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Soil amendment with Zeolites and Biochar influenced soil properties, photosynthetic performance and olive fruit and oil composition

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Olive orchards represent a key agricultural system in the Mediterranean basin. Soil degradation processes associated to unsustainable agronomic practices and climate change could severely impact the sustainability of Mediterranean rainfed olive orchards. In this context, soil amendments are important tools that can be used to enhance soil fertility for sustained environmental quality and plant performance. For two years, we evaluated, under rainfed conditions, the effects of a fertilizer compound (FC) and its combination with zeolites (ZL) and biochar (BC) amendments on soil moisture, photosynthetic activity, yield, fruit and oil composition and quality indices. Although no significant effects were observed on crop yield, the application of ZL and BC improved plant photosynthetic performance due to lower stomatal limitations. The effects on soil quality were more evident in ZL amendment, due to the reduction of acidity, and enhanced moisture, cation exchange capacity, microbial biomass carbon and enzymatic activity. Results relative to olive composition show that the polyphenolic content was strongly influenced by treatments. ZL improved fruit fatty acid composition and oil quality, while BC enhanced the concentrations of polyphenols with high nutritional value (3,4-dihydroxyphenylglycol, oleuropein and rutin). In contrast, olive oil from FC fruits showed the poorest quality. The applied soil amendments appear to be a promising sustainable strategy to implement in olive rainfed orchards, and can be an interesting complement to mineral fertilization, in order to promote soil quality, increase physiological performance and olive oil quality.

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