

Use of thermographic sensors to determine the water status of plants in a controlled environment

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Keywords: greenhouse, thermal camera, leaf temperature

The foliar temperature of plants, relative to ambient temperature, can be used to infer the water status of plants, as can be seen in [1]. Both in the field (crops) and in greenhouse, infrared temperature sensors can be used or even thermal cameras to measure leaf temperature without contact with plants. For the case of the greenhouse, Embrapa Rice and Beans created a system, called SITIS (Integrated System of Induced Treatment of Stress). This platform automates the planning and execution of plant irrigation in a greenhouse. One of the variables that this system provides is the water status of the plant. In addition to the leaf temperature sensor MLX90614, which gets punctual data, there is another way to infer about the water status of the plant, which is low-cost thermal camera measurement. It is a Flir Lepton 3 long-wave infrared imager camera integrated with a minicomputer (Toradex Colibri or Apalis, Raspberry Pi, etc.) to produce thermal imaging of crops. The long-wave infrared sensor can detect thermal radiation emitted by objects near the ambient temperature and then determine its temperature. The acquired data is sent through the communication of the serial peripheral interface (SPI) to the computer and with this data a false color image of 160 x 120 pixels is created. With the thermal images generated, the state of the plants can be evaluated. This technique has major advantages because it is a non-invasive, non-contact and non-destructive way of determining the water conditions of crops. This camera can evaluate at least 8 different plants simultaneously and with various temperature values throughout the plant.

Acknowledgments:

To Embrapa Rice and Beans and Universat (universat.com.br) by the resources made available.

References:

[1] R.D. Jackson, S. B. Idso, R.J. Reginato, P.J. Pinter JR. *Canopy temperature as a crop water stress indicator*. Water Resources Research, V. 17, Issue 4, August 1981.