

Geophysical Research Abstracts
Vol. 18, EGU2016-6665-1, 2016
EGU General Assembly 2016
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Available water modifications by topsoil treatments under mediterranean semiarid conditions: afforestation plan

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During dry periods in the Mediterranean area, the lack of water entering the soil matrix reduces organic contributions to the soil. These processes lead to reduced soil fertility and soil vegetation recovery which creates a positive feedback process that can lead to desertification. Restoration of native vegetation is the most effective way to regenerate soil health, and control runoff and sediment yield.

In Mediterranean areas, after a forestry proposal, it is highly common to register a significant number of losses for the saplings that have been introduced due to the lack of rainfall. When no vegetation is established, organic amendments can be used to rapidly protect the soil surface against the erosive forces of rain and runoff.

In this study we investigated the hydrological effects of five soil treatments in relation to the temporal variability of the available water for plants. Five amendments were applied in an experimental set of plots: straw mulching; mulch with chipped branches of Aleppo Pine (*Pinus halepensis* L.); TerraCotten hydroabsorbent polymers; sewage sludge; sheep manure and control. Plots were afforested following the same spatial pattern, and amendments were mixed with the soil at the rate 10 Mg ha⁻¹.

In control plots, during June, July, August and September, soils were registered below the wilting point, and therefore, in the area of water unusable by plants. These months were coinciding with the summer mediterranean drought. This fact justifies the high mortality found on plants after the seeding plan. Similarly, soils have never exceeded the field capacity value measured for control plots. Conversely, in the straw and pinus mulch, soils were above the wilting point during a longer time than in control plots. Thus, the soil moisture only has stayed below the 4.2 pF suction in July, July and August. Regarding the amount of water available was also higher, especially in the months of December, January and February. However, the field capacity value measured has not showed any differences regarding the control. For these treatments, the survival sapling rates measured were the highest.

Sludge, manure and polymers showed a moisture retention capacity slightly more limited than straw and pinus mulch. Likewise, it has been found that the area of usable water by plants was also lower, especially during the months of January and February. This situation is especially sharpened in plots amended with manure. In this treatment, the upper part of the soil profile was below the wilting point for six months a year (from April to August). For this treatment, the survival sapling rates measured were the lowest.

In conclusion, from a land management standpoint, the pinus and straw mulch treatments have been shown as effective methods reducing water stress for plants. In this research, mulching has been proved as a significant method to reduce the mortality sapling rates during the mediterranean summer drought.