Final Project Summary

P2a: Metabolic investigations into dairy cow longevity

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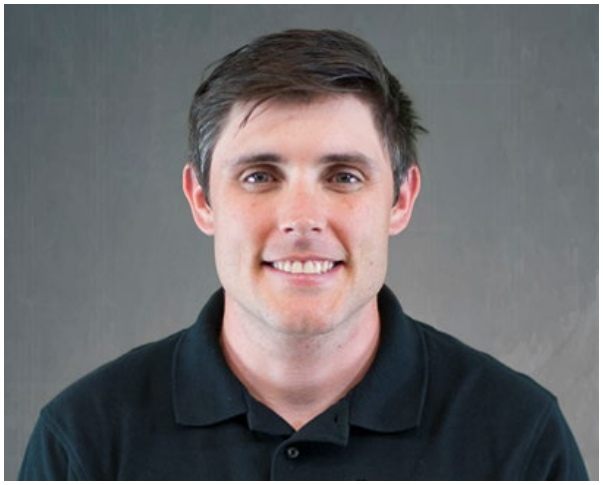

Longevity matters

Cows tend to produce more milk with each lactation: older cows produce about 16% more milk than their younger counterparts.

But cows in Australian dairy herds are young. Only 10% of cows produce milk for five lactations or more and about 60% of the average national milking herd has calved twice or less.

Optimising the productive life of dairy cows ensures dairy farm businesses receive the best return on their investment from rearing the calf; it also increases milk production and reduces the environmental footprint of individual cows.

David Sheedy's PhD investigated metabolic markers that could be associated with longevity in dairy cows.

Key findings

Cows in housed systems were metabolically older than cows of the same age in pasture-based systems. Further work is needed to determine if this has implications for cow health and longevity in different systems.

Collectively, the findings from this work and earlier studies suggest that targeting the fat profile of diets could help optimise longevity in Australian dairy herds. Specifically, supplementary omega-3 warrants further investigation.

Unlocking the potential of cows

Dairy UP's P2 project aimed to unlock the potential of dairy cows to achieve their genetic potential under NSW conditions.

P2 was a suite of seven projects that collectively explore ways to profitably increase both productivity and wellbeing in commercial settings.

P2a: Cattle Longevity
P2b: Early Alerts
P2c: Milk as a Diagnostic Tool
P2d: Diet and Heat Load
P2e: Calf Husbandry
P2f: Infectious Diseases ('Infectome')
P2g: Heifers Early Calving

This document provides a final summary of the findings from research undertaken by David Sheedy for his PhD thesis which contributed to Project P2a.

Benefits

Retaining the best dairy cows in herds for longer is expected to make dairy businesses more profitable and less risky.

Thanks to technology such as sexed semen and fixed time artificial insemination, retaining more older cows could also provide the opportunity for a dairy business to produce more dairy-beef.

Increasing the proportion of older cows in a dairy herd would also ensure that dairy farm businesses receive a return on the investment in rearing these calves. A full return for the cost of rearing a dairy heifer often isn't realised until she calves for the third time.

From an industry and farm perspective, reducing the "wastage" of older cows is good news for dairy's environmental footprint. The more milk a cow produces over its lifetime, the less its environmental emissions intensity.

In addition, there are expected industry 'social licence' benefits from optimising the longevity of dairy cows.

Research approach

This project established a unique large-scale data set, created by a partnership between DataGene and Scibus. It included herd test data and farm management records from selected Australian dairy herds with excellent quality records. Weather, bulk milk tank and pasture data were also included.

Twenty-nine Australian dairy herds provided farm records for inclusion in the data set. Fourteen of these herds were pasture-based and 15 operated contained housing systems.

The project also involved metabolomics in collaboration with researchers at AgriBio, Victoria. Metabolomics is the large-scale study of small molecules called metabolites within each cow and can provide insights into health and longevity.

Blood samples were taken from about 1700 cows (half at peak milk production and half dry) for metabolomic analysis.

Novel statistical methods were used to gain insights into relationships between blood fats and cow age/parity, feeding system and longevity.

Results

1. Health and parity

The results confirmed findings from earlier studies that used previous health and reproduction data from 13 studies conducted in Australia, Canada, and the USA.

As cows age (especially beyond the second lactation):

- Pregnancy risk decreases (they are harder to get in calf)
- Mastitis risk increases.
- Lameness risk increases.
- Survival (culling or mortality) risk increases.

2. Body condition and body weight

As cows age, they gain weight but lose body condition. This occurs in both pasture-based and contained housing systems. The exception was cows entering their second lactation, who often had the lowest body condition and low body weight.

Albumin, a blood protein, was strongly associated with high body condition and body weight.

This finding paves the way to develop nutritional interventions (protein metabolism) to improve body condition in older cows.

3. Blood lipids (fats) and age

This work investigated 185 blood lipids in cows of different ages.

The results showed that older dairy cows had lower levels of omega 3 fatty acids in their blood.

This is an important finding as omega 3 fatty acids have been associated with improved reproduction, health and possibly survival in cattle.

4. Blood lipids (fats) and survival/longevity

To investigate survival, cows that had blood samples taken were followed for about 600 days and all exit reasons were recorded.

Multiple lipids were associated with the timing of cow removal. Importantly, this included the omega-3 fatty acids that were associated with increased survival time.

5. System differences – lipids and health

Herds in contained housing had higher levels of mastitis compared to pasture-based herds.

However, there was no difference in reproductive performance or lameness. Increasing parity had a larger impact on these metrics than the effect of housing system.

Cows in contained housing systems had lower blood levels of omega 3 fatty acids and higher omega 6 compared with pasture-based cows of the same age.

The differences in omega fatty acid profiles are

likely to be associated with maize silage which is the main forage source in contained housing TMR diets. Maize silage is comparatively low in omega 3 fatty acids and high in omega 6, while fresh pasture has high omega 3 and low omega 6 content. A different lipid profile between housing systems may imply different survival risks between systems.

Cows in housed systems were metabolically older than cows of the same age in pasture-based systems. Further work is needed to determine if this has implications for cow health and longevity in different systems.

Collaborators

The data base used for this work was developed through a collaboration between researchers from Dairy UP, Sc*ibus*, DataGene, AgriBio and the participating commercial farms.

Read more

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More info

P2 final report

PhD candidate
David Sheedy
Email davids@scibus.com.au

Dairy UP P2a Project lead
Ian Lean
Email: ianl@scibus.com.au

www.dairyup.com.au

Delivery organisations

The University of Sydney Dairy Research Foundation | NSW Government Department of Primary Industries and Regional Development | Scibus | 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

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