



Plant-based sensing for cotton irrigation

1. What is the project about?

Water is the most limiting factor for cotton production in Australia. This project aims to help optimize the irrigation strategies for fully irrigated and partially irrigated cotton by utilizing plant-based sensing techniques including canopy temperature and UAV thermal imaging (Fig. 1). The project will also provide technical and extension support to cotton industry for adoption of irrigation scheduling based on continuous canopy temperature measured using infield infrared sensors. Research trials will be conducted at the Australian Cotton Research Institute (Narrabri), and on farms in different cotton growing valleys in New South Wales and Queensland.

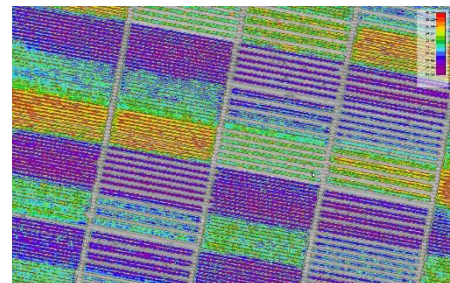


Figure 1: UAV thermal image showing spatial variability in crop water stress

2. Why do irrigators need to know about it?

We monitored the canopy temperature on farms in different valleys where growers used their own experience and/or fixed soil moisture deficits to make irrigation decisions. The continuous measurements of canopy temperature showed that many irrigations on some monitored farms did not match the recommended threshold. These observations highlight significant opportunity to increase water productivity through optimizing irrigation scheduling.

As canopy temperature is a direct response of plant's access to (or lack of) soil water (Fig. 3), continuous monitoring of canopy temperature provides direct actionable information on plant's water status that can be used for irrigation scheduling. This project offers growers the opportunity to assess the practicality and cost effectiveness of an irrigation scheduling tool that is based on real-time monitoring of a crop's need for water using canopy temperature sensors. The canopy temperature infrared sensors (Fig. 2) are affordable, easy to use and maintain, and can be a significant addition to the suite of tools available to growers for making important irrigation decisions.

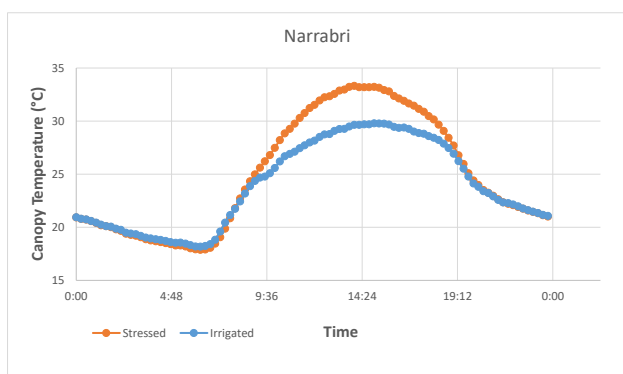


Figure 3: Diurnal pattern of differences in canopy temperature caused by crop water status



Figure 2: Infrared canopy temperature sensor monitoring crop stress in an irrigated cotton field



3. How will the research benefit irrigators?

This project will work closely with growers to further refine the methodology and help progress the adoption of canopy temperature approach of irrigation within the cotton industry. Specifically, this project will investigate:

- Utility of multipixel canopy temperature sensors for early season irrigation decision making when standard canopy temperature sensors with single field of view cannot be used because of smaller canopies
- Extend the utility of canopy temperature sensors for irrigation scheduling in limited water situations by developing new thresholds based on detailed research and on-farm trials.
- Testing CSIRO's canopy temperature predictive algorithms platform for scheduling irrigations in advance.
- Assessing spatial variability of canopy temperature on larger commercial farms to determine the minimum number of canopy sensors required for effective and efficient irrigation scheduling.

4. Key results to date

Several trials have been set up on farms and at the Australian Cotton Research Institute during the 2019-20 cotton season. Results will be updated when available.

For further information or project progress updates, contact:

Dr Hiz Jamali, Project Leader T: 0477 366 618 E: Hiz.Jamali@csiro.au