Final Project Summary
P2c: Milk as a Diagnostic Tool

May 2026

Milk as a monitoring tool

Testing samples from bulk tank milk for somatic cell count (SCC) is a well-established practice. But testing milk samples has the potential for broader uses to monitor, predict and manage risks to dairy cow health, productivity and fertility.

Bulk tank milk samples provide insights at a herd level, while herd testing offers insights at an individual cow level. And the growing adoption of inline metering offers opportunities for more convenient and frequent on-farm sampling to provide insights about individual cows, including specific udder quarters.

Research approach

This project involved a literature review to investigate opportunities to use milk samples as a monitoring and diagnostic tool in Australian dairy herds. It focussed on potential insights about:

- Dietary imbalance
- Udder health (mastitis)
- Viral diseases

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 explored ways to profitably increase 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 is the final update on P2c: Milk as a diagnostic tool. This project was closely linked with P2f: Infectious diseases.

Potential applications

While the work was NSW-focussed, the outcomes are potentially applicable to all Australian dairy herds.

Using milk as a monitoring and diagnostic tool has potential benefits at the industry, herd and individual cow level.

Biosecurity

Ultimately, the diagnostic capability of bulk tank milk could help reduce the risk of disease spread within and among herds.

At an industry level this is vital for biosecurity as the detection of pathogens or specific antibodies in milk can be used for monitoring endemic diseases within a farm, region, or country.

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Herd/animal health monitoring
Testing bulk tank milk could be a cost-effective and fast way to monitor herd health changes, potentially equipping veterinary services, or milk processors with new tools to assist farms as part of an efficient integrated farm service.

For example, antibody testing for Mycoplasma bovis (which causes pneumonia, mastitis and arthritis in cattle) can be conducted at bulk tank milk level.

Management interventions
Using bulk tank milk as a diagnostic tool on farm would help farmers make informed business management decisions to improve animal well-being, productivity, and profit.

Early and accurate detection of metabolic disorders can guide intervention strategies, while bulk tank milk urea and protein content are useful indicators of herd nutrition.

Bulk tank milk could also provide a cost-effective and efficient assessment of a herd's disease status with this information supporting disease control programs for viral diseases.

At an individual level, the early diagnosis and treatment of infections and nutritional disorders will improve animal health and welfare.

More information

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P2 final report

Key findings: Ways milk can be used as a diagnostic tool

Commercially available applications

- Somatic cell count — udder health monitoring, mastitis management, selective dry cow treatment
- Bulk tank milk protein and urea — herd nutrition and fertility risk
- Herd testing — earlier identification of cows at risk of metabolic disorders such as ketosis
- Conductivity — early indicator of udder inflammation and mastitis
- Polymerase chain reaction (PCR) testing — identification of mastitis-causing pathogens
- Bulk tank milk surveillance — herd-level disease and biosecurity e.g. bovine leukosis, *Mycoplasma bovis*

Tools with potential for greater use

- Bulk tank milk — herd-level monitoring of nutrition, minerals, vitamins and disease risk
- Integration of herd testing and inline milk data — earlier identification of health and metabolic issues
- More proactive use of bulk tank and individual cow milk data — for earlier intervention and herd management decisions

Emerging technologies

- Microbiome analysis — bacterial profiling for mastitis and udder health
- Immune biomarkers — early indicators of inflammation and infection
- MALDI-TOF milk testing — rapid identification of mastitis-causing bacteria
- Multiplex milk testing — multiple diseases from one milk sample
- Advanced metabolic profiling — earlier detection of ketosis and acidosis risk
- Integrated sensor systems — combining milk, behaviour and herd data for earlier alerts

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Research and results

Literature review

The Dairy UP team undertook a literature review of previous work, focusing on the role of milk as an indicator of dietary imbalance, milk as a diagnostic fluid for udder health management and milk as a diagnostic fluid to monitor viral diseases in dairy cattle.

This review also informed further consideration of the development of diagnostic tests using milk, in addition to those already commercially available.

Dietary imbalance

Herd level

The review concluded that bulk tank milk is an under-used resource for monitoring herd health and nutrition.

Bulk tank milk has potential as a low-cost herd monitoring tool, but results can be harder to interpret because it is a mix of milk from cows at different stages of lactation.

