

Precision Livestock Farming '13

Edited by D. Berckmans
and J. Vandermeulen

Papers presented at the 6th European Conference on Precision Livestock Farming

Leuven, Belgium
10-12 September '13

Combining automatic milking and precision grazing on dairy farm systems

B. O'Brien and J. Upton

Livestock Systems Research Dept., Animal & Grassland Research & Innovation Centre, Teagasc, Moorepark, Fermoy, Co. Cork, Ireland

Bernadette.obrien@teagasc.ie

Abstract

Dairy farming in Europe has adopted automatic milking (AM) at an accelerating rate for reasons such as improvement in lifestyle, reducing physical work, difficulty in attracting skilled labour and increased profitability based on higher milk production and lower labour costs. However, while indoor feeding systems have been well adapted to AM, cow grazing systems have not. Thus, if AM is to become a realistic alternative to conventional manual milking in grass based milk production systems, such as in Ireland, the practical challenges of integrating AM and grazing must be researched. It must be scientifically proven if AM technology is compatible with grazing for successful adoption. That is the aim of the current study. This issue is crucially important as AM could represent an important advancement in precision dairy farming in such countries. AM has the potential to improve automatic data collection, providing herd managers with data that will enable them to make effective management decisions, and through the use automation to reduce manual tasks on farms, allowing farmers to shift their focus from operational tasks to management and strategic tasks that are economically beneficial.

Keywords: automatic milking, cow grazing, precision management

Introduction

During the last several decades, new milking management systems have been introduced, of which development of AM systems is a significant step forward. AM has become an established management system, considered as an alternative to conventional manual milking methods, particularly in Western Europe (Jago 2011). This trend is increasing and it is envisaged that up to 20% of cows in Europe will be milked automatically by 2020. Indoor feeding systems have been well adapted to AM, however cow grazing systems have not. This is leading to a decrease in grazing on farms with AM (Van den Pol-van Dasselaar *et al.*, 2011). This is an undesirable trend since grass-based systems of animal production are becoming increasingly competitive. Allied to this is the positive impact on milk quality and reduced environmental footprint associated with increased quantities of grazed grass in the diet as well as increased animal welfare standards.

In a production system where grazing constitutes a significant proportion of cow diet, grass has to be the main motivator for cows to move voluntarily to the AM installation.

Thus, new grazing technologies are needed to optimize integration of AM and grazing. Dairy farmers, policymakers and researchers in North Western Europe consider the combination of AM and grazing to be important from both labour (Irish) and cheaper feed source /milk quality (European) perspectives. This system also offers possibilities for precision management of individual cows in a herd, freeing up of labour and allowing the cow greater control of her activities.

The objective of this study was to determine the feasibility of integrating automatic milking with cow grazing.

Materials and Methods

Farm System Description

A milk production system trial was put in place at Teagasc, Moorepark, Ireland. The farm-let associated with the AM system consisted of a 24 ha milking platform. During the lactation of 2012 (1st complete lactation) there were 72 cows in the system with a mean calving date of 15th February (range 1st February-15th March). This herd comprised 36 Friesian, 16 Jersey Friesian cross and 20 Norwegian Red cows. The land area was divided into 3 grazing sections of 8 ha each (A, B, C) which are further divided into 1 ha paddocks. Four main roadways radiated from the centrally located dairy. Water was located at the dairy. Maximum distance to the furthest paddock was ~750m. The dairy featured one Merlin AMS unit (supplied by Fullwood for research) installed adjacent to the existing shed. The infrastructure incorporated a pre-milking waiting and post-milking area. There were three drafting units, two positioned at the entrance to the dairy that drafted cows to the pre- or post- milking area depending on readiness for milking, a third positioned at the dairy exit which drafted cows to the holding yard (for treatment or inspection) or to grazing (Section A, B or C). Automatic milk diversion (colostrum, antibiotic) was included and extensive milking and cow information was recorded at each milking (e.g. milk yield, milking time, milk flowrate, SCC, concentrate dispensed).

