Does reserving fresh pasture for cows milked later impact herd level milk production?

Smart Feeding - Factsheet 2

Key points

Reserving fresh pasture for cows milked later in the milking order did not result in greater milk solids production at an overall herd level, compared to control cows where no fresh pasture was reserved.

In early lactation cows, reserving fresh pasture resulted in an improved feed conversion efficiency (FCE) compared to control cows.

Pasture nutritive characteristics remained consistent across all timepoints when fresh pasture was reserved.

Reserving fresh pasture provided a more uniform supply of nutrients to all cows across the herd resulting in less variation in milk production and pasture intake.

Introduction

Consistently offering a nutritionally optimal diet to grazing dairy cows in pasture-based dairy farm systems in Australia can be challenging for farmers. Several variables combine to influence the provision of a grazed pasture diet that maximises individual cow dry matter intake (DMI) and milk production. These can include variation in pasture nutritive characteristics, pasture biomass and daily pasture allocation to the herd. In addition, there are cow and farm infrastructure level factors to consider, including the stage of lactation and the amount of time spent away from pasture during milking.

As outlined in Factsheet 1 of this series, research at the Agriculture Victoria Ellinbank SmartFarm, in West Gippsland, Victoria, showed that the order in which cows are milked within a herd is very consistent from day to day - with the first group of cows milked generally always first every day, and the last group of cows generally always last milked each day. The research also showed that for the first three hours away from paddock during a milking event, there is a decline of over 2 litres per hour in milk production per cow.

This consistent difference between the first and last cows milked in a pasture-based herd offers an opportunity to develop management strategies to even out the supply of nutrients and subsequent milk production across the herd, thus increasing overall average herd milk yield without extra feed resources being used.

Reserving fresh pasture experiments

The results described in Factsheet 1 of this series raised the question – what mitigation strategies could be implemented to counteract the reduced milk yield in cows milked towards the end of the milking order, that might also result in a positive overall impact on herd milk production? As part of the Dairy Feedbase - Smart Feeding research program, two experiments using early lactation and late lactation cows respectively, investigated the impact of reserving an allocation of fresh pasture for cows that returned to the paddock later, on overall feed nutrient supply, dry matter intake (DMI) and milk yield.

Design of experiments

In the late lactation experiment a control treatment was implemented where one third of the cows in the herd entered the same paddock at three different timepoints across a three-hour period following milking (Figure 1). This control treatment reflected what would be considered normal farm practice on a typical Australian pasture-based dairy farm – where the first cows had access to the entire allocation of pasture for the total herd (from T0:00), with cows returning an hour and a half later (T1:30) and three hours later (T3:00) joining those cows in the same area.

For the reserving fresh pasture treatment (referred to as the "grazing treatment"), one third of the total cows in this treatment also entered their paddock at the same three timepoints with the following differences to the control group:

- at each time point a "mini-paddock" of pasture was made available to the herd, i.e. at T0:00 one third of the total area for the grazing treatment was provided, then at T1:30 another third of the herd was put into the second "mini-paddock", and finally at T3:00 the remaining third of cows were put into the final "mini-paddock". These three groups were kept separate at all times while grazing, i.e. fences dividing each mini-paddock were not removed.

This approach (Figure 1) enabled a more even supply of nutrients from pasture for each group within the grazing treatment.

Pasture allocation was approx. 25 kg DM/cow/day (measured to ground level) for both treatments.

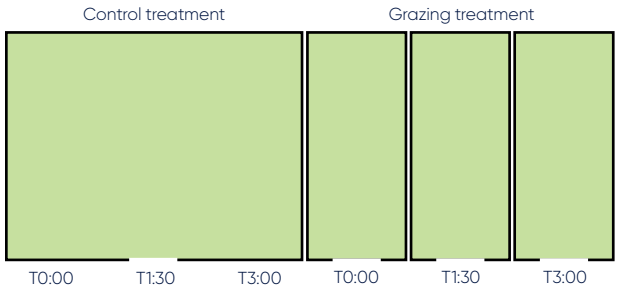

Figure 1 Outline of treatments in late lactation reserving fresh pasture experiment

In the early lactation experiment, an identical design as shown in Figure 1 was implemented but with one exception - there was just two time-intervals instead of three - immediately post milking (T0:00) and three hours later (T3:00).

Figure 2 Aerial photo of the experiment being conducted

Results

Milk yield in the early lactation experiment (averaged over a six-day period) for the cows that entered the paddock immediately post milking (T0:00) and three hours later (T3:00) is shown in Figure 3. Milk fat yield (Figure 4a) and milk protein yield per cow (Figure 4b) are also presented.

