

Assessment of canopy transpiration from temperature: applications for almond orchards

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Almond growing is increasing throughout the Mediterranean area, and especially in Spain, because of the high prices fetched by this commodity in recent years. This has led to the establishment of new, intensive almond orchards in many Spanish irrigation schemes, even though traditionally, almonds have been grown in Spain in marginal soils under low-input conditions. The expansion of irrigated almonds has increased irrigation demand, which for Western Andalusia has been quantified in recent research as high as 7,000 m³/ha. Considering the societal requirements to decrease the share of fresh water diverted in agriculture, it remains essential to optimize almond water productivity in irrigated schemes which may be achieved through precision irrigation. To do so, we need an accurate estimation of the spatial distribution of water requirements within irrigated orchards. This work proposes a methodology to map water use by almond trees based on their canopy temperature and its relationship with crop transpiration. For this purpose, we have developed the Non-water Stress Baseline for the crop and implemented a methodology to obtain the Crop Water Stress Index using information acquired with infrared thermometers installed over selected trees. After that, this information was combined with high-resolution airborne thermal imagery acquired over the whole experimental area to derive a transpiration map. This new approach enables the segmentation of the area according to their needs, providing relevant information for precision irrigation management and system re-engineering.

Keywords: transpiration, water stress, irrigation management, orchard trees, CWSI, canopy temperature, airborne thermal imagery

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