

Are Sap Flow Measurements Useful for Determining Water Use of Fruit Orchards, when Absolute Values Are Important?

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Abstract

The determination of accurate figures for orchard water use is critical for improved irrigation scheduling and for the issuing of water licenses. Under- or overestimations can have serious implications for production and water resources in water scarce countries, such as South Africa. In order to meet this need for more definite water use figures the Water Research Commission solicited a project on fruit tree water use, which included the use of the heat ratio method to estimate transpiration in a macadamia orchard. The use of a visually measured wounding width yielded water use figures much lower than expected and as a result a wound effect calibration coefficient was determined by calibrating the sap flow measurements against micrometeorological measurements of evapotranspiration using the Eddy Covariance technique and evaporation measurements using microlysimeters. Following calibration it was evident that transpiration would have been underestimated by at least 40% with a visually observed wounding width. Importantly, the calibration coefficient stayed relatively constant for three measurement periods, over a two-year period, indicating that calibration of the heat ratio method can take place in the field using evapotranspiration and evaporation measurements and that this calibration procedure only needs to be carried out once. Sap flow techniques therefore represent a valuable tool for estimating transpiration in orchards but the system must be calibrated for each new orchard in which the system is installed.