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Effect of the addition of organic amendments to C-poor agricultural soils on soil resistance against drought

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Climate change´s effect on soil functioning is a major concern in the Mediterranean basin, where rainfall will be likely reduced by 30% by the end of the century. Soil organic matter contributes to water balance by improving soil structure and aggregate stability, increasing water infiltration and holding capacity. Therefore, C-poor soils, as agricultural soils, might be more vulnerable to drought conditions. The addition of organic amendments increases soil organic matter and improves soil properties. The quality of the added substrate may determine soil microbial community structure and activity, which can also influence soil response to drought. The main objective was to evaluate the effect of the application of organic amendments with different quality (as indicated by their C:N ratio) on soil properties, plant development, and the resistance of soil functioning against simulated drought conditions. Hypothetically, the addition of a substrate with a high C:N ratio favours fungal dominance within the soil microbial community, which is usually related to a higher soil resistance.

An experiment was carried out in pot mesocosms under greenhouse conditions. Four organic substrates in a C:N ratio range were selected: 1) leonardite (LE, C:N = 57,8); 2) earthworm humus (HU, C:N = 15,6); 3) biosolid compost (BC, C:N = 8,8); and 4) dry biomass of *Vicia faba* (VF, C:N = 10,2). Their effect was compared with a non-amended control (NA). After amendment application, seeds of *Lolium rigidum* and *Medicago polymorpha* were sown, and a drought treatment was established. Half of the replicates received a 30 % less water supply, belonging to the drought treatment (DR), compared to the control (CT). The factorial experimental design resulted in 10 treatments with 10 replicates per treatment. A base-line soil sampling was done before the establishment of the drought treatment and repeated after 30 days, analysing soil biological properties (microbial biomass, enzyme activities, soil respiration rate). Soil moisture in the upper 5 cm was periodically measured.

Amendment addition improved some of the microbial activity indices in relation to non-amended soils, such as N-acetylglucosaminidase activity (in all the amended soils) and dehydrogenase activity (in HU and VF). Microbial biomass was greatly increased by amendment application (80 % increase). BC was the most efficient in improving soil water availability (32% higher than in NA), showing no significant differences in soil moisture between DR and CT. BC and VF amendments significantly reduced *L. rigidum* germination rate, and drought conditions significantly reduced plant growth compared to the control. However, by the end of the experiment, *L. rigidum*

biomass in both treatments was higher than in the other treatments. *M. polymorpha* germination rate was also reduced in BC and VF, but only in LE drought conditions significantly affected plant development. Despite this, the simulated drought conditions did not result in a significant change in any of the soil functioning variables measured. In conclusion, organic amendments enhanced soil microbial activity in a C-poor agricultural soil but did not clearly improve soil response to a simulated drought event.