Geophysical Research Abstracts
Vol. 19, EGU2017-17978, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Effect of high soil copper concentration on mycorrhizal grapevines

Amaia Nogales (1), Erika S. Santos (1), Wanda Viegas (1), Diego Aran (2), Sofia H. Pereira (1), Patricia Vidigal (1), Carlos M. Lopes (1), and M. Manuela Abreu (1)

(1) Linking Landscape, Environment, Agriculture and Food (LEAF), Instituto Superior de Agronomia (ISA), Universidade de Lisboa. Tapada da Ajuda. 1349-017 Lisboa, Portugal, (2) Department of Soil Science and Agricultural Chemistry, University of Santiago de Compostela. 15782 Santiago de Compostela, Spain

Repeated application of Copper (Cu) based fungicides in vineyards since the end of the 19th century has led to a significant increase in the concentration of this chemical element in many viticultural soils. Although Cu is an essential micronutrient for most organisms, it can be toxic for the development and survival of plants and soil (micro)organisms at high concentrations and eventually lead to yield loses in viticulture, as it negatively affects key physiological and biogeochemical processes. However, some soil microorganisms, including arbuscular mycorrhizal fungi (AMF), have developed adaptive mechanisms for persistence in environments with supra-optimal levels of essential elements or in the presence of harmful ones, as well as for increasing plant tolerance to such abiotic stress conditions.
The objective of this work was to evaluate the effect of a high total soil concentration of Cu on microbial soil activity as well as on the development of mycorrhizal and non-mycorrhizal grapevines. A microcosm assay was set up under greenhouse and controlled conditions. Touriga Nacional grapevine variety plants grafted onto 1103P rootstocks were inoculated either with the AMF Rhizophagus irregularis or Funneliformis mosseae, or were left as non-inoculated controls. After three months, they were transplanted to containers filled with 4 kg of a sandy soil (pH: 7.0; electrical conductivity: 0.08 mS/cm; [organic C]: 5.6 g/kg; [N-NO_3]: 1.1 mg/kg; [N-NH4]: 2.5 mg/kg; [extractable K]: 45.1 mg/kg; [extractable P]: 52.3 mg/kg), collected near to a vineyard in Pegões (Portugal). Two treatments were carried out: with and without Cu application. The soil with high Cu concentration was prepared by adding 300 mg Cu/kg (in the form of an aqueous solution of $CuSO4{\cdot}5H_2O$) followed by an incubation during four weeks in plastic bags at room temperature in dark.
Physico-chemical soil characteristics (pH, electrical conductivity and nutrients concentration in available fraction), soil dehydrogenase activity and the number of mycorrhizal infective propagules were evaluated in association with several plant physiological parameters (vegetative growth, NDVI–Normalized Difference Vegetation Index and PRI–Photochemical Reflectance Index, leaf nutrient content) and root mycorrhizal colonization percentage.
Preliminary results indicate an overall decrease in soil microbial activity due to Cu addition, regardless of the presence or absence of the inoculated mycorrhizal fungus. High Cu concentrations in soil decreased plant shoot length, root fresh weight and NDVI and PRI values. However, differences between mycorrhizal treatments were detected on plant response to Cu stress. The usefulness of grapevine inoculation with AMF to enhance plant performance at high Cu levels in the soil is discussed.