Final Project Summary

P2e: Calf husbandry

May 2026

The early life performance of calves on dairy farms is strongly associated with lifetime productivity in the herd. Calves reared on dairy farms may include both female calves for replacements and non-replacement calves reared for dairy beef or other markets.

Improving calf care reduces antimicrobial use, lowers mortality rate, improves dairy business profitability and helps maintain social licence.

There were two elements to the project:

- Automated calf rearing.
- Rearing Holstein steers for dairy beef.

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 update on P2e: Calf Husbandry.

Automated calf rearing

The project was undertaken as part of Dr Sarah Legge's PhD thesis, titled '*The lasting impact of calf performance*'.

The study focussed on calves reared with automatic feeders on a large commercial dairy farm in NSW following industry best practices.

Research approach

The aim of this research was to determine the factors affecting calf growth and if there's an opportunity to intervene to improve lifetime performance.

This research was 'farmer-led' in that the project arose from the farmer's observation of a relatively large, unexplained variability in the size of calves at weaning. Despite uniform management and adherence to best practice standards, there was concern that calves with problems were not always identified early enough for intervention or prevention of issues. The impact of this variability on lifetime productivity and profitability was not known.

Real-farm data underpinned the three studies in this research. On-farm records and the automatic feeders provided a rich data set including birth dates, weights at various ages, health indicators and feed intake.

The first and second study followed a cohort of 1,440 calves reared on automatic feeders.

The third study involved modelling, drawing upon a dataset of more than 14,000 calves.

Key findings

The first study looked at factors affecting the growth of calves reared with automated feeders. It found a wide variation (60kg) in weaning weight, despite a very low mortality rate (<0.1%). Birth weight, visitation and

consumption had the greatest impact on weaning weight.

Underperforming calves on automatic feeders could be identified from day 5 in the feeder system (cumulative consumption), offering the opportunity for early management intervention.

The second study followed the long-term survival and lactation performance of the 1,440 calves in the milking herd. It looked at the association between weaning weight and future lactation performance (yield and number of lactations).

Of the 1,440 calves reared in the first study, only 55 reached their fourth lactation in the herd:

- 406 were removed between weaning and their first lactation (surplus to farm requirements or not in calf).
- 233 were removed after their first lactation.
- 392 were removed after their second lactation.
- 354 were removed after the third lactation.

A heavier weight at weaning translated to higher production (especially in lactation 1 and 2) and a longer life in the herd.

Weaning weight was more strongly associated with survival in the herd than birth weight. For example, calves with a weaning weight of 100kg were more than twice as likely to remain in the herd for three or more lactations than calves with a weaning weight of 50kg (40% compared with 17%).

Weaning weight and cumulative consumption at day 5 had a significant impact on total lifetime milk production.

The third – modelling – study investigated the effect of preweaning factors on removal from the herd, using a dataset from more than 14,000 animals from the same herd.

Birth weight, weaning weight and days in milk significantly influenced the likelihood of a cow being removed from the herd. There were three points in the lactation where cows were more likely to be removed from the herd: early lactation (transition period), around 128 days in milk (not in calf) and after 305 days (long lactation cows). Cows with a lighter weaning weight were more likely to be removed from the herd early.

On-farm implications

This study quantified strong and positive associations between the performance of female dairy calves at weaning and their subsequent performance as lactating animals.

The findings provide the basis to develop early alert systems for calves being reared with automatic calf feeders.

This work is an example of the huge opportunity to use passive data collection from modern technologies such as automated calf feeders to improve farm management.

Further research

Further research is currently being undertaken by masters student, Kimberly Church. This project is using automatic calf feeder data from multiple commercial dairy farms to investigate whether similar patterns occur across different rearing systems and management conditions.

The project aims to:

- Quantify differences in calf weaning weight across commercial dairy systems and identify the main factors influencing these.
- Investigate how early-life calf performance is linked to later productivity, fertility and longevity in the herd.
- Develop early-life risk indicators that may help predict poorer lifetime performance.
- Help identify lower-performing animals earlier to improve management and culling decisions.

This broader dataset may help identify practical early-life indicators that can be used to improve calf-rearing strategies, herd management and long-term productivity outcomes.

Holstein steers for dairy beef

There were two elements to this study:

- Feeding strategies
- Feedlot adjustment

The feeding strategies study tested whether an integrated dairy-beef management strategy developed in Spain could be adapted for rearing Holstein steers under Australian conditions, including systems for the ‘antimicrobial-free’ beef market.

DairyUP
Unlocking potential

Two lifetime feeding strategies were compared for 72 Holstein steers from 3–7 days of age through to slaughter at 452 days:

- A lower starch (38%) diet containing antimicrobials (monensin and flavophospholipol).
- A higher starch (47.5%) diet using yeast products instead of antimicrobials.

The steers were evaluated for rumen function, microbial adaptation, production and carcass characteristics.

The feedlot adaption study investigated the differences between high- and low-performing steers during the first three weeks after feedlot induction. Ninety-four Holstein, British and European breed steers were assessed for rumen fermentation, growth performance, carcass traits and indicators of acidosis risk.

Key findings

Feeding strategies: Both feeding systems successfully produced dairy-beef animals suitable for the Australian red meat supply chain.

Steers fed the lower starch antimicrobial-containing diet:

- Produced heavier carcasses.
- Had higher dressing percentage and greater fat cover.
- Showed greater rumen fermentation activity.
- Had a lower risk of subclinical ruminal acidosis late in the feeding period.

The higher starch antimicrobial-free system also successfully finished steers for beef production, although liver abnormalities were more common and carcass weights were lower.

Different feeding strategies resulted in different patterns of rumen microbial development over time, highlighting the long-term impact of early nutrition and feeding management on rumen function.

The feedlot adaptation study found:

- Steers with higher weight gain during feedlot induction achieved better growth rates and more desirable carcass traits at slaughter.
- Rumen fermentation profiles alone did not explain differences in performance.
- Overall rates of rumen lesions and other abnormalities were low under good management.

Collaborators/funders

The P2e project was a collaboration between SciBus, the University of Sydney and Charles Sturt University, Meat & Livestock Australia, Church and Dwight and participating dairy herds.

Read more

S.W.J. Legge, et al. (2024) Milk consumption and behaviour of calves in automated calf-feeders as early indicators of weaning liveweight, JDS Communications Volume 5, Issue 5, Pages 474-478

Golder HM, et al. (2025) Different lifetime dietary strategies affect carcass characteristics and rumen function in Holstein steers. *Animal Production Science* 65

H.M. Golder, et al. (2024) Shifts in rumen profiles of Holstein steers fed antimicrobial and starch diets. Journal of Dairy Science, Vol 107 (Suppl 1), pg 431 (abstract 2712)

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P2 final report

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