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Conservation Agriculture under Mediterranean Climate: Effects on below and Above-Ground Processes during Wheat Cultivation

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Abstract : Conservation agriculture (CA), is a production system approach that can tackle the challenges of climate change mainly through facilitating carbon storage into the soil and increasing crop resilience. This is extremely important for the vulnerable Mediterranean agroecosystems, which already face adverse environmental conditions. The agronomic practices used in CA, i.e. permanent soil cover and no-tillage, result in reduced soil erosion and increased soil organic matter, preservation of water and improvement of quality and fertility of the soil in the long-term. Thus the functional characteristics and processes of the soil are considerably affected by the implementation of CA. The aim of the present work was to assess the effects of CA on soil nitrification potential and mycorrhizal colonization about the above-ground production in a wheat field. Two adjacent but independent field sites of 1.5ha each were used (Thessaly plain, Central Greece), comprising the no-till and conventional tillage treatments. The no-tillage site was covered by residues of the previous crop (cotton). Potential nitrification and the nitrate and ammonium content of the soil were measured at two different soil depths (3 and 15cm) at 20-days intervals throughout the growth period. Additionally, the leaf area index (LAI) was monitored at the same time-course. The mycorrhizal colonization was measured at the commencement and end of the experiment. At the final harvest, total yield and plant biomass were also recorded. The results indicate that wheat yield was considerably favored by CA practices, exhibiting a 42% increase compared to the conventional tillage treatment. The superior performance of the CA crop was also depicted in the above-ground plant biomass, where a 26% increase was recorded. LAI, which is considered a reliable growth index, did not show statistically significant differences between treatments throughout the growth period. On the contrary, significant differences were recorded in endomycorrhizal colonization one day before the final harvest, with CA plants exhibiting 20% colonization, while the conventional tillage plants hardly reached 1%. The on-going analyses of potential nitrification measurements, as well as nitrate and ammonium determination, will shed light on the effects of CA on key processes in the soil. These results will integrate the assessment of CA impact on certain below and above-ground processes during wheat cultivation under the Mediterranean climate.

Keywords : conservation agriculture, LAI, mycorrhizal colonization, potential nitrification, wheat, yield
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