

# Effect of milking permission and concentrate supplementation in an automatic milking system on milk yield per cow

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## Summary

- Free milking permission (MP; permission to milk after 6-8 h of previous milking) and high concentrate supplementation (CS; 3.5 kg/cow per day) increased the number of milkings/cow per day and the milk yield/cow per day.
- Milk yield/cow per day over the experimental period was similar for the cow groups on restricted MP (permission to milk after 12-14 h of previous milking) and high CS compared with free MP and low CS (0.5 kg/cow per day).

## Introduction

A significant issue for the future sustainability of the family dairy farm is over-demand on the farm family's time and flexibility leading to a perceived less than satisfactory quality of life. Currently, the conventional milking process is considered a causative factor, accounting for more than 30% of the demand for labour on Irish dairy farms. Automatic milking (AM) is a technology with the potential to address these issues. The system works with cows voluntarily presenting themselves to be milked and the AM robot deciding and performing the task. However, some challenges of the AM system operating in a grass-based system include achieving a high number of milkings/robot per day, establishing the optimum herd size for the robot, achieving high grass intake, thus maximizing the grass proportion of the cow diet. The objective of this study was to examine the effects of milking permission (MP) and concentrate supplementation (CS), individually and their interaction, in order to optimize the operation of an AM system within a grass-based scenario.

## Materials and methods

We conducted an experiment at the Dairygold Research Farm (Fermoy, Co. Cork, Ireland) between May 1<sup>st</sup> and September 17<sup>th</sup> 2022. Sixty-eight spring-calving dairy cows were selected. Cows were milked using one Lely AM robot. Cows were blocked on parity ( $2.9 \pm 0.1$ ), days in milk ( $47.2 \pm 3.5$ ) and milk yield ( $24.2 \pm 0.5$ ). Cows were randomly assigned to one of four groups. The treatments consisted of two levels of MP and two levels of CS. Free and restricted MP represented permission to milk after 6-8 h and 12-14 h of the previous milking, respectively. This was achieved by changing the settings of the robot to decide if a cow was due for milking or not. Low and high CS levels were 0.5 kg and 3.5 kg of concentrate/cow per day, respectively. Cows grazed on an ABC grazing system appropriate to AM; post-grazing height averaged 4.1 cm.

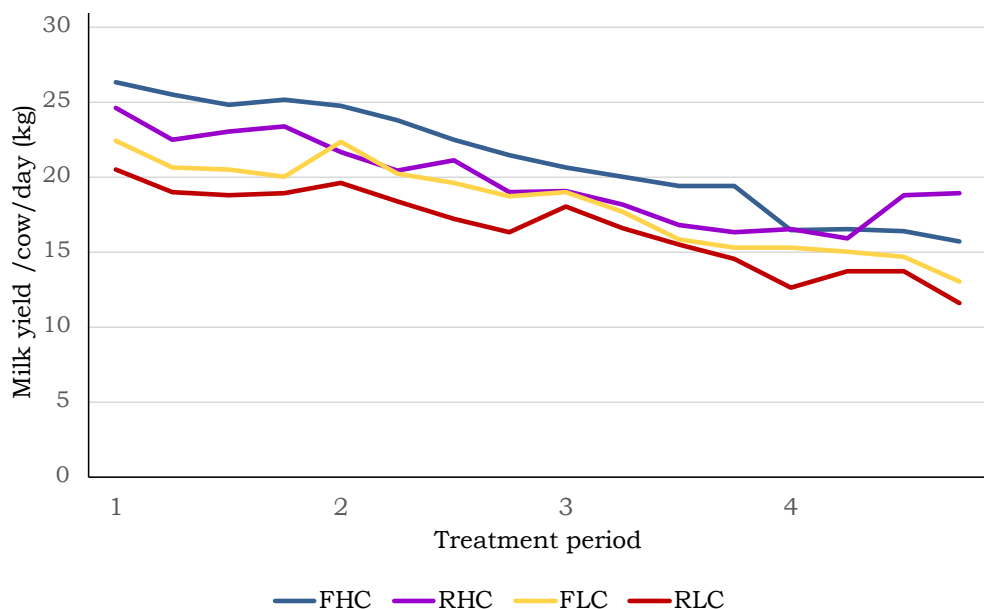
## Results

The impact of MP and CS on milkings/cow per day and milk yield/cow per day are shown in Table 1 and Figure 1. Both variables were affected by MP and by CS level. Cows with a free MP and high CS had a higher number of milkings/cow per day and milk yield/cow per day. Milking duration/milking and average milk flowrate/milking were higher in cows with a restricted MP. The milk yield/cow per day over the experimental period was similar for the cow groups on the restricted MP/high concentrate treatment and those on the free MP/low concentrate treatment. The cow groups on the free MP/high concentrate and restricted MP/low concentrate treatments had the highest and lowest milk yields, respectively.

**Table 1.** Main effects of milking permission<sup>1</sup> (free and restricted) and concentrate<sup>2</sup> level (low and high) on cow and milking parameters

	Milking permission <sup>1</sup>		Concentrate level <sup>2</sup>	
	Free	Restricted	High	Low
Milkings per cow/day, n	2.1	1.4	1.9	1.6
Milk yield per cow/day, kg	19.2	17.6	19.9	16.9
Milking time/milking, min	4.8	6.1	5.42	5.45
Average milk flowrate/ milking, l/min	2.43	2.55	2.51	2.47

<sup>1</sup>Milking permission: free and restricted MP represented permission to milk after 6-8 h and 12-14 h of the previous milking, respectively; <sup>2</sup>Concentrate supplementation level: low and high concentrate supplementation level represented 0.5 kg and 3.5 kg of concentrate/cow per day, respectively.



**Figure 1.** Milk yield per cow/day (kg) across the different trial periods (P1= 9 May to 5 June 2022, P2= 13 June to 10 July 2022, P3= 18 July to 14 August, P 4= 22 August to 19 September 2022) for each treatment group (FHC= free milking permission, high concentrate; FLC= free milking permission, low concentrate; RHC= restricted milking permission, high concentrate; RLC= restricted milking permission, low concentrate)

## Conclusions

Free MP and high CS each, individually increased milk yield/cow per day. When the treatments were combined, the milk yield/cow per day over the experimental period was similar for the cow groups on the restricted MP/high concentrate treatment and those on the free MP/low concentrate treatment. The cow groups on the free MP/high concentrate and restricted MP/low concentrate treatments had the highest and lowest milk yields, respectively. As concentrate costs can be reduced with the free MP/low concentrate treatment, this is likely to be a more economical option than having additional cows to fill the extra available time on the robot with restricted permission.