

Automatic Milking Systems: an option to address the labour shortage on New Zealand dairy farms?

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Abstract

There is a growing shortage of labour within the dairy industry. To address this the industry needs to attract more people and/or reduce the labour requirements on dairy farms. Current milk harvesting techniques contribute to both the labour requirements and the current labour shortage within the industry as the process is labour-intensive and necessitates long and unsociable working hours. Automated milking systems (AMS) have been in operation, albeit on a small scale, on commercial farms in Europe for a decade and may have the potential to address labour issues within the New Zealand dairy industry. A research programme has been established (The Greenfield Project) which aims to determine the feasibility of automated milking under New Zealand dairying conditions. A Fullwoods MERLIN AMS has been installed on a prototype farmlet and is successfully milking a small herd of 41 cows. Progress from the prototype Greenfields system offers considerable potential for implementing AMS in extensive grazing systems.

Keywords: automated milking systems, dairy cattle, grazing, labour

Introduction

It is predicted that the dairy industry will require an additional 5000 labour units in the next 5 years mainly as a result of the expansion of dairying in the South Island (Gaul 2000). The number of school leavers wishing to enter the dairy industry at the farm level as well as the number of people training in agricultural courses is decreasing (Nolan 2001). Consequently there will not be enough people to fill the labour requirements in the foreseeable future.

To address this issue the dairy industry needs to attract more people and/or reduce the labour required on dairy farms. According to a recent survey, reasons for young people not being attracted to work on dairy farms include a perception that the work is hard and the social life poor (Kuriger 2001). The labour intensive process of manual milk harvesting which takes place twice daily for up to 300 days per year is a major reason for the long working hours. An automatic milking system (AMS), which attaches and removes teat cups without human intervention, is one technology that has the potential to address both the working conditions and labour requirement issues facing New Zealand dairy producers.

This short communication briefly details the development and features of automated milking systems, with comment on their application within grazing systems. It reports on the progress of a research programme that has been established at Dexcel to develop innovative cow management systems utilising automated milking technology within pastoral dairying.

The development of automated milking systems

Research to develop fully automated milking systems began in Europe in the 1980s (Ipema *et al.* 1992). Initial major technical hurdles such as how to attach teat cups were overcome and by the end of that decade a commercial prototype was released. The first commercial installation of an AMS occurred in the Netherlands in 1992 (Lind *et al.* 2000). By late 2000 the technology of AMS had advanced significantly and there were an estimated 700 systems installed and seven commercial AMS designs available in the market place. While the Netherlands remains the leader in terms of the number of commercial installations, there are currently reported to be about 1000 commercial units on dairy farms in a growing number of countries including Denmark, The United Kingdom, Ireland, Italy, Spain, Germany, Israel, Canada and most recently Victoria, Australia.

The fundamental difference between traditional and AMS milk harvesting methods is that AMS rely on cows using the milking station/s throughout the day and night to achieve sufficient cow throughput. Consequently milking can occur any time day or night and is distributed over a 24h period, rather than occurring in a batch fashion, usually twice daily.

Most AMS designs are single-stall modular units although there are two designs that allow for the sharing of a single cup-attachment arm between stalls. Within an AMS all aspects of the milking process are carried out without the need for human assistance including, animal identification, teat washing, teat cup attachment and removal and teat sanitising. The technology to detect and redirect abnormal (e.g. antibiotic) or specialised milk (e.g. colostrum), obtain a milk sample for herd test analysis, and identify and separate cows to holding yards automatically is also available on some AMS designs. In addition to back-flushing between each milking, the units automatically carry out hot or cold washes at pre-set times determined by the operator.

