Bio-mimetic Wetness Device and Method

Tech ID: 32990 / UC Case 2022-832-0

BACKGROUND

In 2019, the Food and Agriculture Organization of the United Nations estimated that between 20 to 40 percent of global crop production are lost to plant diseases and pests annually, with plant diseases costing the global economy roughly $220B each year. Disease-warning systems are currently being used by growers to preemptively mitigate destructive events using chemical treatment or biological management. Meteorological factors including rainfall, humidity, and air temperature are all considered in these systems, but the measurement of leaf wetness duration (LWD) is important to its governing role in infection processes for many fungal pathogens. The longer a leaf stays wet, the higher the risk that disease will develop, because many plant pathogen propagules require several hours of continuous moisture to germinate and initiate infection The current gold standard to measuring LWD is using the capacitive leaf wetness sensor (LWS). The LWS functions by measuring a change in the capacitance seen at its surface which then yields an output signal that changes according to its surface wetness. Commercial leaf wetness sensors estimate the amount of surface water and leaf wetness duration by measuring the change in capacitance of a surface that accumulates condensed water. However, the one-size-fits-all commercial sensors do not accurately reflect the variation in leaf traits (particular shape, texture, and hydrophobicity) these traits strongly affect surface wettability (hydrophilicity) and vary widely among plant species.

TECHNOLOGY DESCRIPTION

To help address these challenges in LWD measurements, investigators at UC Santa Cruz (UCSC) have developed a new LWS to better reflect the surface properties of leaves, involving an interdigital capacitive sensor overlaid with inert silicone polymer materials. The first polymer layer acts as an insulating layer for the exposed copper traces of the interdigitated capacitive sensor. The second polymer layer is the replicative patterned layer and acts as the interface for water droplets and the capacitive sensor. In developing this new LWS, the UCSC team created replica surfaces to reasonably represent a broad range of leaf wettability, including three co-occurring plant species: Umbellularia californica, Platanus racemosa, and Escallonia iveyi. Preliminary tests showed a 60% error between the commercial replica LWS and the P. racemosa replica LWS. This discrepancy suggests poor performance of the commercial replica LWS. Moreover, the UCSC results suggest that commercial LWSs may indicate full saturation prematurely for other leaf types with hydrophobic surfaces, like U. californica.

APPLICATIONS

- AgTech

ADVANTAGES

- can be used with a broad range of leaf types
- outperforms peer sensors including PHYTOS 31 by Meter Group
- fully customizable for leaf type
- reasonably inexpensive at $5 BOM (2023)

INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
United States Of America	Published Application	20230384254	11/30/2023	2022-832

CONTACT

Marc Oettinger
marc.oettinger@ucsc.edu
tel: 831-502-0253.

INVENTORS

- Nguyen, Brian

OTHER INFORMATION

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Devices
- **Materials & Chemicals**
  - Agricultural
  - Polymers
  - Textiles
- **Sensors & Instrumentation**
  - Environmental Sensors
  - Physical Measurement
  - Scientific/Research

RELATED CASES

2022-832-0

RELATED MATERIALS

- A Bio-mimetic Leaf Wetness Sensor - 05/27/2022
- A Bio-Mimetic Leaf Wetness Sensor (thesis submitted by Brian Nguyen) - 04/01/2022

University of California, Santa Cruz
Industry Alliances & Technology Commercialization
Kerr 413 / IATC,
Santa Cruz,CA 95064

Tel: 831.459.5415
innovation@ucsc.edu
officeofresearch.ucsc.edu/
Fax: 831.459.1658