



Milking order affects yield in pasture-based dairy systems

Smart Feeding - Factsheet 1

Key points

Cows have a broadly consistent milking order within the herd each day.

This experiment showed that daily milk yield declines by over two litres per cow for each hour cows are away from the paddock during milking.

Daily pasture intake also declines as cows wait longer at the dairy to be milked. A large majority of available pasture (above 1,500kg DM/ha) is already eaten by the time the last cows milked arrive back to the paddock.

Estimated daily milk income over feed cost was nearly \$2.50/cow higher in the first group of cows milked compared to the cows milked last.

Introduction

On most Australian pasture-based dairy farms, cows graze pasture and are milked twice daily. Herd sizes have grown substantially over recent times and in many cases milking facilities have not kept pace with the rapid increase in cow numbers on farms. It is not uncommon for some cows to spend three or more hours at each milking event away from the paddock, either on the laneways, walking to and from the dairy or in the yards waiting to be milked. Some larger grazing herds have reported cows routinely spending over four hours at each milking (eight hours per day) away from pasture.

Extended periods of time away from the paddock during milking are undesirable as they are likely to have a negative impact on the cows' ability to consume sufficient nutrients from grazed pasture to maximise milk production.

A further factor that may affect the uniformity of feed and nutrient intake across the herd is whether the first cows that access a new break of pasture after milking (generally the first group of cows milked at each milking event) have access to superior quality pasture than cows in the last group milked.

Research from several parts of the world on pasture-based dairy systems, including research from Australia, has shown that the order and hierarchy of cows milked in grazing systems is quite consistent. The first and the last cows milked are generally the same, while some variation can appear in the order of milking for the cows in the middle of the herd.

Understanding detailed cow behaviour patterns – and reasons why milking order affects the total performance of the herd – may provide opportunities for farmers to address this issue and find ways to increase overall herd milk production from the same daily feed resource.

Establishing exactly how much milking order affects a typical herd

An experiment was set up at the Agriculture Victorian Smartfarm in Ellinbank, Victoria, as part of the Dairy Feedbase - Smart Feeding research program. This evaluated whether cows that are milked first in the herd (in the first or second rows milked in a typical herringbone dairy or in the first couple of rounds in a rotary dairy), have any difference in milk production compared to cows at the rear of the milking order. These are cows naturally spend a greater amount of time away from pasture at each milking event.

In this experiment, cows were collected from the paddock for morning and evening milking at the same time, divided into five groups at the dairy before being milked at approximately 45-min intervals, and subsequently returned to the same paddock after milking. All cows were given 6kg dry matter (DM) of concentrate per day.

Milk yield

Energy corrected milk (ECM)* yield per cow declined significantly as the time spent waiting at the dairy to be milked increased from 0-3 hours. For every hour that cows were away from the paddock there was a reduction in milk yield of 2.15 kg/cow per day. Milk fat concentration was not different at any time point, but milk protein concentration was higher in cows (3.24 per cent) that got back to the paddock first compared to the other groups of cows (2.99–3.08 per cent).

**Note: Energy corrected milk is milk yield corrected to a standard amount of fat and protein and is a more accurate way to compare milk yield across different treatment groups than using raw milk yield.*

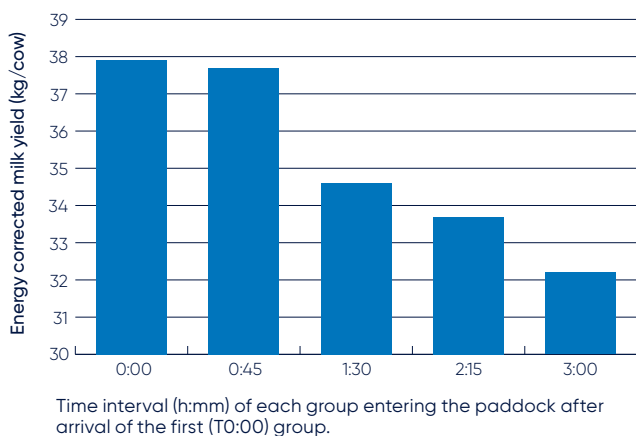


Figure 1 Average energy corrected milk yield of each group.

Pasture intake

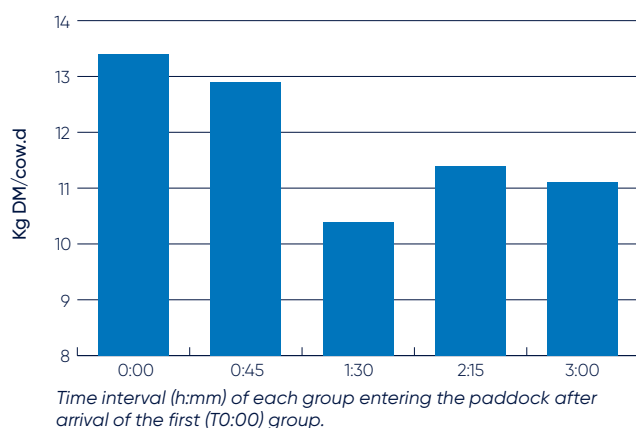


Figure 2 Average daily pasture intake of each group.

Pasture dry matter intake (DMI) declined as cows waited longer at the dairy for milking. It wasn't just the amount of pasture eaten that was lower; the pre-grazing pasture cover in the paddock when the first cows returned to the paddock was 2,820 kg DM/ha and this declined linearly by 330 kg DM/hr over the next three hours such that when cows in the last group entered the paddock after milking, three hours after the first, there was a pasture cover of just 1,860 kg DM/ha available.

