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“Management of land use systems for enhanced food security:
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Basis on Rhizoculture: Management of “Underground Agroforestry Systems” to Improve their Climate Change Resilience

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Abstract

Agroforestry has traditionally been focused on the most economically valuable elements of plants. However, Horizon 2020 Societal Challenge analyses indicate that new nature-based solutions that include the multiple functions of ecosystems are needed for the transition towards a circular economic eco-innovation system to change production and consumption patterns towards a green society. In agroforestry, a better understanding of soil and organism interactions with host plants would allow an intensification on the development and activity of their roots leading to increased resistance of plants to climate change and soil C sequestration and to decreased fertilisation dependence. The development of this multidisciplinary body of knowledge could be called “rhizoculture”. The present work propose a review and a research project to develop a new rhizoculture approach in Agroforestry connecting the root, rhizosphere, agroforestry uses, fertiliser managements and landscape planning, all supported by four research approaches: (1) agrotechnological support to root development, (2) biological and biogeochemical support to “soft” fertilisation and rhizosphere management, and (3) soil organism management by soil organic matter control (by extensive livestock and biomass uses) and other tools, (4) landscape planning using territorial analysis tools, as i.e., Openforis Collect Earth. Seeking to change production and consumption patterns towards a sustainable, green economy and society, the benefits associated to this type of research on rhizoculture may increase the biodiversity and C stock in the soil, moreover, the development of the roots in agroforestry systems would increase the plant’s ability to cope with environmental and climatic changes. This approach would also improve the health and performance of plants and decrease the high costs and pollution associated to fertilisers and phytochemicals.

Keywords: Biodiversity, fertiliser management, resilience to climate change, rhizosphere, root management, soil biodiversity, soil C stock, soil carbon