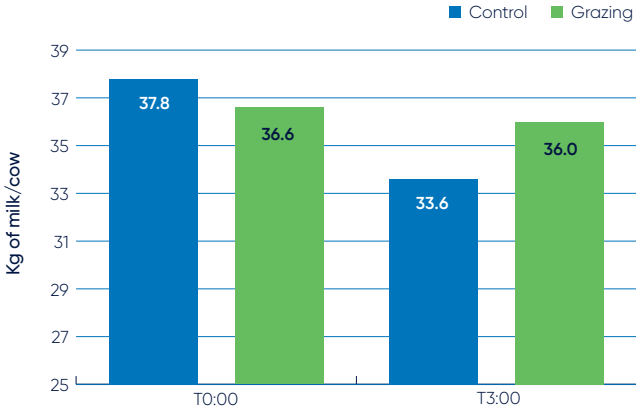

Figure 3 Average daily milk yield at each timepoint in the early lactation experiment

The overall average daily milk yield (both timepoints combined) for the control group in the early lactation experiment was 35.7 kg/cow, vs 36.3kg/cow in the reserving fresh pasture (grazing) treatment, a difference of 0.6 kg/cow.

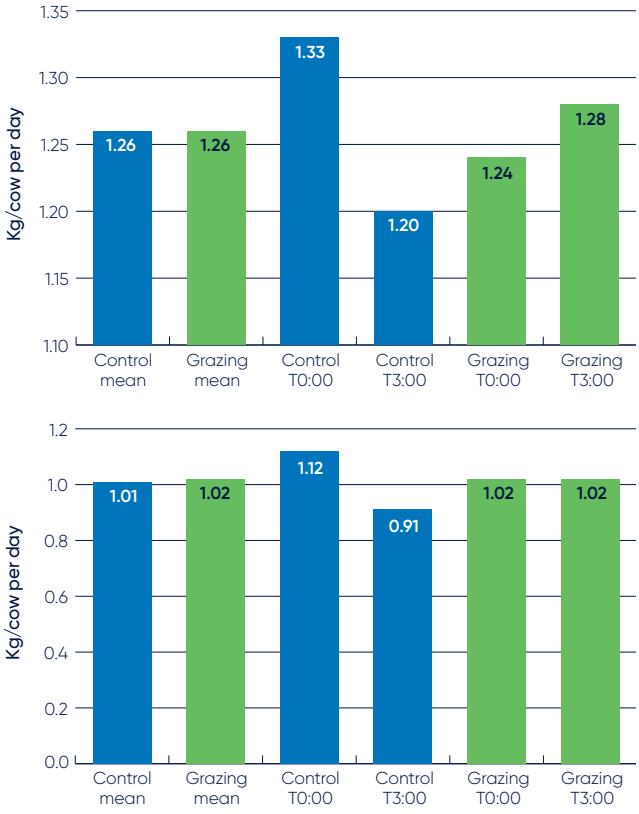

Figure 4a (milk fat yield) and **4b** (milk protein yield) per cow per day in the early lactation experiment

Total daily kilograms of fat and protein (milk solids)/cow did not differ overall between treatments, with control cows averaging **2.27 kg** of milk solids/cow and reserving fresh pasture cows averaging **2.28 kg** of milk solids/cow.

Dry matter intake and feed conversion efficiency (FCE) in early lactation cows

Daily concentrate DMI for all cows was 7 kg DM/cow and was the same for all cows throughout the early lactation experiment. Daily grazed pasture DMI (estimated using the *n*-alkane technique) is shown in Figure 5 and like the milk solids production, the DMI of pasture was more uniform across both timepoints for cows in the reserving fresh pasture (grazing) treatment, compared with cows in the control treatment.

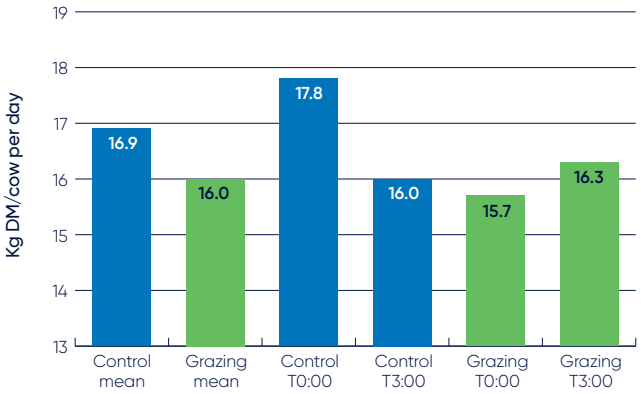

Figure 5 Dry matter intake of grazed pasture in early lactation cows

Feed conversion efficiency for each group in the early lactation experiment was calculated as kilograms of energy corrected (ECM) milk per kilogram of DMI and is shown in Figure 6. The marginally higher FCE in the reserving fresh pasture cows was driven by a slightly lower pasture intake than control cows, but they produced the same amount of energy corrected milk. This could lead to a slighly higher stocking rate if the reserving fresh pasture strategy was implemented, potentially increasing overall yield of milk solids on a per hectare basis.

