SMARTER IRRIGATION FOR PROFIT 2

FINAL REPORT SUMMARY

What's My Yield Gap?
Maximising Water Productivity

Australian Government
Department of Agriculture, Fisheries and Forestry

Dairy Australia

This project was supported by funding from the Australian Government Department of Agriculture, Fisheries and Forestry as part of its Rural R&D for Profit program.

INTRODUCTION

The second phase of Dairy Australia's six-year Smarter Irrigation for Profit research, development and extension project was completed in 2022 and the results are already helping farmers across Australia make better irrigation decisions, which improve water use efficiency and lead to greater profit.

91 per cent of participants of the project extension activities said they were likely to make changes to their irrigation practices and 81 per cent of these within the next two years, highlighting the benefit of applying the principles and the strategies developed through the six years of the projects.

The Smarter Irrigation for Profit – Phase 2 project (also known as SIP2) is a partnership between the dairy, cotton, sugar, rice and grain sectors. It was funded by the Australian government's Department of Agriculture, Fisheries and Forestry as part of its Rural R&D for Profit program and each of the industries involved, including Dairy Australia.

Below is the Plain English Summary taken from the SIP2 Final Report. The full report is also available for download from the Dairy Australia website.

PLAIN ENGLISH SUMMARY

Research Development and Extension activities conducted under Smarter irrigation for Profit Phase 1 (SIP1) found considerable opportunities for improved water productivity and efficiency even on well managed dairy farms. *Smarter Irrigation for Profit 2 (SIP2): What's my yield gap? Maximising Water Productivity* aimed to fast-track adoption of key irrigation principles determined in SIP1 by addressing the barriers to adoption identified.

Method

All Australian dairy regions have businesses that use irrigation, but the types of application and agronomic systems are diverse. New and existing irrigation technologies and strategies were trialled and evaluated in a local context, with input from farmers and service providers through different extension models.

Ten *Dairy Optimisation sites* were established across the seven dairy regions of mainland Australia to capture data for up to three irrigation seasons or defined irrigation periods. Site reference groups were established to act as a discussion and support group and included farmers and private sector providers.

The objective for each irrigated dairy optimisation site was to decrease the 'yield gap' between modelled yield potential and measured yield, using the first season as a baseline. Data on irrigation system performance and design, water and energy usage, and pasture productivity was collated each year for each site to provide objective measurement of system performance and to determine changes throughout the project.

Each site was an example of the primary irrigation system or irrigation system of interest to regional dairy irrigators and was representative of the regional dairy feedbase. Local farmers and service providers helped to determine the *Dairy Optimisation Site* research questions to be addressed over the project's duration. The research, extension and communication activities at each site was conducted by a locally based *Optimisation Site Coordinator.*

Standardised data collection and analysis was adopted to assess the efficiency and profitability of practices and improvements or constraints associated with closing the yield gap. Water and power efficiencies were identified and evaluated by collecting site data including growth rates and water and power usage. The metrics used were:

PRODUCTION

- Pasture or crop growth rate (kgDM/ha/day)
- Gross Production Water Use Index (GPWUI – tDM/ML (Irrigation + rainfall))
- Energy Efficiency (kWh/ML pumped, kWh/tDM produced, kWh/ML/ metre head)

COSTS

- Water use costs ($/tDM)
- Energy use costs ($/tDM)
- Energy Efficiency ($/ML pumped, $/ML/metre head)
- Total Cost per tDM (Cost Energy + Cost Water= $/tDM)

Relevant dairy and irrigation benchmarks were used to assess performance against industry standards.

The irrigation scheduling technologies trialled by the *Dairy Optimisation Site*s were:

1 Soil moisture probes (EnviroPro®) which were installed across different soil types of the site and connected to a cloud-based reporting platform using telemetry (Wildeye®);

2 The weather-based irrigation scheduling tool, IrriPasture, developed by the project (**www.app.irripasture.com**);

3 The weather forecasting system, SWAN Systems Weatherwise daily 7-day forecast ETo/rainfall report;

4 Pasture.io, a cloud-based spatial satellite and modelling online software package, used to validate accuracy of yield data reported against measured data collected on-site; and

5 A prototype of an automated irrigation scheduling tool using field-based equipment linked to the SWAN Systems water scheduling tool (Mepunga East and Bega Only).

Outcomes

Using irrigation scheduling and soil moisture monitoring technologies, the *Dairy Optimisation Site Farmers,* and engaged peers, made informed irrigation decisions. The technologies allowed the farmers to evaluate the impact of weather conditions (evapotranspiration and rainfall) on their irrigation strategies and build their confidence to maintain soil moisture within the Readily Available Water (RAW) zone, the optimal soil conditions at which plants can easily access water to grow.

