

Searching for efficiencies – Evaluating irrigation systems



Irrigation program overview

The Smarter Irrigation for Profit 2 (SIP2) program was developed to improve irrigator profit and maximise water productivity by driving efficiencies through new technology adoption and improved irrigation practices.

This program is a partnership between Australia's major irrigation industries – including dairy – and the Australian Government's Department of Agriculture Fisheries and Forestry through its Rural Research and Development for Profit program. "What's my yield gap? Maximising water productivity" was one of four SIP2 projects in the dairy industry run by Dairy Australia across three years. "Optimisation sites" on dairy farms across Australia were the key to demonstrating irrigation improvements and encouraging practice change on-farm. Each optimisation site included a reference group of local farmers and service providers who were involved in ongoing irrigation discussions.

As part of the SIP2 program, irrigation system evaluations were conducted on eight dairy farm optimisation sites, including, Coraki, Bega and Tocal in New South Wales, Mt Gambier and Mt Compass in South Australia, Dardanup in Western Australia, and Yarram and Mepunga East in Victoria.

KEY FINDINGS

Dairy farmers can make energy and cost savings with improved pump efficiencies and avoid operating at excessively high pressures.

Upgrading irrigation sprinklers improved water application.

Most irrigation systems demonstrated uniformity of application.

Centre pivot control panel calibration is one way to improve water application accuracy.

Most centre pivot evaluations revealed more than one area for improvement.

Irrigation system evaluations are the only way farmers can identify performance issues within their irrigation systems.

Irrigation systems evaluations

The performance of an irrigation system is crucial to maximising water productivity and irrigator profit. The SIP2 program included irrigation system evaluations to identify areas of improvement and recommend changes.

Only two of the eight irrigation systems were evaluated at the beginning and end of the project, while another two were partially evaluated at the beginning but had a full analysis at the end of the project. Four optimisation sites were evaluated once during the project.

Evaluations were conducted by Peter Smith from Sapphire Irrigation Consulting and David O'Donnell, a NSW south coast consultant.



Key findings

There were nine measures of improvement across the evaluation sites.

Many sites encountered more than one issue and many of the irrigation system challenges were common to most optimisation sites.

Most irrigation systems were not performing as well as they could, with the evaluations revealing several areas of improvement – especially for those with centre pivot systems.

The areas of improvement included:

- Irrigation pressures
- Control panel and settings
- Pump efficiency
- Flow meter capacity
- Sprinkler package
- System capacity
- Uniformity
- Energy use
- Application rates

Irrigation pressures

Some irrigation pressures were too high, others too low or the pressure varied across the length of the pivot. Irrigation systems with incorrect pressures can cause excess energy use and poor performance. Issues with pressure variation were normally a result of poor design, or a need for maintenance of the irrigation system or sprinkler pack. Recommendations to address pressure challenges included changing the pressure to match the system specifications, and investigating the cause of the pressure variation.

Control panel and settings

A mismatch between the information shown on an irrigation control panel and the function of the irrigation system was a common issue for many optimisation sites. Excessive variation between the control panel readings and paddock soil measurements can lead to under or over irrigation. To rectify this issue, a recalibration of the panel and settings was advised, while others were encouraged to adjust the irrigation speed control. One South Australian optimisation site invested in a hydraulic speed control unit to ensure irrigation accuracy.



Pump efficiency

Pump efficiency was found to be “generally low” across the optimisation sites. Inefficient pumps cause excessive energy use and potentially reduce the performance of an irrigation system. Recommendations from the evaluation included investigating the cost versus benefit of an irrigation pump renovation and/or installing a pump with a variable speed drive. Two South Australian optimisation sites chose to replace pumps to rectify this issue.

Flow meter accuracy

A flow meter that can’t measure water accurately affects irrigation management and water billing. Described in the report as “often poor” across the optimisation sites, those with this challenge were advised to install new meters. A flow meter on a NSW optimisation site was recalibrated as a result of this evaluation.

Sprinkler package

The sprinklers on many of the optimisation site irrigation systems were found to be old, worn or varying from the system specifications. Poor functioning sprinklers on irrigators contribute to non-uniform water application and application depth errors. Following the evaluation, several optimisation sites have replaced sprinklers or are in the process of doing so. One Victorian dairy farm is investigating the use of variable rate irrigation.

System capacity

Described in the valuation as “generally okay”, system capacity was a key measure to ensure irrigation applications were sufficient to meet the moisture requirements of pasture growth during peak periods. The evaluations recommended a few small changes to ensure irrigation systems ran at peak capacity. These included increasing the flow rate, decreasing the irrigable area, and minimising the “non-pumping” time.



Uniformity

Testing showed uniformity of water application was “generally good” across the optimisation sites, but the evaluation suggested improvements would deliver benefits. Improvement suggestions included replacing or repairing sprinklers and checking the performance of the irrigator “end-gun”.

Energy use

Irrigation systems were using too much energy across all the evaluations, and this led to increased running costs. Optimisation sites in South Australia had committed to investigating this further.

Average application rates

Testing revealed that average application rates were too high across the optimisation sites which caused water movement within paddocks as well as run-off. Recommendations to rectify this situation included installing modified sprinklers, reducing the water application, adjusting the irrigator “end-gun”, and changing paddock practices to minimise water movement down slopes.

On-farm changes

All eight optimisation sites involved with irrigation systems evaluations made changes to their business which resulted in positive outcomes.

Many optimisation sites identified opportunities to reduce irrigation running costs. Examples of changes to lower costs included replacing sprinklers and pumps, installing variable rate irrigation technology, control panel recalibration and changing the irrigation system operating pressure.

Other benefits included improved uniformity of water application, better and more accurate water application.

Broader impact

Many farmers and reference group members indicated they’d undertake further irrigation system evaluations with some likely to undertake field efficiencies measures and pre-season system checks.

Some farmers also indicated they’d make changes to their irrigation systems based on the efficiencies recommended as part of the SIP2 program evaluation.

Service providers in the Tocal, NSW, and Mepunga East Optimisation Site reference groups were keen to gain expertise in system evaluations, while farmers in Gippsland indicated they’d check their pump performance.

MORE INFORMATION

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