

Organic amendments as restoration techniques in degraded arid and semiarid systems: A review

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There is an increasing concern at the global scale about interrelated environmental problems such as soil degradation, desertification, erosion, and climate change impacts (Hueso-Gonzalez et al., 2014). Indiscriminate use of agro-chemicals, excessive and deep tillage, excessive irrigation, among many others factors, have largely contributed to soil degradation, particularly in arid and semi-arid areas (Lal, 2008). Soil is an essential non-renewable resource with extremely slow formation and regeneration potential (Muñoz-Rojas et al., 2016a and c, Martínez-Murillo et al., 2016). The decline in organic matter content of many soils is becoming a major cause of soil degradation, particularly in dryland regions (Muñoz-Rojas et al., 2016b) where low soil fertility cannot maintain sustainable production in many cases (Hueso-González et al., 2015). The use of soil organic amendments is a common practice in agricultural management and land restoration that can help to improve physical and chemical soil properties, soil structure, temperature and humidity conditions, as well as nutrient contents which are essential for plant growth (Guerrero et al., 2001). Under degraded conditions, several studies have shown their benefits for improving soil physical, chemical and biological properties (Jordan et al., 2010 and 2011). However, there are many research gaps in the knowledge of the effects of climatic conditions on their application, as well as the adequate types of amendment and doses and decomposition rates, (Hueso-Gonzalez,2016). All these factors are crucial for the success in their application. Here, we review long-term experiments worldwide studying the benefits associated with the application of organic materials, particularly, in restoration of arid and semiarid ecosystems together with the possible threats and risks that can result from their use. We will specifically address: (1) type of amended and benefits arising from their use, (2) application methods and more common doses and, (3) risk derivatives for their application.

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