METER
ENVIRONMENT

PREDICTING THE AMOUNT OF WATER ON THE SURFACE OF THE PHYTOS 31 DIELECTRIC LEAF WETNESS SENSOR

Contributors

METER's PHYTOS 31 leaf wetness sensor was designed primarily to measure leaf wetness duration or the total amount of time that the canopy experiences wetness. However, due to the unique dielectric measurement technique used to sense wetness on the surface of the sensor, the PHYTOS 31 can also be used to quantify the amount of water on its surface, which can be a good approximation of the amount of water on the leaves in the canopy.

UNDERSTAND CANOPY INTERCEPTION AND PRECIPITATION

This measurement can be used to understand canopy interception of precipitation, which is a major component of the water balance and energy balance in full canopy ecosystems. Similarly, leaf wetness amount can be used to understand fog deposition processes in maritime ecosystems. Several agricultural researchers have also used the leaf wetness sensor to monitor the amount and distribution of foliar agrochemical spray application.

The PHYTOS 31 is calibrated during the production process to have a very repeatable sensor output when dry, allowing the dry-to-wet threshold to be precisely known for calculating leaf wetness duration. However, repeated testing of multiple sensors indicates that the amount of water on the surface of the sensor can be accurately predicted from the sensor raw output. The following data sets were obtained by carefully misting increasing amounts of water onto the surface of the PHYTOS 31 while simultaneously measuring the mass of the sensor and sensor output at three common excitation voltages (2500, 3000, 5000 mV). This test method was repeated three times on a total of six sensors.

At all three excitation levels, it is apparent that the amount of water on the sensor surface can be predicted quite accurately when small amounts of water are present on the surface. The scatter in the data increases as the amount of water increases past about 150 g/m2, due primarily to differences in the droplet size and distribution that evolve as water is added to the sensor surface.

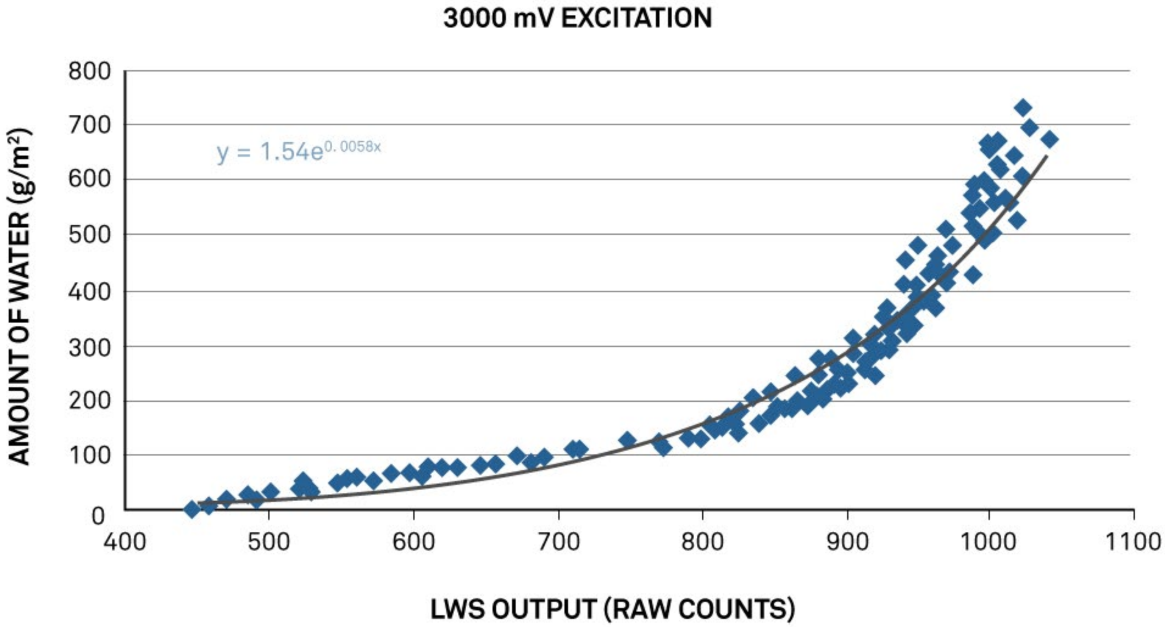

Figure 1. Amount of water on PHYTOS 31 surface as a function of PHYTOS 31 raw counts measured with METER EM50 series data logger