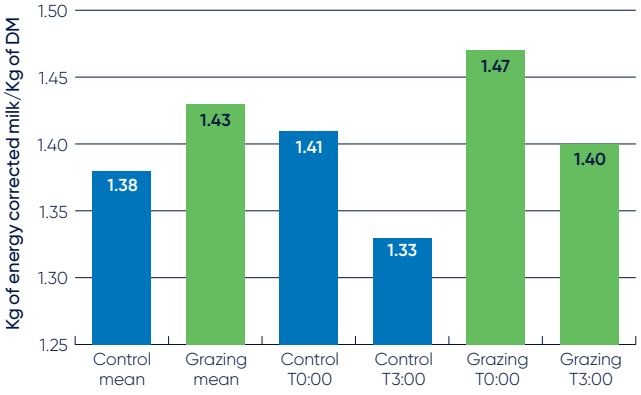

Figure 6 Feed conversion efficiency of cows at each time point in the early lactation experiment

Late lactation experiment

In this experiment the control group cows produced on average 21.2 kg of milk per cow, comprising 0.87 kg of milk fat and 0.75 kg of milk protein for a daily total of **1.62 kg** milk solids/cow. Meanwhile the reserving fresh pasture cows produced 20.2 kg of milk per cow, comprising 0.86 kg of milk fat and 0.70 kg of milk protein for a daily total of **1.56 kg** of milk solids/cow.

Changes in pasture nutritive characteristics

In both experiments, a significant finding was the difference in pasture nutritive characteristics across the varying timepoints. As shown in Figure 7, pasture metabolisable energy (ME) and crude protein (CP) concentration in the control cow paddock declined significantly at each time point in the late lactation experiment while it remained consistent in the reserving fresh pasture treatments. In the grazing (reserving fresh pasture) treatment, cows were accessing pasture of the same or similar ME and CP concentration because they were provided with a fresh strip of pasture that had not been grazed. Since pasture DMI in the control herd at each time point was already significantly lower in the later timepoints, this data reinforces that there were large differences in total nutrient intake from pasture between the first and last cows entering the paddock for the control treatment.

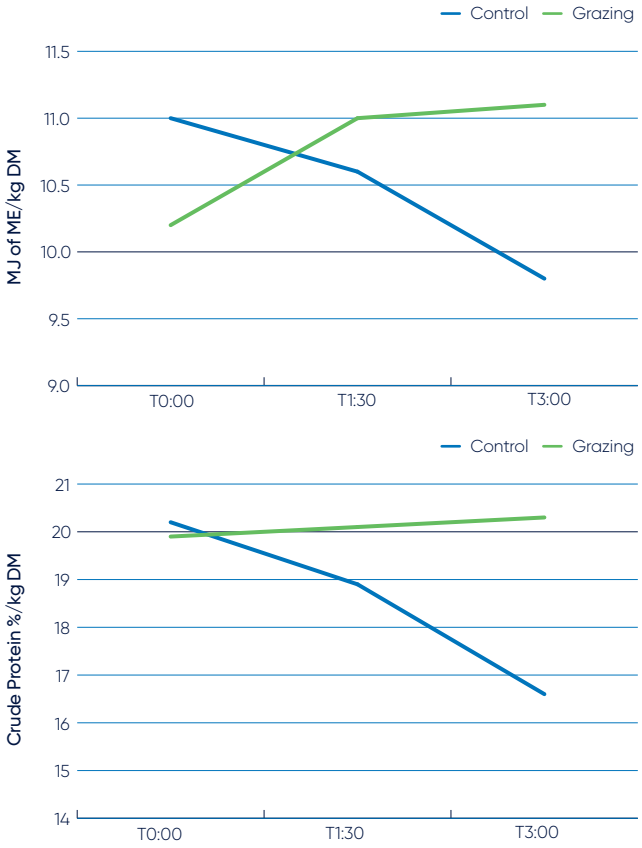

Figure 7 Changes in pre-grazing pasture metabolisable energy (top) and crude protein concentration (bottom) at each timepoint in the late lactation experiment

In the early lactation experiment, the trend was very similar, with pasture ME content and CP concentration in the control group declining from T0:00 to T:3:00 while remaining similar at each timepoint in the grazing (reserving fresh pasture) treatment.

