Better grazing opportunities with a mobile milking robot

Haan M.H.A. de, Philipsen A.P., Van den Pol-van Dasselaar A., Holshof G., Lenssinck F.A.J. and Koning C.J.A.M. de
Wageningen UR Livestock Research, P.O. Box 65, 8200 AB Lelystad, the Netherlands
Corresponding author: michel.dehaan@wur.nl

Abstract

Although grazing of dairy cows is very common in the Netherlands, the number of grazing cows is decreasing. Mobile milking robots might support grazing, in particular in situations of large herds, in remote grassland areas and in extensive natural grasslands. In the Netherlands, a stand-alone mobile milking robot has been developed using caterpillar tracks. Every day, this milking robot moves to a new part of the pasture and every two days concentrates, fuel, water and milk are separately transported from and to the mobile milking robot. The system was tested in the 2008 grazing season using a herd of 35 dairy cows. During the 2009 grazing season the project was scaled up to a herd of 60 cows on an area of 20 ha peat soil. In 2009 a strip grazing system with controlled as well as free cow traffic was used in order to increase the visit and milking frequency. The mobile milking robot was capable of managing a 60-cow herd grazing 24 hours while producing a rolling milk average of 7500 kg cow^{-1} yr^{-1}. The challenge is to improve the milk yield per cow and year by increasing the milking frequency.

Key words: grazing, grazing system, mobile milking robot, automatic milking

Introduction

Although grazing of dairy cows is very common in the Netherlands and the north-western part of Europe, the number of grazing cows is decreasing. This development is unfavourable concerning farm economics and societal preferences (Van den Pol-van Dasselaar *et al.*, 2008). Grazing is the most cost-effective option to feed dairy cows and also animal health and animal welfare seem to profit from grazing. Furthermore, society appreciates a landscape with grazing cattle. A mobile milking robot might be an opportunity to support grazing, in particular in situations of large herds, remote grassland areas and extensive natural grasslands. Therefore a stand-alone mobile milking robot was developed in the Netherlands. Since it was unknown whether a mobile milking robot would function technically well in grazing conditions, the first goal was to explore the technical results of the milking procedure in the field. The next goal was to develop a suitable farming system, managing more than 60 cows yielding about 8000 kg cow^{-1} yr^{-1} of milk.

Materials and methods

The developed mobile milking robot is based on three components, namely a track-wheeled carrier vehicle, a container storing the equipment needed for robotic milking, and a DeLaval VMS robot. The system is completely self-propelled and more mobile than other systems (Oudshoorn, 2008). The only inputs needed are diesel for driving and generating electricity, fresh water for rinsing the robot, and concentrates for feeding the animals. The caterpillar tracks were chosen to achieve low pressure on soil. Every day, the milking robot moves to a new part of the pasture and every two days the concentrates, fuel, water and milk are separately transported from and to the mobile milking robot. This is done using a trailer with different storage facilities, which was specially developed for the project that started on the experimental farm 'Zegveld' on peat soil in 2008. During that grazing season 35 dairy cows, remaining day and night in the field, were milked by the system. A continuous grazing system

was implemented. All cows stayed in the same, large paddock for 6 weeks. During the 2009 grazing season the project was scaled up to a herd of 60 dairy cows on an area of 20 ha. In 2009, a strip grazing system was used combined with controlled cow traffic. The cows could only enter a strip of fresh grass by passing the mobile milking robot. After a period of 10 hours, when all cows passed the robot, the fence was removed and cows could then visit the milking robot voluntarily. From September 2009 on, strip grazing was combined with free cow traffic, which means unlimited mobility for the cows. During the grazing period no additional roughage was supplied. In 2008 the project aimed to test the technical performance as well as monitor the continuous grazing system on a large surface. In 2009 the method of plan-do-check-act cycle was used. The project started with a strip grazing system and, if needed, the grazing system was adjusted every three weeks.

Results and discussion

In 2008 the mobile milking robot proved to function technically very well. Within 5 minutes the complete system could be moved to a new grazing strip. Only a few failures occurred during the testing period. The number and size of technical failures were the same as for an indoor milking robot. However, the milk yield per cow and day was lower than in the winter period, when cows were kept inside.