Protein and urea levels in bulk milk samples can provide useful indications of herd nutrition and may help flag nutritional issues affecting fertility.

Bulk tank milk can be used to assess herd mineral and vitamin status, including selenium, zinc, beta-carotene and vitamin E.

Individual cows

Testing individual milk samples can help identify metabolic problems in individual cows early enough to support targeted management or treatment.

Herd testing reports can aid earlier identification of cows at risk of metabolic disorders such as ketosis.

The milk fat-to-protein ratio can help identify fibre deficiency and acidosis risk in individual cows, although it is better at confirming problems than detecting all affected cows.

Udder health (mastitis)

The review found a growing range of milk-based tests that are becoming available to detect inflammation and infection associated with mastitis.

The performance and interpretation of diagnostic tests can differ depending on whether they are applied to quarter milk, individual cow milk or bulk milk samples.

Some proven diagnostic tools may still be under-used on farm, while newer technologies require further validation before widespread adoption.

Herd level

The review concluded that the well-established practice of testing somatic cell count (SCC) in bulk tank milk remains an important tool for monitoring herd udder health.

Individual cows or quarter sampling

Testing milk samples from individual cows (or quarters) for somatic cell count is an important tool for detecting udder inflammation and guiding mastitis management, including decisions about selective dry cow treatment.

Electrical conductivity testing is used commercially as an indicator of udder inflammation and mastitis.

Additional markers of inflammation can indicate disease severity, although they do not identify the specific pathogen involved.

Milk samples can be used to identify mastitis-causing pathogens using laboratory culture or polymerase chain reaction (PCR) testing.

A number of emerging technologies show promise for improving the detection and identification of mastitis-causing pathogens. They include loop-mediated isothermal amplification (LAMP), microbiome analysis and advanced organism identification methods such as matrix-assisted laser desorption/ionization time of flight (MALDI-TOF). However, many of these technologies are still in the research or development stage and are not yet used with bulk tank milk testing.

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Some pathogen-specific immune markers are available, but their practical value for on-farm udder health management is still unclear.

Viral diseases

This review focused on the use of bulk tank or pooled milk samples to monitor viral diseases at the herd level. In this context, pooled milk refers to milk combined from groups of cows within a herd rather than individual animals.

Milk testing can detect either viral pathogens or antibodies, supporting herd, regional and national disease surveillance programs. The results can help inform biosecurity decisions and on-farm disease management.

At the herd level, bulk tank milk can be a cost-effective way to monitor exposure to viral diseases.

Bulk tank milk testing has already supported disease control programs for some viral diseases, such as bovine leukosis.

Choosing the most suitable testing approach requires careful consideration of the disease being monitored and the structure of the herd.

The accuracy of pooled milk testing depends on factors such as herd size, infection prevalence, vaccination status, and how long infected cows shed virus or antibodies into milk.

Reliable interpretation of pooled milk results depends on understanding the strengths and limitations of each test, including false positive and false negative risks.

Larger dairy herds increase the need for highly sensitive tests because infected milk can become diluted in the bulk tank.

Technology opportunities

Improved testing systems could strengthen herd surveillance and support faster disease detection in the future.

For example, new technologies may allow multiple diseases to be monitored from a single milk sample.

But testing "pooled" milk does come with challenges. The accuracy of tests relies on achieving both low false positive and false negative estimates together. This can be difficult and influences the value of the tests to industry.

Researchers concluded that the integration of new biotechnologies could enhance multiplexing and data interpretation for comprehensive surveillance.

Related projects

P9a: Producing milk with less lactose

P9b: Adding value to dairy waste

Collaborators

The P2c project was a collaboration between researchers from Dairy UP, Scibus, University of Sydney and NSW DPIRD.

Journal articles

Milk as an indicator of dietary imbalance
Milk as a diagnostic fluid to monitor viral diseases in dairy cattle
Milk as diagnostic fluid for udder health management

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 Government Local Land Services
Norco

Additional program supporters, collaborations or partnerships

Charles Sturt University | DairyBio | DataGene | Eagle Direct | Entegra
Macquarie University | NSW EPA | smaXtec | UC Davis | University of Technology Sydney