



Irrigation in citrus aims for achieving high yields and desirable fruit size and sugar level¹. Irrigation coefficients are commonly used to determine water application, however, they do not take into account variability between years caused by difference in crop load, light interception and more. This can be resolved by having real-time plant feedback². Dendrometers are direct tree sensors proven to assist in irrigation optimization in citrus^{2,3}.

TIMING FOR WATER STRESS



Water stress during spring induces flower drop and has the **strongest negative effect on yields**.



Water stress leads to a decrease in fruit size. This is a temporary effect which can be reversed if irrigation is increased.



Some water stress has a positive effect on fruit quality⁴.

THE PHYTECH SOLUTION

Sensors on selected trees continuously measure changes in stem diameter, which are translated into plant stress indications.

Sensors on selected fruits continuously monitor **fruit development**.



Phytech identifies yield reducing stress and immediately alerts growers on mobile and web platforms.

Supporting parameters included in the system: irrigation monitoring, soil moisture monitoring, climate data and satellite image analysis.



1. "Crop Yield Response to Water", UN food and agriculture organization report, <http://www.fao.org/docrep/016/i2800e/i2800e.pdf>.

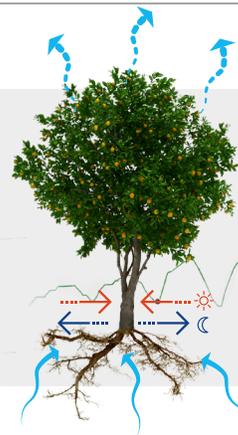
2. Velez, J.E., Intrigliolo, D.S., Castel, J.R., "Scheduling deficit irrigation of citrus trees with maximum daily trunk shrinkage", *Agricultural water management*. 90(3):197-204 · February 2007.

3. Ginestar, C., Castel, J.R., "Use of stem dendrometers as indicators of water stress in drip-irrigated citrus trees", *Acta horticulturae*, 1998.421.22.

4. Abdelfatah, Ashraf, et al. "Evaluation of the response of maximum daily shrinkage in young cherry trees submitted to water stress cycles in a greenhouse." *Agricultural water management* 118 (2013): 150-158.

HOW DOES IT WORK?

A trunk of a citrus tree shrinks during the day as a response to lowering water levels. The more it is stressed, the more it contracts, before replenishing again at night. Phytech's algorithms utilize this shrink-swell mechanism as a tool to quantify water stress.



“IT’S LIKE AN AUTOMATIC PRESSURE BOMB..”

Stem water potential measurements (SWP), manually taken with a pressure bomb, are proven to assist in citrus irrigation. However, acquiring the measurement is time and staff consuming. Phytech uses the dendrometers, which are correlated with citrus SWP, to create its' **plant status** stress indicator.

Plant status is taken automatically every day.

Plant status results go directly to the grower's mobile phone or computer.

Phytech automatically transforms reading into stress alerts.

The plant status indicator takes into account both the daily water stress level (MDS) and the plant growth, resulting in a more accurate algorithm.

THE ART OF BALANCING GROWTH

Balancing vegetative (trunk) growth and fruit growth is an important aspect of growing citrus. Strong trunk growth during the fruit growth stage is unwanted, as shoots forming at this stage are unlikely to form fruit, and resources invested in them can come at the expense of fruit growth. Phytech allows easy monitoring of both trunk and fruit growth to reach the best irrigation practice. **Best practice** is to irrigate to the amount where **fruit growth is positive**, while **trunk growth is close to zero**.

To demonstrate, here are the results of an irrigation trial held in California during September 2016.

	Irrigation amount	Fruit growth	Trunk growth	results
Deficit irrigation	 24% of ET	 0.06 mm/day	 No trunk growth	Water stress prevents fruit growth
Best Practice	 60% of ET	 0.17 mm/day	 No trunk growth	Optimal balance of water resources ✓
Over Irrigation	 90% of ET	 0.12 mm/day	 Positive trunk growth	Trunk growth at the expense of