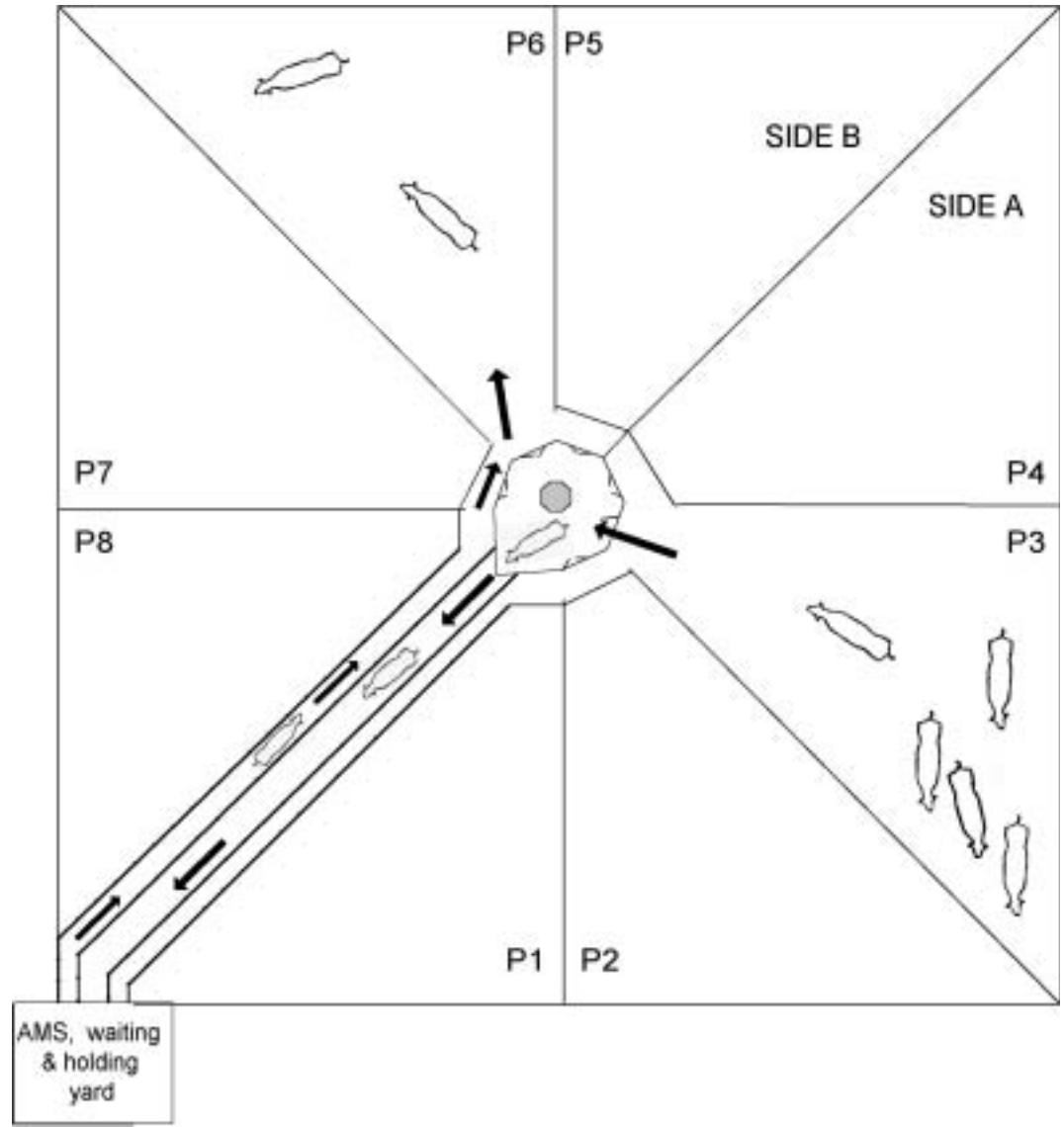
Grazing and automated milking systems

Automated milking systems were primarily developed for small herds (< 100 cows) housed and fed indoors in large barns meaning that cows have only to walk short distances to the milking stations. Cows are enticed into the milking station by the offer of concentrate and/or the prospect of gaining access to a roughage feeding station after being milked. The farming environment and animal management systems typical on New Zealand farms are very different from those on overseas farms adopting AMS technology. Herd sizes are large (national average 240 cows) (LIC Dairy Statistics, 2000-2001), cows often walk long distances (up to 3km twice daily) to and

from milking and herds are grazed exclusively outdoors on pasture.

Several overseas research institutes and commercial farms have combined AMS with grazing for part of the year, however none to the degree of reliance on pasture that will be required in the New Zealand scenario. Problems have included low levels of cow attendance resulting in an unacceptably low milking frequency and considerable numbers of cows unwilling to walk to the AMS station, having to be manually herded to the dairy (S. Benbow, pers. comm.). Studies in the Netherlands showed that weather conditions and pasture sward height were factors influencing cow movement patterns

Figure 1 The farm layout indicating radial paddock design separated into Side A and Side B, central collecting area, water placement and two-way race system.



(Ketelaar-de Lauwere & Ipema 2000; Ketelaar-de Lauwere *et al.* 2000). Cows tended to spend less time at pasture in wet conditions, and as the pasture availability decreased spent more time indoors at the AMS and supplementary feeding stations. One of the key concerns was that over time cows began to attend the AMS as a herd rather than in small groups or individually (Ketelaar-de Lauwere & Ipema 2000).

