

Effects of organic amendments on water use efficiency evaluated by a stable isotope technique. A case study in experimental mine restoration.

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Water deficit and low infiltration reduce restoration success in semiarid post-mine soils, where high mortality of plants has been observed in early years of the restoration. Species that originate from arid and semi-arid regions are often considered appropriate for xeriscaping, but there have been relatively few direct measurements of main water related parameters as water use efficiency (WUE) in restoration strategies. In this respect, the goal of this study was to analyse the efficiency with which native plants use water when organic amendments and mulches are applied in mine soil restorations. The experimental design was established in a calcareous quarry in Almería (SE Spain), under arid climate. We tested two organic amendments (sewage sludge from water treatment plant and compost from vegetable residues) and gravel mulch. Three plant species were planted in 50 m² experimental plots: *Macrochloa tenacissima*, *Genista umbellata* and *Anthyllis cytisoides*. Soil moisture was monitored at a depth of 0.1 m during 4 years and at the end of this period stable isotope of Carbon ($\delta^{13}\text{C}$), considered as an effective method to evaluate the plant intrinsic WUE, was measured. We did not observe significant differences in soil moisture among the different soil restoration treatments. With regard to WUE, species is the factor most important to establish differences. *Anthyllis cytisoides* showed the lowest mean $\delta^{13}\text{C}$ values, indicating low WUE. On the contrary, *Macrochloa tenacissima* presented high $\delta^{13}\text{C}$ values. Moreover, species showed higher $\delta^{13}\text{C}$ values when gravel mulch was applied. To increase WUE in restored soils under arid conditions it is necessary to apply water conservation methods and to use the most appropriate species.