



# Automated irrigation systems: Precise real-time automated cotton and dairy irrigation for improved water productivity

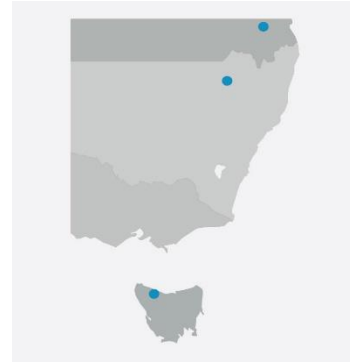
## 1. What is the project about?

This project is developing fully autonomous broad-acre irrigation control systems for cotton (furrow & pivot) and dairy pasture (pivot). Research is being conducted on large commercial-scale fields under real farming conditions to ensure the systems are robust, reliable, and practical. The aim is to maximise water productivity by using existing advanced bio-physical crop modelling in conjunction with the latest irrigation optimisation models under the VARIwise control system.

Activities include further development of two minimal viable products (MVPs); VARIwise cotton yield and dairy pasture biomass prediction capability based on fixed tower and UAV camera vision analysis of key plant attributes; and SISCOweb synchronous furrow irrigation optimisation measurement and modelling techniques.

The project is also supporting the commercial development of irrigation automation technologies previously developed in Smarter Irrigation for Profit Phase 1.

Project sites are located on farms near Burnie, Jondaryan and WeeWaa.



## 2. Is remote control of irrigation practical?

The autonomous irrigation technology developed through this project will support unassisted operation of autonomous broad-acre irrigation systems for cotton and dairy. The vision of operating a broad-acre irrigation system remotely is now a reality.

While research to ensure these systems are robust is ongoing, some of the automation products representing interim steps toward fully autonomous optimised irrigation control systems are now under commercial development. The SISCOweb server based system to optimise furrow irrigation events when triggered by advance sensors is fully operational and running on commercial servers through the USQ API.



## 3. How will the research benefit irrigators?

Autonomous irrigation systems can increase water productivity and reduce labour costs. With improved measurement to inform management, better use of valuable water resources for agricultural production is possible.

VARIwise controlled cotton irrigation has led to a 6% yield improvement and 14% more efficient water use. The MVP VARIwise Yield Predictor has regularly predicted final cotton yield to within 3% of actual yield six weeks prior to picking.

Furrow irrigation optimisation leads to an average 10 to 15% water saving per irrigation event. Commercial scale deployment of remote-controlled furrow irrigation is now common for less than \$800/ha.





### 4. Key results to date

#### Proof-of-concept crop and irrigation trials for selected MVPs

The second year of successful commercial-scale field trials of the VARIwise Yield Prediction MVP was completed through the 2020/2021 summer irrigation season with VARIwise in-field cameras, and with a UAV camera, to predict (a) crop yields in skip-row cotton, on a VRI centre pivot irrigated cotton field in 1.5 metre wide rows and at the Tasmanian Dairy Research Facility's VRI centre pivot over multiple replicated trial plots in dairy pasture at Elliott.

Furrow irrigation advance sensor technology has been developed for use in the optimization of furrow irrigation events with the SISCO surface irrigation model. The operational TagAlert SMS reporting system interrogates the Taggle sensor databases for updates regarding sensed water arrival for each Taggle IrriMate sensor deployed and provides a message to the growers about the optimal time-to-cut-off that the inflow into the surface irrigated field should occur.

#### Adapted autonomous control systems on both surface and centre pivot irrigation systems.

Trials on commercial fields continued during the summer of 2020/21. Some of the key outcomes to date include:

- Deployment of replicated trial plots to compare VARIwise yield and irrigation performance with more traditional irrigation control techniques across dairy pasture and cotton centre pivot sites.
- Collection of an excellent set of pasture growth data by independent sensor systems, along with related soil moisture data under various trial irrigation configurations, to allow proof of the VARIwise yield prediction capability and autonomous control of irrigation through the VARIwise uploading of prescription maps.
- The enhanced version of the VARIwise pasture prediction capability achieved a 96% accuracy in determining grazing activity in the field, with these highest results being achieved with images taken during the morning.
- Successful deployment of API for Padman gate actuators over a sPTB system, and interaction with newly installed level sensors and gate actuation equipment from Padman, through the SISCOweb server based surface irrigation optimization system over a couple of irrigations.
- Synchronous optimization by SISCOweb of furrow irrigation reduced the duration of small Pipe thru Bank irrigation from the grower selected 9 hours to an optimised 7.5 hours. This meant a 16% reduction in water applied to the field, resulting in a reduction of, tail-water and subsequent pumping costs, and deep drainage for this irrigation event.
- Successful UAV flights by motivated cotton grower for VARIwise yield prediction data collection through use of Mavic drone, Liitchi flight plan, and image upload to VARIwise yield prediction webpage that generated yield predictions.

For more information visit the [Smarter Irrigation for Profit](https://smarterirrigation.com.au) website and watch the videos:

- Irrigation automation in dairy and cotton – Dr Alison McCarthy (podcast) Available at: <https://smarterirrigation.com.au/irrigation-automation-with-dr-alison-mccarthy/>
- SISCO surface irrigation optimisation system- Dr Malcom Gillies and Assoc. Prof Joe Foley (video). Available at: <https://smarterirrigation.com.au/malcolm-gillies-and-joseph-foley-from-usq-talk-about-sisco-at-the-gvia-field-day/>
- Andrew Greste irrigation farmer WeeWaa talks about precise real time automated cotton irrigation (video). Available at: <https://smarterirrigation.com.au/andrew-greste-talks-about-precise-real-time-automated-cotton-and-dairy-irrigation-for-improved-water-productivity/>
- Assoc Prof Joseph Foley talks about automation of large-scale irrigation (video). Available at: <https://smarterirrigation.com.au/joseph-foley-talks-about-automation-of-large-scale-irrigation/>

Videos on VARIwise and yield prediction tools can be accessed from the CottonInfo website:

- Variable rate irrigation using VARIwise; [https://www.youtube.com/watch?v=fL1DG07Fge8&list=PLQy8KAPn-DyrR0kMHHeiZyCGcIWp\\_6hZf](https://www.youtube.com/watch?v=fL1DG07Fge8&list=PLQy8KAPn-DyrR0kMHHeiZyCGcIWp_6hZf)
- Yield prediction using remote images; [https://www.youtube.com/watch?v=y7ns4AccRmc&list=PLQy8KAPn-DyrR0kMHHeiZyCGcIWp\\_6hZf&index=2](https://www.youtube.com/watch?v=y7ns4AccRmc&list=PLQy8KAPn-DyrR0kMHHeiZyCGcIWp_6hZf&index=2)

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