

## How Accurate is the Implexx Sap Flow Sensor?

### Overview

- The accuracy of the Implexx Sap Flow Sensor is approximately 3%.
- The Implexx Sap Flow Sensor is a unique advancement in sap flow technology because it provides a calibrated output of total tree sap flow whereas other sap flow sensors are not calibrated.
- The Implexx Sap Flow Sensor also utilizes the Dual Method Approach (DMA) to measure sap flow – a scientifically backed method that can measure the entire range of sap flow observable in plants.
- The Implexx Sap Flow Sensor has been tested against 19 different tree species and 132 independent samples. This is one of the largest test data sets for any sap flow sensor.
- The Implexx Sap Flow Sensor also measures sapwood water content with an accuracy of approximately 5%.
- These claims and results are supported by internationally peer-reviewed scientific studies published in prestigious journals including *Tree Physiology* and *Forests*.

### - References:

Forster (2020), *Tree Physiology*, 40, 683.

Forster (2019), *Forests*, 10, 46.

### Detailed Information

Sap flow sensors are compared against an independent measure of sap flow such as a potometer, lysimeter or other device.

In the following examples, the Implexx Sap Flow Sensor was installed on a cut stem which was then connected to a potometer. This is a water pressure device where known levels of water pressure are forced through the sapwood. The output from the Implexx Sap Flow Sensor should be equal to the output from the water pressure system. That is, the curve in the following graph should be 1:1.

Figure 1 is the result from a Chinese pistachio (*Pistacia chinensis*). The circles are each measurement point and the dashed-line is the curve describing the relationship between the Implexx Sap Flow Sensor and actual sap flow from the water pressure device. In this example, the slope of the curve is 0.995. Therefore, the accuracy of the Implexx Sap Flow Sensor is 0.5% for this species.

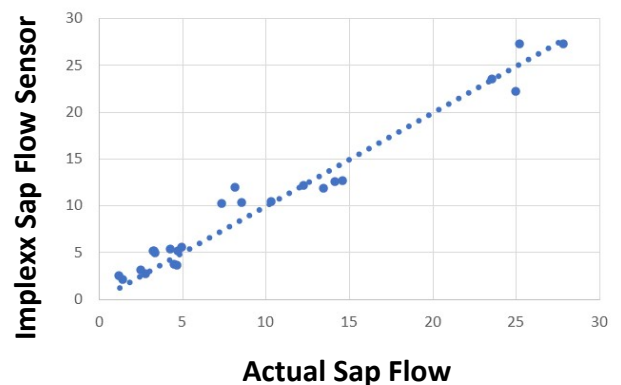


Figure 1. A comparison between the Implexx Sap Flow Sensor and actual sap flow in a pistachio stem created by a water pressure device.

Figure 2 is the result from apple (*Malus domestica*) stems. In this example, the slope of the curve is 1.04. Therefore, the accuracy of the Implexx Sap Flow Sensor is 4%.

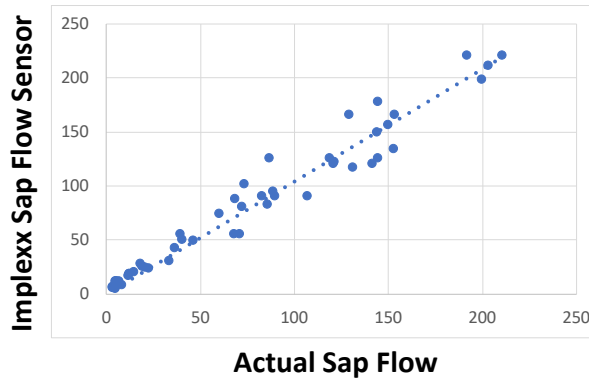


Figure 2. A comparison between the Implexx Sap Flow Sensor and actual sap flow in an apple stem created by a water pressure device.

Figure 3 is an example from an almond (*Prunus dulcis*) stem. In this example, the slope of the curve is 1.03 meaning the accuracy of the Implexx Sap Flow Sensor is approximately 3%.

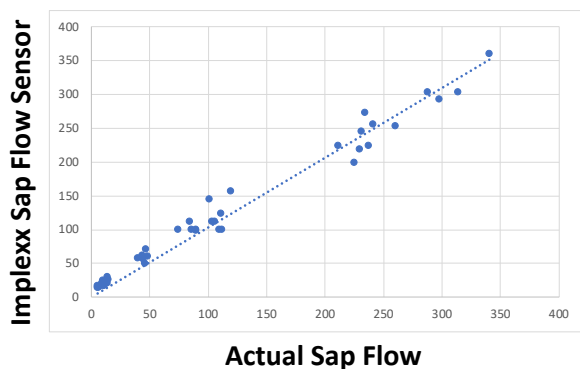


Figure 3. A comparison between the Implexx Sap Flow Sensor and actual sap flow in an almond stem created by a water pressure device.