Given that best practice grazing management principles recommend that cows should graze pastures to a post grazing residual cover of 1,500 kg DM/ha (approx. 4–5cm), this means that a large majority of the available pasture for grazing by the herd was already eaten by the time the last group cows arrived back at the paddock after milking.

Changes in nutritive characteristics of the pasture during a grazing session

A key point of interest was how the nutritive characteristics of the pasture changed during a grazing session. Analysis of the pasture from the morning grazing sessions showed the metabolisable energy (ME) of the pasture declined by 0.2 MJ/kg DM per hour after the first cows entered the paddock. This means that by the time the last group entered the paddock they were eating pasture that was 0.6 MJ/kg DM lower than the first group. So not only did they have less pasture available to consume, the ME concentration of that pasture was also lower.

It was the same for crude protein (CP) concentrations in the pasture; mean CP per cent declined by 0.87 per cent per hour. Fibre levels, meanwhile (measured as neutral detergent fibre; NDF) increased by 0.97 per cent per hour from the time the first group of cows entered the paddock.

This experiment has shown that pasture biomass, pasture nutritive characteristics, and milking order have a significant influence on milk yield and composition of the individual cow and across the milking herd.



Grazing behaviour

Another key question was whether the increased time away from pasture affected the amount of time spent eating pasture each day? Cows were fitted with RumiWatch® noseband sensors and pedometers to answer this. Data showed that the timing of arrival back to the paddock post milking had no impact on the total daily time spent eating. However, there was a change in the grazing behaviour of the cows, particularly when grazing and ruminating activities occurred during the day, but no difference in total eating time. From these results, it can be concluded that increased time away from pasture did not affect the cows eating time, as the cows that arrived back at the paddock last in this experiment still spent the same amount of time eating as the cows that had first access to the pasture. However, it did affect what pasture (mass and quality) was available for them to consume and total pasture intake.

Economic analysis

The DMI and milk production data for each group of cows at the five timepoints (45-minute intervals that cows were milked and returned to the paddock) was used to conduct an economic analysis using a five-year average milk price.

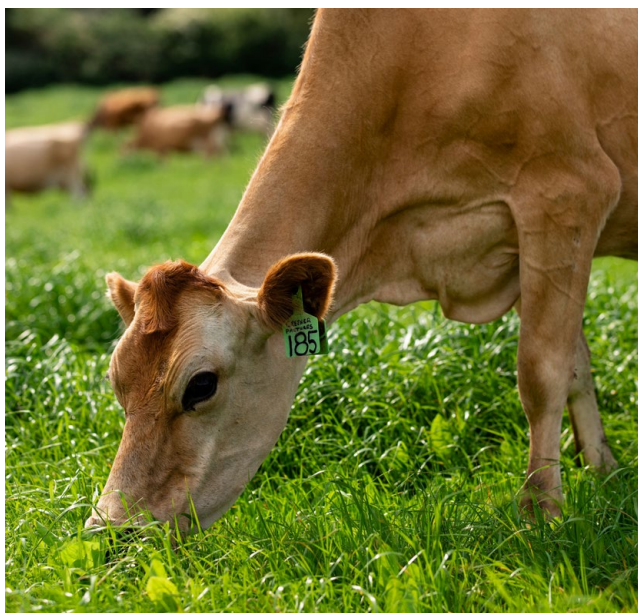
Table 1 Milk income minus total feed costs per cow.

	T 0:00	T 0:45	T 1:30	T 2:15	T 3:00
Milk income (\$/cow.d)	15.62	15.10	13.89	13.56	12.80
Supplementary feed costs (\$/cow.d)	1.97	1.98	1.97	1.98	1.98
Pasture feed costs (\$/cow.d)	2.01	1.94	1.56	1.71	1.67
Milk income less feed costs (\$/cow.d)	11.64	11.18	10.36	9.87	9.15

The analysis showed that the cows that returned to the paddock first had a net benefit per day of \$2.48 per cow more than cows that returned to the paddock last.

Validation of these results on a commercial farm

A commercial pasture-based farm in west Gippsland milking over 500 cows was used to validate these findings in a follow up study. A key difference to the Ellinbank experiment was that the cows on the commercial farm were in late lactation in the month of May, where the mean days in milk of the herd was approximately 220 days.



The data from this commercial herd was divided into four groups (quartiles) based on their milking order and time entering the paddock post-milking. Preliminary analysis showed that a daily difference of over 3 L/cow of milk was observed between the first group and the last group milked within the herd. It took approximately two hours to milk the cows on the commercial farm which differed from the three-hour difference in the Ellinbank experiment. Analysis of available pasture on the commercial farm showed that two hours after milking, just 33 per cent of the pasture that was available at the beginning of milking was still available at the end of the second hour. These results align with those from the controlled experiment and indicate the size of the challenge for farmers to manage their available feed resources in such a way that all cows are provided with an equal opportunity to access high quality feed at grazing.

Summary and implications for farmers

The experiment showed that there is a substantial difference in milk yield between cows milked first and last on pasture-based farms. Economic analysis showed that this is worth \$2.48 per cow per day for early lactation cows.

Some possible mitigation strategies are outlined in subsequent factsheets in this series to address this issue. These strategies are based on further experiments undertaken at the Ellinbank SmartFarm as part of the Smart Feeding program. While this challenge is more likely to affect larger herds, the outcomes equally apply to smaller farms where the time spent away from pasture at milking is comparable to large farms. If cows are spending more than two hours at the dairy during milking, then these results are relevant regardless of herd size.

Disclaimer

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