Project Update

P6: Future Systems – Dairy DaTA

October 2023

Data, Advanced Technology and Automation (DATA)

Copious volumes of data are collected across the Australian dairy industry. Until now this has been stored in numerous, separate data bases.

This project aims to utilise data, advanced technologies and automation to integrate information from multiple sources to enable the creation of tools that support on-farm decisions.

P6a Resilient Cattle (heat tolerance)

Dr Anna Chlingaryan and Alice Shirley, PhD student

Managing dairy cattle in hot, humid conditions is an increasing issue for the Australian dairy industry with climate change and the increasing intensification.

This project explores the diversity in response by dairy cattle to heat events. It uses new sources of data (core body temperature) and new methods (machine learning) to help manage cows in hot, humid conditions.

Fit with Dairy UP 10 projects

Dairy UP's P6 project is exploring ways to use existing farm, climate and industry data to develop ways to monitor cows and systems to help farmers make better decisions, for example about heat management, health and feeding. One aim is to support animal and environmentally friendly intensification.

P6 is a suite of three projects that combine animal science and data science. Each project is being undertaken by a PhD student.

- P6a: Resilient Cattle (heat tolerance): optimising on-farm energy use and cooling systems.
- P6b: Resilient Cattle (health): early intervention for improved animal health, enabled by advanced sensing.
- P6c: Digital Feeding – data-driven feeding to optimise grain allocation in pasture-based herds.

This document provides an overview of the three projects.

Progress: October 2023

Cows on three Australian pasture-based dairy farms have been fitted with rumen sensors (reticuloruminal boluses) to monitor core body temperature, every 10 minutes, 24 hours a day. A water threshold model has been developed to account for water intake, isolating the impact of drinking events on core body temperature. This model will soon be validated on a fourth dairy farm.

The team is currently exploring:

- individual cow variability in response to climate
- the association between the Heat Tolerance Australian Breeding Value (ABV) and a metric that will be developed using core body temperature data.

New South Wales climate data from the past 20 years has been obtained from the Bureau of Meteorology.

The Dairy UP team has examined the current method for measuring heat tolerance in cattle. A pre-processed historical herd test dataset supplied by DataGene was merged with climate data at the postcode level. A novel machine learning-based approach has been developed to improve the calculation of heat tolerance. This machine learning approach is more versatile and robust in modelling a wide range of relationships between milk production, climate variables, and cattle characteristics.

The new methodology may enable a more reliable identification of cattle that are resilient to climate variation and extreme events.

The next steps in this project include:

- Validation: checking that animals identified with the developed methodology are in fact more heat tolerant.
- Working with Dairy UP's P2 project team to explore opportunities for housed cows.

P6b Resilient Cattle (health)

PhD student: Maddi Perce

The number of dairy cattle housed indoors in Australia is increasing with the trend towards intensive systems.

Intensively housed animals can be fitted with sensors (in and on the animal) to monitor behaviour in near-real time.

This project aims to develop a model for predicting health issues by combining data from animal sensors with other farm records. This would enable early intervention to either prevent or reduce ill-health.

Progress: October 2023
The Dairy UP team has obtained sensor and health data from a large, intensively-housed herd in NSW.

The next step is to use machine learning techniques to create models of reduced health.

P6c Digital Feeding

PhD student: Blessing Azubuike

This project is investigating ways to use data to guide grain allocation decisions for pasture-based herds with automatic feeders.

The project builds upon earlier work by the University of Sydney that found the potential for a 10% increase in milk production through improved feed allocation to individual animals.

It is drawing upon existing farm data to create a "digital twin" model for optimised, automated, grain feeding.

The digital twin model approach creating a digital version of a living animal that can be applied to optimise biological functions and processes.

Future applications of this approach could be for optimising calf rearing, cow production, reproduction efficiency, cattle health and survival.

Progress: October 2023
A model has been developed that uses the same total daily concentrate budget as flat rate feeding but achieves about 12% increase in milk yield by customising the daily concentrate allocated to each cow.

The model 'learns' the features of individual cows – for example, it's production response to daily concentrate fed – and prescribes concentrate allocations accordingly.

Similar estimated responses were achieved for a commercial farm that is monitored by the Dairy UP project. It showed the potential of an 8% increase in total milk yield production when incorporated with weather data and cow characteristics.

DairyUP
Unlocking potential

Next steps
The next steps involve:

- Exploring the impact of pasture utilisation on the optimum allocation of grain-based concentrate on pasture-based dairy farms.
- Developing a model to optimise the approach at the herd level and adapting it to work on commercial farms.
- Testing the optimisation model on a commercial farm by collecting real-time data that will be used for evaluating the models' performance analysis.

More info

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Delivery organisations

The University of Sydney Dairy Research Foundation | NSW Department of Primary Industries | Sabus | Dairy Australia

Partner organisations

NSW Farmers Growing the best | eastAUSmilk | Dairy NSW | Dairy Australia | AFMH | Leppington Pastoral Company Pty Ltd | NSW Local Land Services | Norco

Additional program supporters, collaborations or partnerships

Charles Sturt University | DairyBio | DataGene | Eagle Direct | Entegra
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