Grassland management

The grass allocation is critical to optimal cow visits to the AMS unit (it can influence too frequent or infrequent cow visits). Cows grazed defined areas or portions of each of the 3 grazing sections during each 24 h period (Figure 1). Cows were allocated 5 kg DM in each of the 3 grazing sections (A, B and C) over each 24 h period. Cows moved between the grazing Sections A, B and C at 1:00 am, 11:00 am and 6:30 pm, respectively. During the May/ June period cows went into grazing areas with grass covers of 1400-1500 kg DM/ha. Pasture mass was estimated twice weekly. Grass covers greater than 1500 kg DM/ha would discourage cow movement to the AM unit and may reduce milking frequency. Cows grazed to a post-grazing height of 3.5-4.0 cm. Cows were stocked at an average of 3.5 cows/ha. All cows received approximately 1 kg supplementary concentrate feed during the main grazing season.

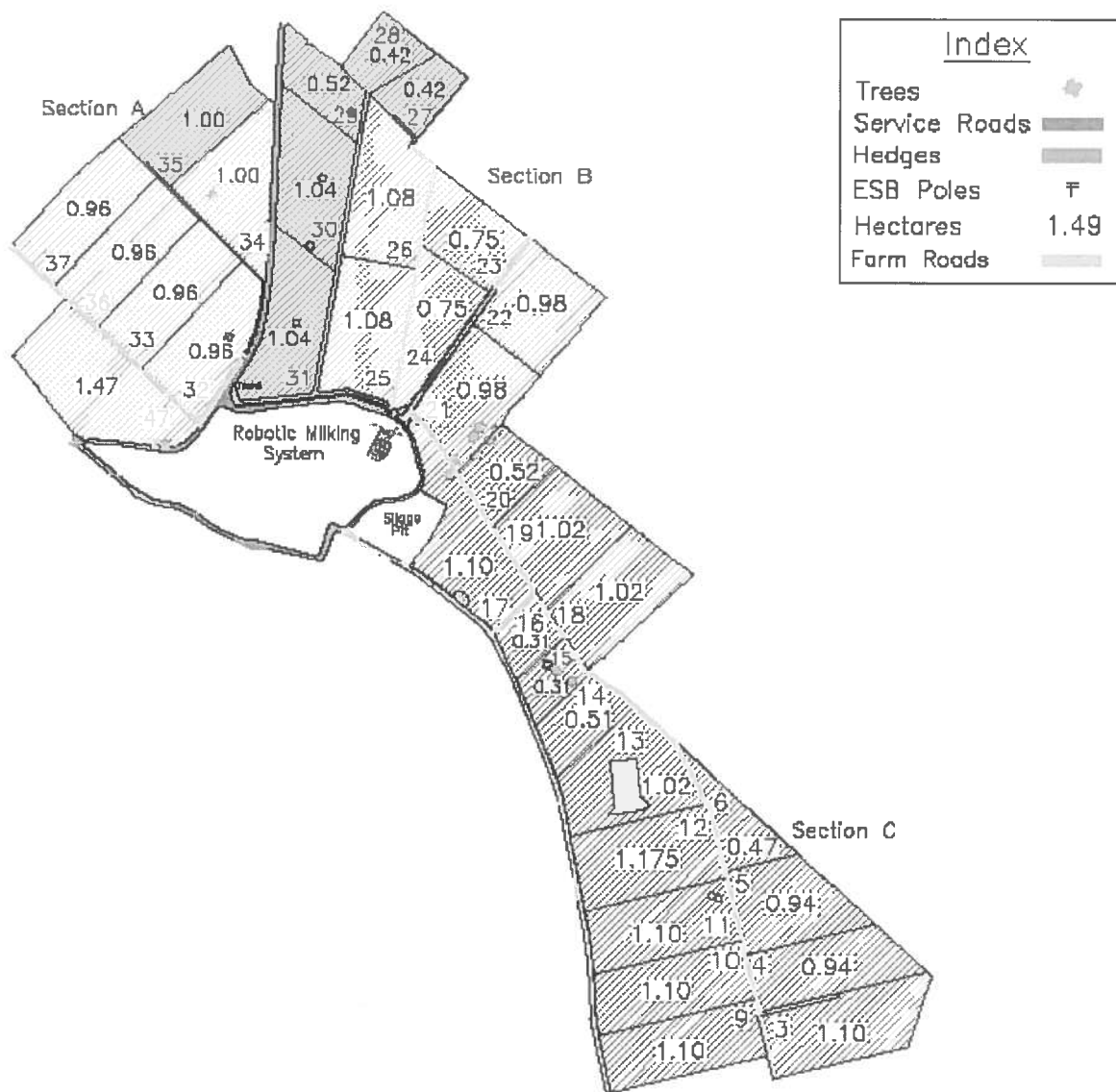


Figure 1. Map of AM farm incorporating sections A, B and C

