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Stemflow in low-density and hedgerow olive orchards in Portugal

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Stemflow (Sf) is responsible for a localized water and solute input to soil around tree's trunks, playing an important eco-hydrological role in forest and agricultural ecosystems. Sf was monitored for seven months in 25 *Olea europaea* L. trees distributed in three orchards managed in two different ways, traditional low-density and super high density hedgerow. The orchards were located in central Portugal in the regions of Santarém (Várzea and Azóia) and Lisboa (Tapada). Seven olive varieties were analysed: Arbequina, Galega, Picual, Maçanilha, Cordovil, Azeiteira, Negrinha and Blanqueta. Measured Sf ranged from 7.5 to 87.2 mm (relative to crown-projected area), corresponding to 1.2 and 16.7% of gross rainfall (P_g). To understand better the variables that affect Sf and to be able to predict its value, linear regression models were fitted to these data. Whenever possible, the linear models were simplified using the backward stepwise algorithm based on the Akaike information criterion. For each tree, multiple linear regressions were adjusted between Sf and the duration, volume and intensity of rainfall episodes and maximum evaporation rate. In the low-density Várzea grove the more relevant explanatory variables were the three rainfall characteristics. In the super high density Azóia orchard only rainfall volume and intensity were considered relevant. In the low-density Tapada's grove all trees had a different sub-model with P_g being the only common variable. To try to explain differences between trees and to improve the quality of the modeling in each orchard, another set of explanatory variables was added: canopy volume, tree and trunk heights and trunk perimeter at the height of the first branches. The variables present in all sub-models were rainfall volume and intensity and the tree and trunk heights. Canopy volume and rainfall duration were also present in the sub-models of the two low-density groves (Tapada and Várzea). The determination coefficient (R^2) of all models ranged from 0.5 to 0.76. The size of leaves was also analysed. Although there were significant differences between varieties and between trees of the same variety, they did not seem to affect the amount of Sf generated. Through analysis of bark storage capacity, it was found that older trees, with rough and thick bark, had higher trunk storage capacity and, therefore, originated less Sf. The results confirm the need for considering the contribution of stemflow when trying to correctly assess interception loss in olive orchards. Although the use of simple and general statistical models may be an attractive option, their precision may be small, making direct measurements or conceptual modelling preferable methods.