Usage of milk revenue per minute of boxtime to assess cows selection and farm profitability in automatic milking systems

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Abstract.*The number of farms implementing robotic milking systems, usually referred as automatic milking systems (AMS), is increasing rapidly. AMS efficiency is a priority to achieve high milk production and higher incomes from dairy herds. Recent studies suggested that milkability (i.e., amount of milk produced per total time spent in the AMS [kg milk/ minute of boxtime]) could be used for as a criteria for genetic evaluations. Therefore, an indicator of milkability was developed, which combines economical and efficiency aspects: Milk revenue per minute of boxtime (MRBT, Can$/minute). The MRBT can be used to help producer daily decisions in retaining or not a cow in their herds, and improve AMS efficiency and herd profitability. The aim of this study was to assess the feasibility of using the MRBT indicator to give producers a management decision tool on the selection of lactating cows. Data was extracted from the software of 12 herds equipped with Lely AMS. Data included daily milk production, milk components (i.e. fat, protein and lactose percentages) and milk production per minute of boxtime of each cow for a period of 24-h. As the data was only available for a 24-h period, a second data extraction was done at different dates for three of the herds to validate the MRBT across time. The use of the MRBT as a tool to select individual cows was tested looking at variation between cows and herds. The overall average of MRBT was $1.23 ± 0.32/minute, and it ranged across herds between $1.15 ± 0.36 to $1.48 ± 0.29. However, variations within herds were larger ($ 0.35 to 2.58/min).The economic impact of using MRBT for taking decisions in retaining or not cows in*

the herd was assessed by replacing 10% of the less performing cows with the average performance of each herd. On average, this resulted in an increase in milk revenue of $124.91/day, which sums up to $45,593/year. Results showed variations between herds going from $64.30 to $213.57/day. These observations suggest that cow selection in real time with the MRBT indicator is possible and can improve herd profitability.

Keywords. *Automatic milking systems, milk price, boxtime, profitability*

Introduction

Robotic milking systems, usually referred as automatic milking systems (AMS), are increasingly adopted in dairy farms. This system has the advantage of generating plenty of individual cow data that can be used for precision dairy monitoring. However, the implementation of AMS is a big investment and is important to monitor its efficiency to maximize herd profit. Increasing milk production (Salfer et al., 2017) and optimizing occupation rate per robot (André et al., 2010) are two strategies to increase AMS efficiency. Furthermore, milk production per cow has been associated with higher income over feed cost (Rodenburg, 2017), which improves herd profitability.

Milkability, which is defined as milk yield per total time spent in the AMS (kg milk/ minute of boxtime), is associated with the capacity of the AMS and can be used as an indicator of efficiency (Carlström et al., 2014). It has also been sugested to be used as a trait for genetic selection (Carlström et al., 2014). As occupation time is a constraint in AMS, the most efficient cow will be the one that gives most milk per minute that it occupies the AMS (Løvendahl et al., 2014). Considering the importance of enhancing herd profitability, an indicator of milkability that combines economical and efficiency was developed: milk revenue per minute of boxtime (MRBT, Can$/minute). MRBT can be used by producers to select cows that should stay or not in the herd and improve AMS efficiency, and therefore, herd profitability. In the future, it could also be used for genetic selection. The aim of this study was to assess the feasibility of using the MRBT indicator as a management decision tool to retain or not the lactating cows in the herd.

Material and Methods

Data was extracted from the management software of 12 herds equipped with Lely AMS, and was exported into Microsoft Excel®. Data included daily milk production, milk components (i.e. fat, protein and lactose percentages), and milk production per minute of boxtime of each cow for a period of 24-h. As the data was only available for a 24-h period, a second data extraction was done at different dates for three of the herds to evaluate the stability of the MRBT over time. Milk price was calculated as a rolling average from august 2016 to august 2017 for each farm according to its milk composition. Feeding costs were taken from the profitability report of Valacta. Only cows with more than 10 days in milk were included in the analysis (n = 1620 cows).

Results and Discussion

Results showed that the MRBT varied among and within herds. The overall average of MRBT was $1.23 ± 0.32/minute, and it ranged across herds from $1.15 ± 0.36 to $1.48 ± 0.29. However, variations within herds were larger ($ 0.35 to 2.58 /min). Such a variation was expected since production and behavior is specific to each cow (Heringstad et Bugten, 2014; Byskov et al., 2015). This variation also suggests that the selection of cows with this indicator is feasible. Preliminary analyses showed that if a cow had a low MRBT, it would remain low over time.

An analysis was made to take into account individual cow factors such as stage of lactation (DIM) and number of lactations (parity). All the cows included in the study were used to evaluate the stability of the MRBT indicator across the lactation (number and stage). As it is shown in Figure 1, the MRBT indicator was steady throughout the whole lactation, which suggests that it can be used at any stage of lactation and the results are going to be consistent. However, when making decisions to retain or not cows in the herd based on MRBT, it must be taken into consideration that cows in their first lactation during their early stage lactation are going to have a lower MRBT (Figure 1). A study reported that factors as parity and DIM could affect milkability (Heringstad et Bugten 2014), which is in line with the results obtained here.

The economic impact was assessed by replacing 10% of the less performing cows with the average performance of each herd. On average, this resulted in an increase in milk revenue of $124.91/day, which sums up to $45,593 per year. Results showed variations between herds going from $64.30 to $213.57 /day.

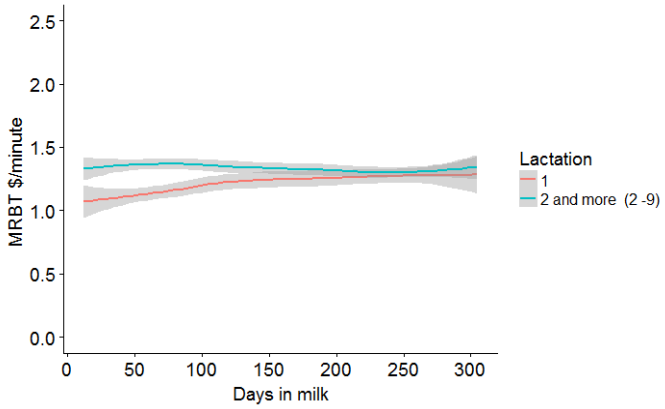

Fig 1. Relationship between days in milk and milk revenue per minute of boxtime (MRBT)

Conclusions

Results suggest that individual cow data from AMS can be used in precision dairy monitoring to select cows in real time using the MRBT indicator and improve farm profitability. It will be important, when making cow selection using MRBT, to take into account the stage and number of lactation of each cow. Further research will be conducted to validate the stability of the MRBT indicator over a longer period of time to evaluate the usability of the indicator in relation to improving herd longevity and profitability.

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