Pasture disappearance rates in control herds

In the control treatment in the early lactation experiment, the first half of the overall control herd (T0:00 cows) had eaten 56 per cent of the total available pasture in the three hours before the other half of the herd (T3:00 cows) arrived back to the paddock. For the late lactation experiment there was three timepoints in the control treatment. The first third of the herd (T0:00 cows) had eaten 39 per cent of the total available pasture when the middle group (T1:30 cows) joined them in the paddock; and 59 per cent of the total available pasture had been eaten by the time the remainder of the herd (T3:00) arrived back to the paddock. This likely affected milk production compared to the reserving fresh pasture treatments because by contrast to the control groups that entered the paddock at later timepoints, a fresh strip of pasture was available at every timepoint in the reserving fresh pasture treatments upon entry to the paddock.

Economic analysis

Feed intake and milk yield data from each treatment in the early lactation experiment was used to conduct an economic analysis analysis (Figure 8), based on a 6-year average milk price of $4.13/kg of fat and $9.09/kg of protein.

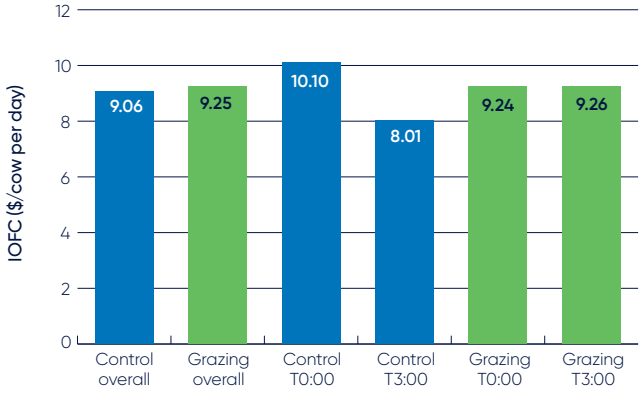

Figure 8 Income over feed cost analysis for the early lactation experiment

Notably, there was a large difference in the estimated daily profit per cow in the control herd at T0:00 compared to T3:00. The reserving fresh pasture treatment made the contribution of each timepoint group to herd level profit more uniform. Taken in isolation, the difference of 19 c/cow per day between both treatments is minor (for a 500 cow herd this would equate to $95 per day) and is mainly driven by reduced feed costs in the reserving fresh pasture treatment, and not by greater milk income in these cows. In addition, the extra labour that it would take to implement a strategy of reserving fresh pasture, which requires more break fences and cow movement etc, was not accounted for in this analysis. However, the cows in the reserving fresh pasture treatment ate less pasture and had better mean FCE and so the opportunity to marginally increase stocking rate and milk solids per hectare is one possible benefit that maybe of interest to some farmers. When this, along with other potential benefits to individual cows of the more balanced nutrient supply are factored in, some farmers may wish to consider this option.

Summary of implications for farmers

The experiments show that under "normal" conditions in a typical pasture based dairy herd, there is an uneven supply of feed nutrients provided across the milking herd. This resulted in the cows in the control treatment that reached the paddock first eating more pasture, with a higher ME and CP concentration, and producing more milk, than cows that reached the paddock later.

In both experiments the lowest producing cows were the last cows to reach the paddock in the control group.

The research team was able to stabilise the supply of nutrients to the cows by implementing the reserving fresh pasture strategy, but overall, this didn't result in more milk solids being produced. There was a slight advantage in raw milk yield in the early lactation experiment where fresh pasture was reserved but when converted to milk solids this advantage did not persist.

On a longer-term basis, the restricted energy intake and milk yield in the last cows to arrive in the paddock, as well as the lower pasture nutrient density available to these animals, could potentially result in a deeper negative energy balance in early lactation animals at farm level compared to their herd mates that arrived at the paddock earlier. This could result in additional costs for in these animals due to increased health issues and poorer fertility rates. Importantly there is no clear evidence to indicate if this was the case because these experiments were not run for a sufficient timeframe to answer this question, but over a longer period of time a DMI difference of 2 kg/day, compounded by a lower nutrient density in pasture for the animals that are eating less, could reasonably be expected to have significant impacts on body condition and reproductive performance in these animals.

Cows that reached the paddock first in the control treatment had access to pasture with higher concentrations of ME and crude protein and lower fibre (NDF) concentration - this is likely the main reason why these cows produced more milk than control cows that arrived later to the paddock. While not tested in this experiment, excessive crude protein intake in these cows from selectively grazing the leafy upper portion of the sward could lead to nitrogen imbalances in the rumen and poor nitrogen use efficiency at the individual cow level.

In summary, reserving fresh pasture did not result in increasing the overall yield of milk solids at a herd level compared to control cows but it did result in a more even and optimised supply of nutrients to all cows within the herd.

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