Automated irrigation systems: Scaling irrigation management to support whole farm operations.

1. What is the project about?

Access to affordable water is an increasing issue for dairy irrigators in the Goulburn Murray Irrigation District (GMID) and the Macalister Irrigation District (MID) due to increased competition from other sectors and climate change. Current water use efficiency (WUE) technologies typically target a single point (e.g. soil moisture at a location) or part of the farm (e.g. individual irrigation bays) and are rarely used at the whole-of-farm scale.

This project is addressing the challenge of managing gravity fed irrigation at a whole-of-farm scale by developing a system which has the potential to manage over 200 bays. It also aims to integrate irrigation decisions with grazing decisions to save time and water.

The project builds on the success of previous research, integrating satellite-based irrigation scheduling and new irrigation bay designs into a farm water management system. The satellite-based approach relies on minimal use of in-field sensors and integrates farm irrigation scheduling with automated management of irrigation re-use systems. The outcomes being improved water use efficiency and increased farm profit. It will quantify the value of whole-of-farm irrigation scheduling and highlight the benefits of enhanced water management to industry.

2. Why do irrigators need to know about it?

The irrigation scheduling tools being developed through this project will support farmers to make better irrigation and grazing management decisions boosting farm profit. To be adopted these tools must work at the farm level and deliver clear benefits to dairy businesses. There is a need to test irrigation scheduling tools on-farm, and then for farmers and service providers to use these tools via development and training activities.

The project is using a participatory approach that sets up a field to farm scale water management research and demonstration sites on commercial farms with supporting industry and farmer development programs.

3. How will the research benefit irrigators?

The research aims to support framers achieve consistently high irrigation efficiencies using a satellite-based whole farm irrigation management system that:

- reduces farmer management of individual irrigations,
- has minimal requirement for in-field instrumentation and telemetry,
- is adaptive to the schedules of other farm operations (e.g. grazing),
- incorporates management of irrigation water reuse systems, and;
- maintains ongoing irrigation performance benchmark data.

The researchers are working with industry extension officers and Agriculture Victoria Research (AVR) dairy research and irrigation service providers to help build farmer understanding of the benefits of moving from irrigation scheduling at the bay level to irrigation scheduling at a whole of farm level.

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4. Key results to date

During the 2020/21 irrigation season, irrigation trials were extended to 3 dairy farms across 5 trial sites in the Goulburn Murray Irrigation District (GMID). These sites represent a range of both pressurised pipe and riser and open channel flood irrigation systems on grazed perennial pasture across a range of light and heavier soil types. On one farm, the first and second experiment sites consisted of five and six consecutive bays, which were irrigated by a pipe and riser system. Irrigations at the third trial site were monitored on three consecutive bays that were irrigated by open channel system. On the other two farms, irrigation assessments were undertaken on bays irrigated by open channel systems and on differing soil types.

In all these trials water level sensors were installed at the end of the bay to verify the success of scheduled irrigation events. Measurement of irrigation runoff was undertaken at the second and third trial sites on the Lancaster farm.

The results from the trial sites at the Lancaster farm in the 2020/21 irrigation season showed that the bay-scale calibrations established in previous irrigation seasons had not changed and that the irrigation management approaches could be successfully scaled up to larger irrigation managements units.

Irrigation management at the Rochester site has shown that 65 mm of water needs to be added in each deficit to cover application losses. It means, for a nominal deficit of 50 mm and additional 115 mm (130% of deficit) of water is required to properly irrigate the bay and to generate some runoff. This site represents a highly permeable soil profile with higher application losses due to deep drainage. While it was demonstrated that the satellite-based irrigation scheduling approach improved irrigation management on this site it also established that management of flood irrigation of pasture on such permeable soils is challenging.

The results of the Tatura site showed that approximately 10 mm additional water should be added to the deficit that was calculated and suggested appropriate irrigation times to the farmer. This site demonstrated challenges around management of channel delivery systems to maintain consistent flows.

Feedback from all the farmers about the irrigation management of the experiment bays was positive and encouraging. Using the satellite-based irrigation management approach irrigators in the trial were able to reduce their irrigation durations by up to 30 minutes which can represent a reduction in water application of 10-20mm per irrigation. The approach was used to manage over 150 irrigation events in the 2020/21 irrigation season.

The results of the experiments showed that satellited-based irrigation management approach could be adopted to manage irrigations for different soil types, bay sizes, flow rates, soil deficits, and for open channel as well as pipe and riser irrigation systems. Irrigation monitoring will continue during the next irrigation season to further evaluate the irrigation management approach. This will also include evaluating the tool which integrates irrigation management with grazing management, developed in collaboration with the AVR Pasture Smart project team.

For more information visit the Smarter Irrigation for Profit website and listen to the podcast or watch the videos:

- AgVic Research team talk about their work with producers (podcast). Available at: https://smarterirrigation.com.au/scaling-irrigation-management-to-support-whole-farm-operations-2/
- Andrew Tyler, dairy farmer from northern Victoria talks about how farmers can use technology (video). Available at: https://smarterirrigation.com.au/andrew-tyler-a-dairy-farmer-from-northern-victoria-talks-about-innovation-in-farming-and-how-farmers-can-use-technology/
- Dr Amjed Hussain, researcher talks about to develop a whole-of-farm scale gravity fed irrigation management system (video). Available at: https://smarterirrigation.com.au/amjed-hussain-talks-scaling-irrigation-management-to-support-whole-farm-operations/.

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