Australian Government
Department of Agriculture, Water and the Environment

MIR for profit

Integrating very large genomic and milk mid-infrared (MIR) data to improve profitability of dairy cows

Dairy Australia Limited

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This summary is an excerpt from the final report, with minor edits made to ensure it meets departmental style and accessibility requirements. The final report can be requested by contacting Dairy Australia.

Summary

About half of Australian dairy farmers routinely herd test which involves collecting milk samples from individual cows and sending them to a laboratory (herd test centre) for analysis.

MIR stands for mid-infrared spectrometry. It involves passing a beam of light through a milk sample to provide data in the form of spectra (wavelengths). Farmers currently receive regular reports with information about individual cows including their production levels and the composition of their milk (for example fat and protein content and milk quality). These are important because they influence the price farmers receive for their milk.

With millions of samples routinely collected and analysed from Australian cows, MIR has the potential to be widely used to understand more about a cow from a single milk sample.

Recent advances in MIR technology has opened up exciting opportunities to provide new information from milk samples. The MIR for Profit project investigated opportunities to use MIR technology to screen herd recording milk samples to enable farmers to identify individual animals to target management, selection and culling decisions, resulting in more profitable decisions on farm.

Benefits of the project to industry/primary producers

The project's long-term objective is to produce equations that can be used to predict a cow's health, reproduction, efficiency and product quality from the MIR spectra collected during routine herd testing. This information could be useful at two levels:

1) For farmers and their advisors, MIR has the potential to provide greater insight from herd test results into the current status of the herd and individual cows in terms of feed efficiency, negative energy balance, fertility, and health and methane emissions.
2) For the herd improvement industry, MIR has the potential to improve the accuracy of predictions of the genetic potential of dairy cattle for specific traits and to help predict new

traits that have been previously difficult to collect performance data, for example health traits.

Objectives

The project aimed to develop:

- a method for predicting the risk of an individual cow's potential health or fertility status in Australia
- more accurate predictions of the genetic merit of dairy cattle (genomic Australian Breeding Values) of key traits
- the software necessary to enable use of the data and prediction equations generated by the project.

Methods and outputs

Running between 2015 and 2018, the project collected Australian data to develop prediction equations for Australian conditions.

The first step in developing Australian prediction equations involved very intensive data collection from Agriculture Victoria's Ellinbank research herd. We worked with data from:

- herd testing (milk samples): MIR spectra, milk yield and milk composition
- animal performance measures: fertility, feed intake, body weight, body condition and methane emissions
- DNA testing (genotypes).

To validate the predictions in a larger, more diverse group of cows, we collected data from:

- 2,000 cows in commercial herds in Victoria, NSW and Tasmania who herd tested twice monthly
- a further 10,000 cows in commercial herds in Victoria, NSW and Tasmania who herd tested monthly.

PhD student, Tim Luke, collected blood samples that were evaluated for predictors of early lactation disease in commercial herds. Tim looked at energy balance in early lactation. Energy balance is an indicator of how much weight the cow has lost which will in turn affect her likelihood of early lactation disease and fertility.

Our analysis also involved assessing European prediction equations for energy balance to compare to the Australian results.

Outcomes

There are two applications from this project:

1) Milk samples could be used for a fast, accurate test for traits such as energy balance in early lactation cows. This would allow early intervention by the farmer to prevent production losses, reduce early lactation disease and improve fertility. Currently there is no fast, accurate test for energy balance in Australia.

2) The development of genomic predictions (Australian Breeding Values) that use information from MIR spectra.

The team will continue to work towards these two applications after the completion of this project. Over the coming 12 to 24 months, we will work with industry to develop useful reports for farmers and their advisors.

Successful delivery of these reports will involve collaboration between herd test centres, veterinarians and nutritionists. Throughout the project, the team has held regular workshops and provided updates and information to keep the various stakeholders informed about the research and potential applications.

Collaborations/acknowledgements

The project was an international collaborative effort to produce prediction equations for cows in Australian dairy herds based on MIR spectral data.

Key members of the MIR for profit team were Dr Jennie Pryce (Agriculture Victoria), Dr Phuong Ho (Agriculture Victoria), Jane McLennan (Dairy Australia), Beth Scott (Dairy Australia), Michelle Axford (DataGene), Erika Oakes (DataGene) and Dr Tim Luke (Agriculture Victoria).

The project worked with:

- 24 Australian dairy herds
- Agriculture Victoria, including the Ellinbank Research Dairy Herd near Warragul and AgriBio Research Centre in Bundoora
- Dairy Australia
- Data Gene (formerly the Australian Dairy Herd Improvement Scheme - ADHIS)
- Herd test centres including TasHerd, Hico, Northern Herd Development Co-operative (NHD) and Dairy Express
- National Herd Improvement Association (NHIA).