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Tea Bag Index protocol for characterising the seasonal variability of organic matter enrichment in super-intensive olive grove plots with different rates of pruning residues

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The use of mulches and inert vegetation cover- such as pruning residues in woody crops- protects soil from erosive processes, and also contributes to improving its physical and chemical properties including the increase of organic matter. Recently, the technological advances of chopping machinery produce prunning residues at sizes less susceptible to xylophages, as well as cost savings derived from distributing them on the lanes instead of their transport and processing. All this has favored their application in a large number of olive grove farms in Andalusia, Spain. The knowledge of their impact on soil organic carbon and decomposition rate dynamics are crucial in order to optimize its management as a mitigation step of climate change effects. This is particularly relevant in Mediterranean environments where there is a notable variability of soil temperature and moisture along the year. In this context, the Tea Bag Index (TBI) methodology (http://www.teatime4science.org/; Keuskamp et al., 2013), is a simple standardized method, created to indirectly measure the rate of decomposition of plant material by using commercial tea bags. The protocol was designed to provide an easily replicable experiment whose results were comparable under different conditions.

In this work, the TBI protocol was applied in a superintensive olive grove including an experimental site with 5 blocks and 4 different doses of pruning residues (0 t.ha-1, 7.5 t.ha-1, 15 t.ha-1 and 30 t.ha-1) for a campaign of a year and 4 measurements (90 days.survey-1) in order to: 1) determine the representative values of decomposition rate (k) and stabilization factor (S) for the study conditions and 2) evaluate their seasonal variations as well as the influence of different pruning residue rates.

Both parameters, k and S, showed a high inter-annual variability with mean values of 0.010 ($\pm$0.004) and 0.493 ($\pm$0.200). The effect of the seasonality resulted significant ($p<0.05$) whereas the treatment did not show any influence on the k and S distributions. It is worth noting how the annual variation patterns of soil moisture and temperature variation in the top horizon must impact k because the highest values were associated to the autumn and spring measurements while the summer measurements presented the lowest values. On the other hand, significant differences of soil moisture (-10 cm) were observed as a function of the treatment along the year. In contrast, soil temperature (-10 cm) was independent on the treatment similarly to k and S. These features should be considered to define representative k and S values of the site, especially in areas with variable climatological patterns such as the Mediterranean Basin. New measurements will allow us to complete the description of k along the year as well as evaluating its correlation with soil temperature and moisture.

REFERENCES

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