By trialling the technologies and strategies on local farms, and having local farmers communicate and discuss their experiences in using the data to inform irrigation decisions, the benefits, and challenges of closing the irrigation yield gap were identified and explored. The project identified increased water productivity can be gained from implementing the following key irrigation principles:

1 Maintain irrigation systems to ensure efficient and effective operation;

2 Determine Readily Available Water (RAW) for each soil type being irrigated;

3 Use a water balance calculator tool to inform irrigation scheduling decisions to apply water at the right time and right rate to maintain soil moisture in the RAW zone;

4 Monitor forecast ETo and rainfall information to assist in more immediate decisions;

5 Monitor soil moisture, using professionally installed soil moisture monitors and reliable telemetry, to inform irrigation start-up decisions at the commencement of the season or after rainfall events;

6 Commence irrigation on-time at the beginning of the season or after rainfall to avoid a green drought scenario where future irrigation are ineffective;

7 Know the capacity of the system and schedule irrigation accordingly to maintain soil moisture requirements whilst deploying other cost-effective measures e.g. off-peak power; and

8 Maintain soil moisture within the RAW zone to create the ideal platform for strategic nitrogen use.

The data generated by the adopted technologies, and support provided by the *Optimisation Site Coordinator* and local service provider and farmer participants, gave *Optimisation Site Farmers* greater confidence to adopt strategies to address the gap between modelled potential yield and actual yield, including:

- Commencing irrigation earlier in season two and three
- Commencing irrigation on time after rainfall events
- Changed application frequency and rate to maintain RAW in Season 3
- Overhauling or purchasing new pumps to improve performance and increase efficiency; and
- Overhauling or purchasing new sprinkler packages to operate within specification, improving application uniformity.

Benefits to industry

Analysis of the data generated from each *Dairy Optimisation Site* was used to evaluate the effectiveness of the changed practices. Seasonal conditions as well as changed practices had an impact on performance metrics. Most sites experienced high variation in seasonal conditions across the three years with heat events or saturated conditions or both. The core strategies implemented delivered productivity and profitability change across the sites.

Across the ten *optimisation sites,* on average there was a 46.76 per cent improvement in Gross Production Water Use Index (tDM/ML). The range in per centage improvement for the Gross Production Water Use Index was -24.6 to 181. Both the significant average improvement and the wide range in overall productivity highlights the potential productivity benefits for Australian dairy irrigators if they adopt the irrigation strategies and principles identified by the project.

The water use efficiency target from the Australian Dairy Industry Sustainability report is to “Improve water use and water productivity to utilise 2.0 tonnes of dry matter per ML used. The range from the optimisation sites for this target is from 0.89 to 3.03 tDM/ML. There are still significant gains needed to reach this Dairy Industry sustainability benchmark, however the SIP2 project has established a range that exists and can be used to increase water productivity.

The project delivered 101 extension activities: 25 field days, 5 professional technical workshops, 47 reference group meetings, 8 webinars and 16 farmer/service

provider workshops. These activities had 1,734 attendees – 811 farmers, 735 service providers and 163 other roles, including researchers, government agencies and commercial operators.

SIP2 participants reported the activities, including field days, workshops, webinars and meetings improved their knowledge of irrigation practices that could increase productivity, and that the activities were highly valuable to their business. Evaluation results of these activities showed that 91 per cent of participants were likely to change irrigation practices and that 81 per cent of these participants were likely to change that practice within the next two years.

Survey respondents reported improved knowledge on average of 1.7 on a rating scale of 1–10. Farmers reported improved knowledge on practices that impacted on farm irrigation decision making on a daily basis, e.g. soil moisture monitoring and interpretation, whereas service providers reported greater improved knowledge of irrigation system performance and basic system checks. Tools and activities that could improve productivity, such as soil moisture monitoring to determine irrigation scheduling were widely adopted. Irrigation start-up time and rates of irrigation were areas where a high level of practice change occurred. More than 65 per cent of participants changed start up time at the beginning of the season, after major rainfall events, and irrigation application rates as a result of being involved in SIP2. Eighty per cent stated they had increased productivity under irrigation.

SIP2 increased the use of soil moisture monitors with telemetry. Of the 81 per cent of respondents who were not already using this tool 52 per cent reported they had started using the tool as a result of being involved in SIP2 and 43 per cent were still considering it. Only 5 per cent were not considering it at all.

The level of uptake of system performance evaluations and the basic system checks was not as great as the soil moisture monitoring. However, 62 per cent of those who were not already doing basic system checks have adopted this through SIP2, whilst 23 per cent are still considering. The Dairy Australia Land, Water and Climate survey report (2020) indicated that 18 per cent of farmers did no system checks at all on their irrigation systems.

Of the 88 per cent of respondents who were not completing whole system performance evaluation prior to SIP2, 39 per cent started because of SIP2 and a further 52 per cent are still considering. The lower rate of adoption of this activity may reflect the difficulty in accessing service providers with the skills to complete the assessments.

Within a cross sectoral evaluation of the SIP2 project, 58 per cent of dairy farmers reported that improving the management of their irrigation system was very important, with 98 per cent of dairy farmers rating this somewhat important, important, or very important.

Compared to other issues on farm, 56 per cent of dairy farmers reported that improving their irrigation system is very important.

Collaborations

The most successful collaboration was between this project and TIA's *SIP2: Beyond Water Smart: advancing dairy irrigation system performance* project. The collaboration between Dairy Australia, TIA and USQ was built on from a previous relationship between these organisations within SIP1. Cross-project and industry collaboration was invaluable.

By working closely together over a total of six years via SIP1 and SIP2, long-term working relationships across industries and organisations, to advance irrigation management and innovation to improve productivity and profitability, is a legacy of the Rural R&D for Profit program, RDC and research organisation investment.

Dairy Australia Limited ABN 60 105 227 987
Level 3, HWT Tower
60 City Road, Southbank Vic 3006 Australia
T +61 3 9694 3777 F +61 3 9694 3701
E enquiries@dairyaustralia.com.au
dairyaustralia.com.au

3513.10 | Dec 2022