer of topsoil (10-30 cm) from the surface. In a second phase, in a specific area (experimental area) of the Green Corridor the addition of organic amendments (Biosolid compost (BC) and Leonardite (LE), a low grade coal rich in humic acids) was carried out to increase pH, organic matter and fertility in a soil which lost its richest layer during the clean-up operation. In our experimental area, half of the plots (A) received amendments for four years (2002, 2003, 2006 and 2007) whereas the other half (B) received amendments only for two years (2002-2003). To compare, plots without amendments were also established. Net balance of C was carried out using values of Water Soluble Carbon (WSC) and Total Organic Carbon (TOC) for three years (2012, 2013 and 2015). To eliminate artificial changes carried out in the plots, amendment addition and withdrawal of biomass were taken into account to calculate balance of kg TOC ha $^{-1}$. Thus, results revealed the effect of amendments. Values of net balance show an increase in C sequestered in amended plots. The retention of carbon in soluble and total forms was reflected in the increase in time. According to the results, application of leonardite (a more stabilized amendment) seems to entail a greater retention of carbon in soil than in the case of biosolid compost. Restoration strategies have multiple benefits for the ecosystem. In our case, the use of organic amendments decreased trace element toxicity, improved soil structure and microbial communities, and contribute to retain C in terrestrial ecosystems.