



## Apogee Instruments SI-131 Infrared Radiometer High Throughput Field Phenotyping Multi-sensor System

Apogee Instruments' SI-131 Infrared Radiometer was selected to be part of a multi-sensor high throughput field phenotyping system for soybean and wheat breeding. The infrared radiometer was used to collect canopy temperature—one of six crop canopy sensor based traits being studied. Temperature, along with the remaining five sensor based traits: canopy height, two NDVI indices, reflectance, and RGB, was studied to find a correlation with final yield.

The system consisted of a manually operated platform using a laptop with a special developed LabVIEW program as a controlling unit to collect, synchronize, and store measurements from all sensors for analysis. Apogee's SI-131 was mounted to a sensor bar on the platform at a distance that allowed for a representative subarea of the crop canopy to be seen in the sensor's field of view. The analog infrared radiometer was connected to the laptop through a USB data acquisition board. The LabVIEW program read the infrared radiometer outputs from the analog input ports and applied Apogee's calibration equation to convert the sensor voltage to degrees Celsius. Yufeng Ge, a Biological Systems Engineer from the study, said, "The infrared radiometer by Apogee Instruments is among one of the most reliable and trustworthy sensors I have used."

The system was successfully tested over 240 plots of wheat and 120 plots of soybean crop using a manual stop-measure-go data collection method.\* The study determined that final grain yield of soybean is strongly correlated with all six sensor base traits and suggested the usefulness of the sensor system in plant breeding.

\*A stop-measure-go data collection method was used because slow response times from sensors did not allow for continuous measurement (the SI-131 with a response time of 0.6 seconds was noted as one of these sensors in the reference article). Since this study took place, Apogee has developed high-speed, analog infrared radiometers with a response time of 0.2 seconds and SDI-12 infrared radiometers.

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### Application Summary

#### Summary

Apogee Instruments' Infrared Radiometer is used to measure canopy temperature on a multi-sensor system for high throughput field phenotyping in soybean and wheat breeding.

**Apogee Sensors Used**  
SI-131 Infrared Radiometer

**Contributing Organizations**  
University of Nebraska-Lincoln

**Location**  
Lincoln, Nebraska



Apogee SI-110 mounted to the sensor bar of the platform

Thermal infrared radiometer	Fiber optics coupled to portable spectrometer	Down-looking SRS NDVI sensor	Ultrasonic sensor	Web camera
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