

S1B/O2: GREEN MANURE LEGUMES AFFECT SEASONAL SOIL AND LEAF CO₂ EXCHANGE RATES IN AN OLIVE RAINFED ORCHARD

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Management methods that decrease requirement for agricultural chemicals are needed to reduce adverse environmental impacts. Moreover, they can play an important role in atmospheric CO₂ emission and fixation. We propose green manure legumes to reduce erosion, soil compaction and nitrate pollution, to improve biodiversity, soil carbon sink and fertility, to save fossil fuels and to increase yield and the nutritional value of food products. The research was carried out near Mirandela, Northeast Portugal, on a 15-year commercial olive orchard (*Olea europaea* L. cv. Cobrançosa), grown under rainfed conditions. Three plots were established: (1) plot cover cropped with white lupine (L); (2) plot cover cropped with self-reseeding pasture species, such as subterranean clover and other annual legume species (AL) with short growing cycle; (3) plot managed according to ordinary fertilization and tillage techniques (OT) used by local growers. The results revealed that cover crops affect the water content of the soil, causing a depletion of its moisture in spring and an increase in summer and early autumn, namely in the inter-row space. Significant seasonal variations in soil respiration (SR) were found during the year with the highest values in the spring (cover crop plots) or in early autumn (OT) and the lowest values in summer. In spring, SR was higher in L plot (43% and 150% over AL and OT, respectively), whereas in summer, when cover crops were in dead mulch form, SR was higher in AL. Meanwhile, in September L had the lowest and OT the highest SR values, namely during the afternoon, when SR rates were consistently higher. Photosynthetic rate followed a seasonal pattern similar to SR rates, indicating that soil moisture was the most important factor driving the soil microbial activity and olive tree photosynthesis. Furthermore, carbon fixation and SR were highly correlated, particularly in summer. A closely association was observed between photosynthesis and stomatal conductance, although non-stomatal limitations to photosynthesis also occur in OT plants, namely in September. Cover crops, specially AL species, improved vegetative growth and physiological performance, as observed by increases of PAR interception and radiation use efficiency that was reflected in higher productivity. In fact, the cumulative yield during 3 years increased 38% in AL comparatively to OT plot. This study supports that green legume manures are a promising strategy to be implemented in rainfed olive orchards in the Mediterranean basin.

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