



## **Positive evolution features in soil restoration assessed by means of glomalin and its relationship to aggregate stability**

Lourdes Luna Ramos (1), Isabel Miralles Mellado (1), María Gisbert Negrell (2), Giovanni Pardini (2), and Albert Solé Benet (1)

(1) Estación Experimental de Zonas Áridas (CSIC), La Cañada de San Urbano, 04120, Almería. Spain , (2) High Polytechnic School, University of Girona, Campus Montilivi, 17003, Girona, Spain

Restoration of limestone quarries in arid environments mainly consists of regenerating a highly degraded soil and/or creating a soil-like substrate with minimal physico-chemical and biological properties. In an experimental soil restoration in limestone quarries from Sierra de Gádor (Almería), SE Spain, with the aim to improve soil/substrate properties and to reduce evaporation and erosion, 18 plots 15 x 5 m were prepared to test organic amendments (sludge, compost, control) and different mulches (gravel, chopped forest residue, control). In order to evaluate the soil quality of the different treatments, their chemical, physical and biological properties were analyzed. Among the most efficient biological indicators are arbuscular mycorrhizal fungi (AMF). AMF play an important role in aggregate stability due to the production of a glycoprotein called glomalin. Therefore, the aim of this study was to quantify, 5 years after the start the experiment, the content of total glomalin (TG) and to analyze its relationship with other soil parameters such as organic matter (OM) and aggregate stability soil (AE). Results indicated a remarkable effect of organic amendments on glomalin content, which was higher in the treatments with compost (6.96 mg g<sup>-1</sup>) than in sludge and control (0.54 and 0.40 mg g<sup>-1</sup>, respectively). Amendments also significantly influenced aggregate stability: the highest values were recorded in treatments with sludge and compost (23.14 and 25.09%, respectively) compared to control (13.37%). The gravel mulch had a negative influence on AE: an average of 16% compared to 23.4% for chopped forest residues and 23.1% of control. Data showed a positive and significant correlation between values of TG and OM content ( $r = 0.95$ ). We also found a positive and significant correlation between abundance of TG and AE when OM contents were lower than 4% ( $r = 0.93$ ), however, there was no significant correlation to higher OM when it was higher than 4% ( $r = 0.34$ ). This suggests that all protein sources which are different to glomalin have not been removed by the extraction process with sodium citrate. Other studies have shown that the ratio between proteins associated to glomalin and AE is curvilinear, meaning that increases in aggregate stability are not detected if the amount of these proteins is very high. In soil restoration, glomalin is an adequate indicator of soil/substrate evolution when organic amendments deliver low to medium OM contents. Nevertheless, further studies are necessary to improve the knowledge about AMF activity on soil aggregate formation and stability.