Results

An average milk yield of 4,500 litres and milk solids (MS) yield of 351 kg per cow per lactation was achieved. Total milk volume and MS produced by the AM unit was 284,592 litres and 22,834 kg, respectively. The average number of milkings per day was 108, ranging from 125 to 80 per day in the March-May and October-November periods (Figure 2). The average number of milkings per cow per day was 1.8, ranging from 2 to 1.5 in the March-May and October-November periods (Figure 3). The average distribution of milkings over a 24 h period during the main grazing season is shown in Figure 4. Each milking averaged 7 minutes duration. An average milk somatic cell count (SCC) of 133,000 cells/ml was observed, while average total bacterial counts (TBC) were at 18,000 cells/ml.

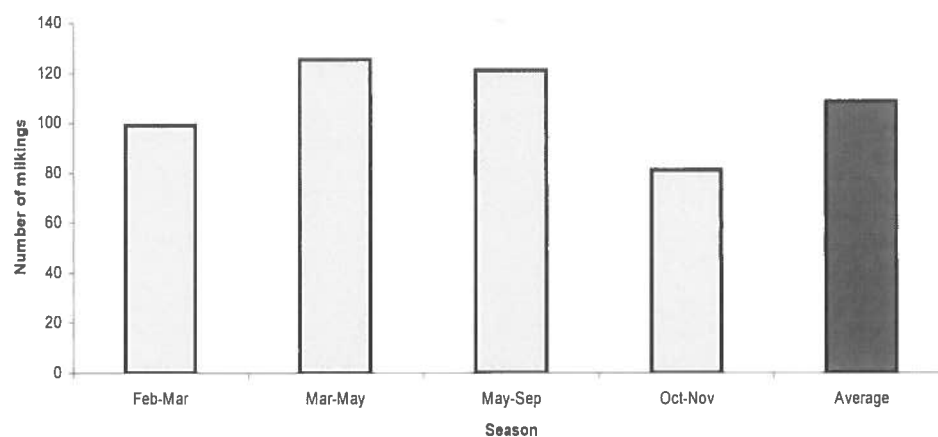


Figure 2. Average number of milkings over a 24 h period

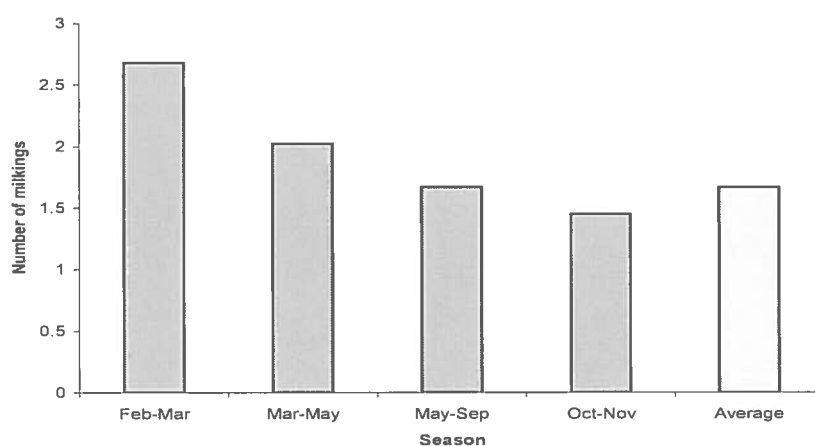


Figure 3. Number of milkings per cow over a 24 h period in different seasons of the year

