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## Quantification of Xylem Sapflow Measurements on Lychee Trees

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### Abstract

Irrigation has been established to produce crops independent of rainfall. Simultaneously it secures and increases the yields of many fruits and crops, creating cash income in many rural areas. Focusing the northern highlands of Thailand, irrigation of fruits is performed in the dry season (November–May), which is the yield-forming phase. The steady increase in lychee production raises also the potential for conflicts about water.

In order to investigate efficiency of irrigation, a farmer's lychee has been equipped with highly sensitive instrumentation. One of these instruments is the sapflow-sensor which enables to measure sapflow-density. It consists of a thermocouple, which is implanted to the tree's xylem tissue. The system uses a method of heat balance equation to conclude on sapflow-density in the xylem. An approximation of actual transpiration of the tree can be estimated, using a representative cross-section of the tree trunk. This equation deals with the assumed area of water-transport pores within a given diameter of a tree. Investigations on the actual specific pore area (SPA) within the xylem tissue were carried out in order to correlate the measured values to an actual transpiration value [ $L/d \cdot \text{tree}$ ]. Knowing the relative value of sapflow density and SPA it is possible to conclude on transpiration rates of the tree. Transpiration is the consumption of water by the tree, described by the  $k_{cb}$ -value, which — in combination with the  $k_e$ -value for the evaporation — allows to calculate the potential evapotranspiration in a lychee-orchard based in the reference-evapotranspiration according to the Penman-Monteith equation.

Furthermore, interactions between soil water suction and transpiration of lychee trees, which are important to monitor water stress, are being investigated for two years. Therefore the trees, which had been exposed to different levels of water supply, were monitored on soil water balance at the means of tensiometers and TDR-probes. Xylem sap-flow of the trees has been continuously monitored. Stomatal conductance and leaf water potential during the course of a day were determined by a porometer and a Scholander bomb respectively. The obtained data allowed a relative description of the trees reaction to water supply.

**Keywords:** Evapotranspiration, crop coefficient, lychee, sapflow, stomatal conductance