

New Dielectric Leaf Wetness Sensor

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FOR MORE than two years, Decagon has worked to develop a dielectric Leaf Wetness Sensor. By approximating the thermodynamic properties of real leaves, the sensor mimics other leaves in a canopy and accurately measures leaf wetness duration.

How the Leaf Wetness Sensor Works

The Leaf Wetness Sensor approximates the thermal mass and radiative properties of leaves to closely mimic the wetness state of a real leaf. The way it works is simple: if the canopy is wet, the sensor is wet; if the canopy is dry, the sensor is dry. The Leaf Wetness Sensor measures the dielectric constant of the top of the sensor. Water (80) and ice (5) have higher dielectric constants than air (1), so the sensor can determine the presence or absence of wetness from this measurement. Measurements can be logged at user-defined intervals to determine the duration of wetness on the canopy.

Key Challenges

Early designs of the Leaf Wetness Sensor met several key challenges. The original sensor was too thick, giving it too high of a heat capacity. Heat capacity affects the sensors ability to hold water for the same duration as a real leaf. To address this, Decagon's engineers used a fiberglass construction with a thickness of 0.65mm. This gives the instrument a heat capacity which closely matches that of a leaf.

Design Innovation

The Leaf Wetness Sensor's surface treatment also affected its ability to mimic the wetness state of a real leaf. Originally, the sensor surface was green. Although the green coating made the sensor look more like a leaf, it absorbed too much radiation, causing it to dry too quickly. By using a white surface coating, the sensor achieved a radiation balance that closely matches that of a real leaf. The surface coating is also hydrophobic, similar to a leaf with a waxy cuticle. The hydrophobic surface means the sensor will only detect moisture when moisture is present; it will not give a false positive reading during periods of high relative humidity.

Despite these early setbacks, the Leaf Wetness Sensor closely mimics the wetness state of a real leaf, resulting in a convenient, accurate solution to monitoring leaf wetness.