Table 1 shows that the average milk yield in the winter period 2008-2009 was 3.6 kg d^{-1} higher than in the 2008 grazing period. Also, the milking frequency that is generally considered a main influencing factor for milk yield was lower in the grazing period than in the winter period. In 2008, walking distances to the mobile milking robot were relatively long (up to 400 metres) due to the implemented continuous grazing system using a large surface of land. This caused a decline in the milking frequency (van Houwelingen *et al.*, 2009). To increase the milking frequency strip grazing was introduced in May 2009 aiming at short walking distances and higher milk yields per cow and day compared with 2008. The maximum walking distance of the dairy cows to the mobile milking robot was 75 metres. The data presented in Table 1 indicate a higher milk yield and a higher milking frequency in the 2009 grazing period than in 2008. The grazing period with controlled cow traffic from June to August 2009 still showed lower milk yields than produced in the winter period. One of the reasons for this might have been the lower milking frequency cow^{-1} compared to the winter period.

Figure 1 shows the milking activity of the dairy cows for the indoor period and the grazing period in 2009. Cows seemed to be less active during the night on pastures than indoors. The next stage in this project will be to motivate cows to visit the mobile milking robot during the night by, for example, offering fresh grass in the night and only allow access to a new pasture when the cow has been milked. Free cow traffic combined with strip grazing might also be a solution. Table 1 shows that free cow traffic in September and October 2009 resulted in a high milking frequency; milk yield however was still 3.8 kg d^{-1} lower than in the indoor situation. The increased milking frequency was probably caused by the poor grass quality in September and the cows' eagerness for concentrates that were offered in the milking robot. On the other hand, the herd got more and more used to day and night grazing and to the mobile milking robot in 2008 and 2009 which might have increased the voluntary visitation frequency permanently. The challenge in this project is to improve the milk yield, probably by increasing the milking frequency.

Table 1. Milking frequency, milk yield and number of cows for different periods and different systems

Grazing/feeding system	Period	Number of cows	Milk yield (kg cow^{-1} d^{-1})	Milking frequency (milkings cow^{-1} d^{-1})
Continuous grazing, free cow traffic	June 2008 – Sept 2008	35	18.5	1.9
Winter period, indoor feeding, no grazing	Jan 2009 – May 2009	59	22.1	2.4
Strip grazing, controlled cow traffic	June 2009 – Aug 2009	61	19.3	2.1
Strip grazing, free cow traffic	Sept 2009 – Oct 2009	50	17.3	2.4

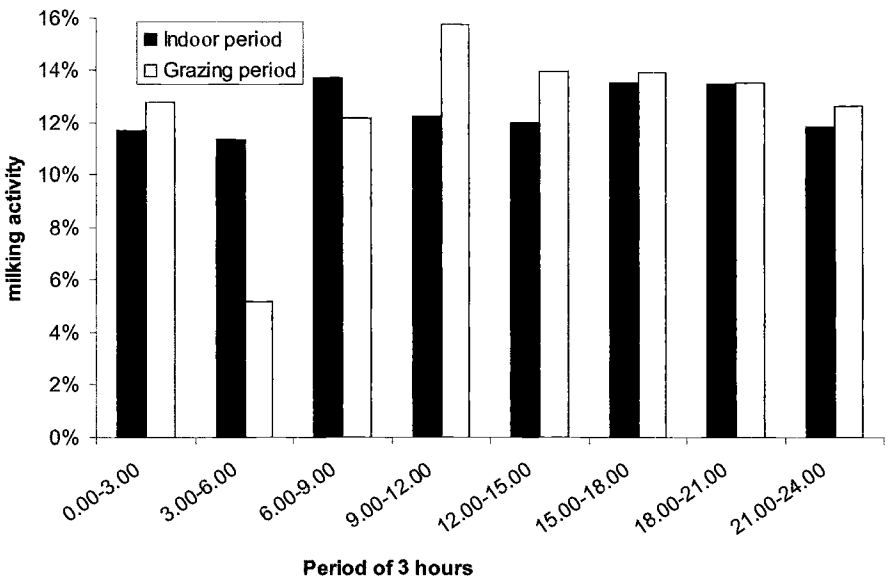

Figure 1. Milking activity of dairy cows during different periods of the day (% of day total, day total =100) for the indoor period and the grazing period of 2009.

Conclusions

The mobile milking robot is capable of combining a herd of 60 dairy cows and a 24 hours grazing system without any additional roughage, producing a rolling average of 7500 kg cow^{-1} yr^{-1} milk with the option of up to 8000 kg cow^{-1} yr^{-1}. Long walking distances to the milking robot cause low milking frequencies and therefore low milk yields. Offering fresh grass when passing the milking robot motivates cows to visit the system. However, there is still a challenge in improving the milk yield by increasing milking frequency. Therefore, free cow traffic and steered strip grazing need to be explored further in spring and summer.

References

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