## Sap Flow and Evapotranspiration

Sap flow is synonymous with transpiration where sap flow is water movement within stems and transpiration is water movement from stems.

Sap flow is also equal to evapotranspiration under certain conditions. Soil moisture must be high and there is no moisture stress. Also, evaporation from soil and other surfaces must be low. For irrigated crops, such as almonds, citrus and grapevines, sap flow can be compared directly with evapotranspiration (also known as crop evapotranspiration or ETC).

Figure 4 compares ETC measured from the Implexx Sap Flow Sensor (orange line) compared with ETC measured via the Penman-Monteith FAO56 equation with a crop factor included (blue line). The measured tree was a lilly pilly (*Syzygium paniculatum*).

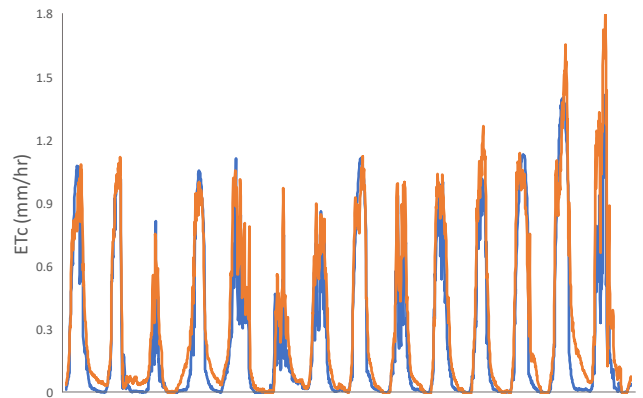


Figure 4. Crop evapotranspiration (ETC) measured via the Implexx Sap Flow Sensor and estimated via a weather station and the Penman-Monteith FAO56 equation. The orange line is the Implexx Sap Flow Sensor and the blue line is the weather station.

Figure 5 is a comparison between transpiration measured via the Implexx Sap Flow Sensor and modelled with the Penman-Monteith equation. The accuracy of the results can be determined via the slope of the curve. This should be a 1:1 relationship; or a slope of 1. In this example, the slope is 0.967 which means the Implexx Sap Flow Sensor can estimate transpiration with an accuracy of 3.3%.

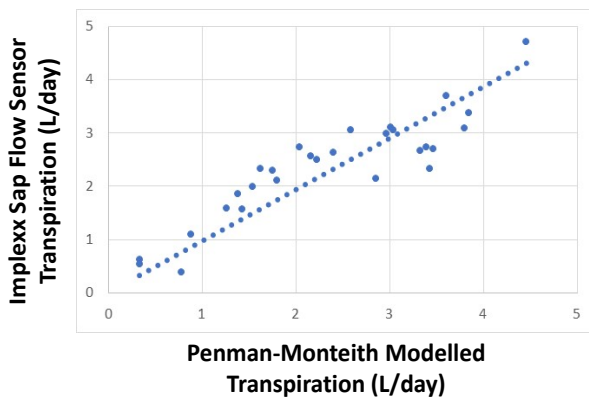


Figure 5. A comparison of transpiration measured with an Implexx Sap Flow Sensor versus transpiration modelled with the Penman-Monteith FAO56 equation. The slope of the curve is 0.967 which means the Implexx Sap Flow Sensor can estimate transpiration with an accuracy of 3.3% with this example data set.

## Stem Water Content

The Implexx Sap Flow Sensor simultaneously outputs sap flow as well as sapwood (stem) water content.

Figure 6 shows the correlation between volumetric stem water content measured from an Implexx Sap Flow Sensor and actual volumetric stem water content measuring with a drying oven. The samples were measured from 4 different species. The slope of the curve is 0.951 which indicates that the accuracy is approximately 5%.

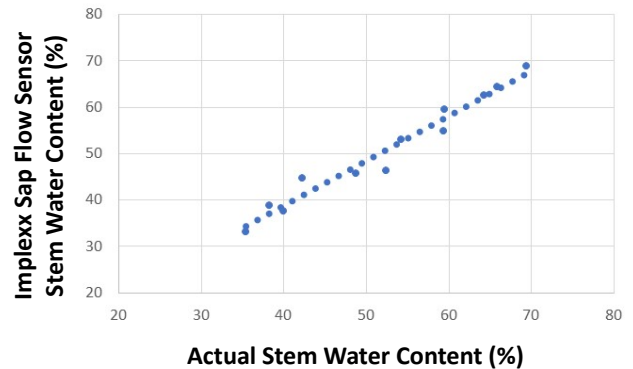


Figure 6. Stem volumetric water content measured via the Implexx Sap Flow Sensor versus actual stem water content.

## Further Information

Details about the Implexx Sap Flow Sensor can be found on the Implexx website:

[www.implexx.io](http://www.implexx.io)

Sap flow methods and applications can be found in the Sap Flow Digest:

<https://www.edaphic.com.au/sap-flow-digest/>

Or, you can contact Implexx Sense:

[info@implexx.io](mailto:info@implexx.io)