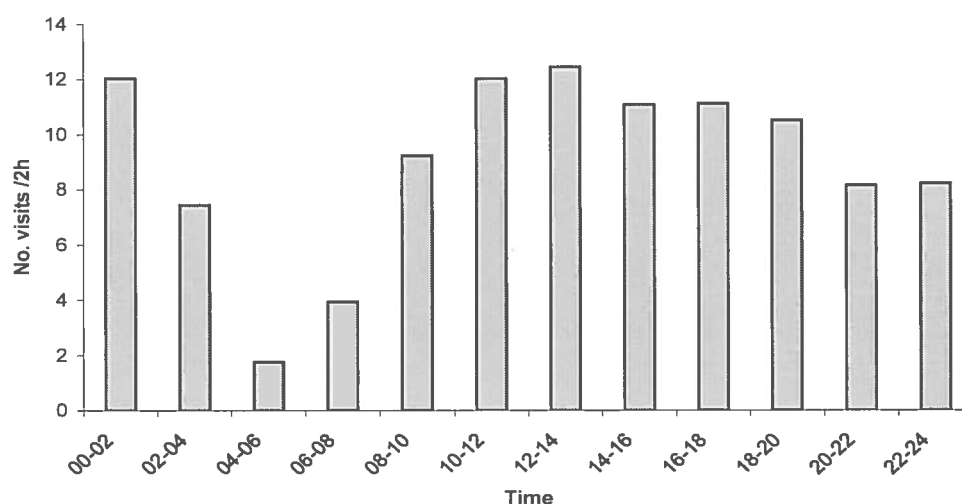


Figure 4. Average distribution of milkings over a 24 h period during the main grazing season

Discussion

The results obtained in this study are in agreement with those conducted in New Zealand in past years, that AM can be successfully incorporated into pasture based milk production systems with moderate levels of supplementary feed (Woolford *et al.*, 2004). The practical challenges to integrating AM and cow grazing include initiating cow movement to visit the AM unit, queuing of cows for milking, achieving high utilization of the AM unit and managing a seasonal calving pattern involving a peak milk yield period. Overall, the integrated AM and grazing system operated satisfactorily. The cows adapted relatively quickly to the system (within approximately 4 days). Milk output was influenced by the fact that it was the first complete lactation of cows on the automatic system, when milk yield is expected to be reduced by 10-15% (Wade *et al.*, 2004). The grass allocation was critical to optimal cow visits to the AM unit. If automatic milking is to be considered as a serious alternative to conventional milking in a grass based system, such as in Ireland, then it has to operate with a similar cow nutritional strategy and focus on cow utilization of grass. Factors such as milk yields, milk quality, feeding, cow traffic, grazing, and animal behaviour are essential elements of AM and grazing.

Irish dairy systems normally use high levels of grazed pasture and have seasonal milk production profiles. However, robotic milking systems are capital intensive, and up to now have been considered best suited to year-round milk supply due to the fixed capacity of the technology. But, Svennersten-Sjaunja and Pettersson (2008) concluded that use of AM and grazing systems together is possible as long as the distance from the milking parlour to pasture is short. With proper management routines, it should be possible to achieve a production level and animal well-being in AM systems that are at least as good as in conventional milking systems.

A 3-year FP7 funded EU project (coordinated by Ireland) on the integration of AM and cow grazing, commenced in January, 2013. Planned outputs include: protocols for optimum feeding strategies; pasture management tools; sustainability assessment tool; and a web based decision support tool to optimise economic efficiency of AM in grazing scenarios.

Conclusion

Successful integration of AM into a grass based milk production system was achieved in this study, however the economic viability of AM will determine how widely the technology will be adopted. A major challenge with automatic milking currently is the high capital cost but the concept of combining automatic milking and cow grazing has potential advantages which could have a positive impact on the dairy industry in the long term. These include reduced labour input, management as opposed to manual labour, ability to expand cow numbers on fragmented land bases and increased knowledge of cow performance data to use as a management tool. However, considerable research

needs to be conducted to establish if the concept presents a realistic alternative to conventional milking systems on dairy farms.

References

- Jago, J. (2011). Primary Industry Management, 15 (3): 19-21.
- Svennersten-Sjaunja, K. M. and Pettersson, G. (2008). Pros and cons of automatic milking in Europe. *American Society of Animal Science*, 86(Suppl. 1):37–46.
- Van den Pol-van Dasselaar, A., de Vliegher, A., Hennessy, D., Peyraud, J.L. & Pinxterhuis, J.B. (2011). Research methodology of grazing. *Proceedings EGF Working Group Grazing*. Report 405. Lelystad, Wageningen UR Livestock Research, 19 pp. 8.
- Woolford, M., Claycomb, R.W., Jago, J., Davis, K., Ohnstad, I., Wlieliczko, R., Copeman, P.J.A. & Bright K. (2004). Automatic dairy farming in New Zealand using extensive system. In *A better understanding Automatic Milking*. A. Meijering, H. Hogeveen et C.J.A.M. de Koning. 280-285.
- Wade, K.M., van Asseldonk, M.A.P.M., Berensten, P.B.M., Ouweltjes, W. & Hogeveen, H. (2004). *Automatic Milking, a better understanding*. Meijering, A., Hogeveen, H. and Koning, de C.J.A.M. pp 62-67. The Netherlands, Wageningen Academic Publishers.