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Preventing runoff generation from rainfed orchards in semi-arid environments

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Most soil and water conservation practices focus on the protection against concentrated runoff. However, sparsely covered croplands are the most important areas of concentrated runoff and increasing crop cover will enhance infiltration and prevent runoff at the source. Farmers in semi-arid environments are reluctant to apply cover crops and grass strips because of the potential competition for water with the main crop. This study aims to identify conditions under which cover crops can be grown without compromising the water availability to the trees in rainfed orchards. This was done through analysis of the relation between tree growth and patterns of water availability as reflected by climate, soil and topography. At the scale of the Mediterranean, the relation between climate, olive (Olea europea L.) canopy cover and tree density was investigated. Climate was characterised by the ratio between annual precipitation and reference evapotranspiration (humidity index, HI). A climatic threshold was found (HI = 0.6) that allows to identify the parts of the Mediterranean where the growth of cover crops is possible without competition for water with the olive trees. The data showed a linear increase of maximum olive tree density with HI for $0.2 < \text{HI} < 0.5$. The impact of patterns of soil properties and topography was studied at the province and field scale in almond (Prunus dulcis Mill.) orchards in Murcia, Spain. There was a preference for almond orchards to be located on marls, shales and schists. This is probably related to 1) the mouldability of the hard rock that facilitates the planting of new trees and clean sweeping of the orchards; 2) a higher water availability compared to limestones and dolomites. Our results point out that the application of cover crops can still be feasible at conditions below the climatic threshold ($\text{HI} < 0.6$). For exam-

ple, the overall orchard productivity is barely affected when the growth of cover crops is restricted to the thalwegs.