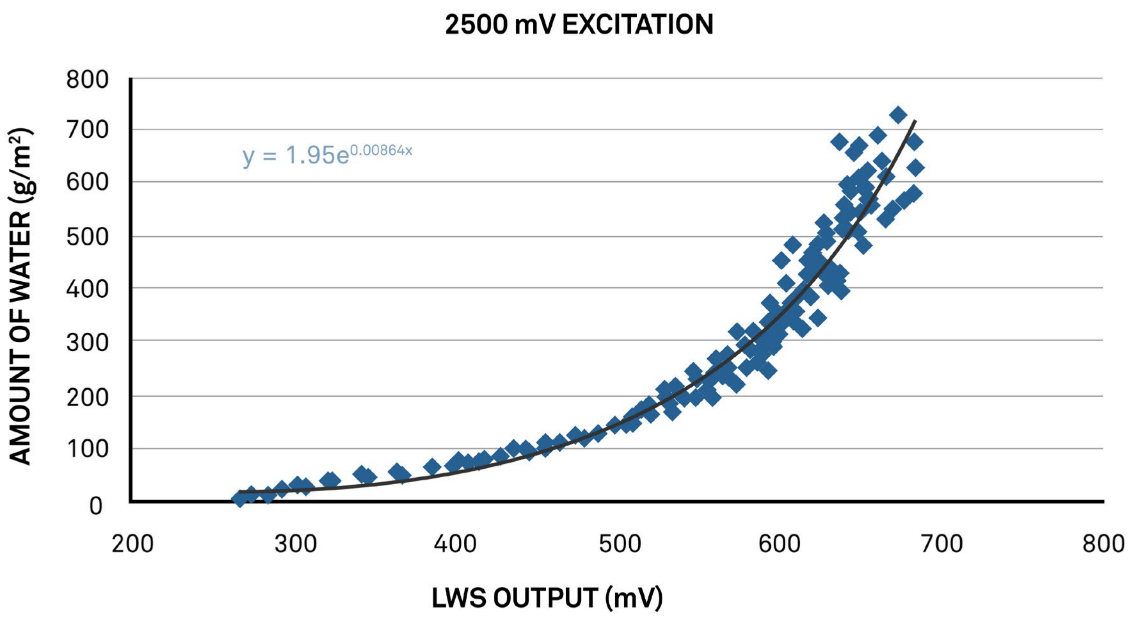

Figure 2. Amount of water on PHYTOS 31surface as a function of PHYTOS 31 mV output when excited at 2500 mV. This relationship can be used with Campbell Scientific of other third-party data acquisition systems that excite the PHYTOS 31 at 2500 mV.

Despite the increased scatter in this region, the data obtained should still be useful. It should be noted here that the data shown were collected using tap water with electrical conductivity of approximately 0.32 dS/m. Rainfall, fog, and condensation generally have quite low electrical conductivity and should be approximated well by the relationships shown. However, some agrochemicals can have very high electrical conductivity, which can skew the PHYTOS 31 output.

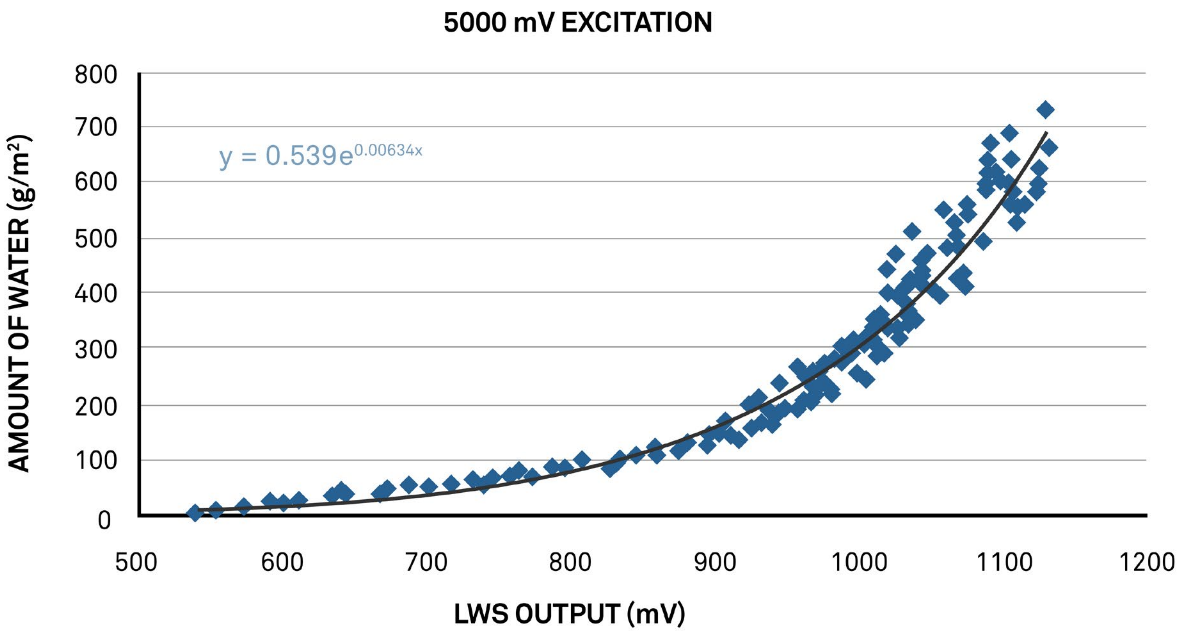

Figure 3. Amount of water on PHYTOS 31 surface as a function of PHYTOS 31 mV output when excited at 5000 mV

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