Prospects for AMS in New Zealand

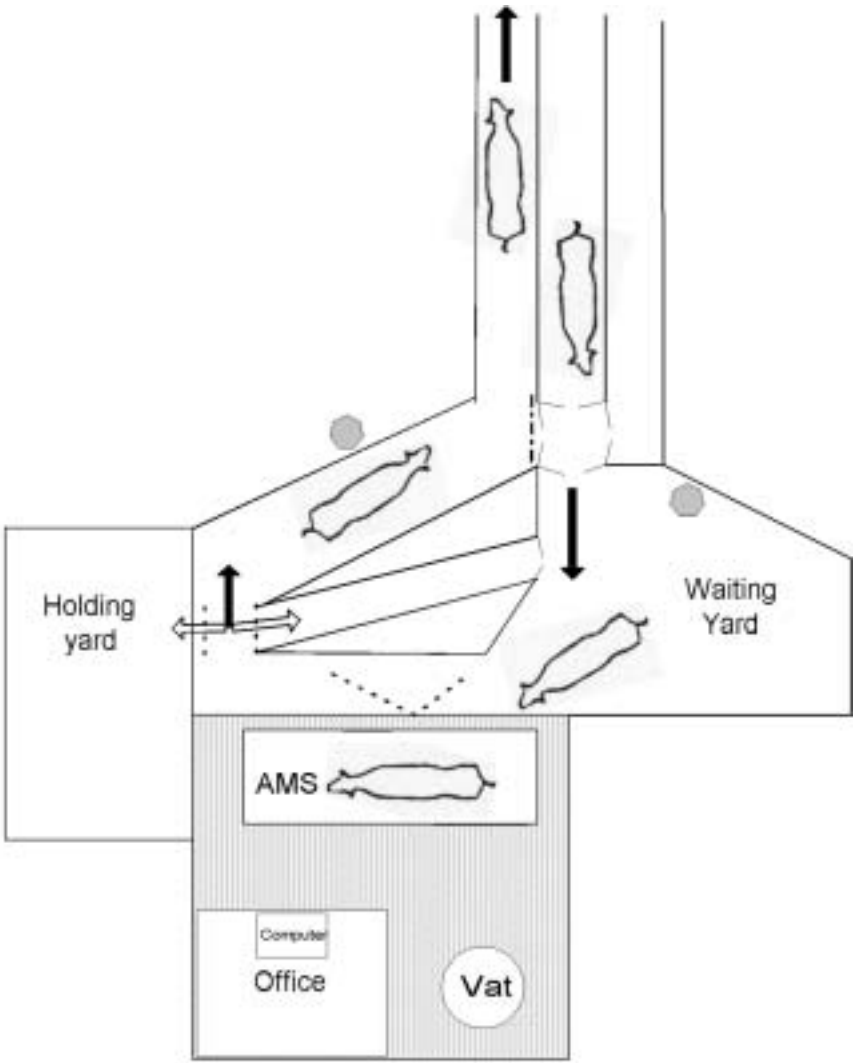
Dexcel has established a research programme to investigate the feasibility of designing farm systems that can utilise AMS in an extensive grazing farm scenario.

Research has to date focussed on devising a cow trafficking system utilising a pasture-based farm management system with minimal supplementary feeding requirements.

A Fullwood (UK) MERLIN AMS was imported and installed on a 10 ha prototype farmlet. Figures 1 & 2 illustrate the novel farm layout. A full description of the cow trafficking system can be found in Jago *et al.* (2002). Briefly, a series of cow-operated and AMS-operated gates direct cow flow. A rotational grazing strategy, where cows move from one paddock to another (Side A of the farmlet to Side B or vice versa) via the AMS over a 24-hour period ensures a maximum

Figure 2 Layout and positioning of the Fullwood Merlin Automatic Milking System adjoining a waiting yard, and showing direction of cow flow via one-way and automatic gate system.

Key: / \ Cow operated one-way gates; AMS operated automatic gates; - - - - - manually operated gates to change destination of cow traffic to Side A or Side B; ◐ water trough.



milking interval of 24h. The direction of cow flow (to Side A or to Side B) is reversed twice in 24h at 10:00 and 21:00. Any cows remaining in the "old" paddock at these times are moved to the central collection area in the centre of the farmlet. A combination of water (available within the central collection area, in the waiting yard and after exiting the AMS), crushed barley (fed in-bale during milking at a rate of 2kg/cow/24h) and fresh pasture (accessible after passing through the AMS) are used as incentives to generate cow flow. Cows may visit the AMS and be milked throughout 24h with the exception of three 10-minute periods when the AMS is automatically washed.

The first cow was milked in the system on June 11, 2001 and currently a herd of 41 mixed-age, mixed-breed cows are milked on the 10ha farmlet. The cows have successfully adapted to the distributed milking system and learned to negotiate their way voluntarily through the novel cow-movement system. Individual daily milking frequency varies from 1 to 3 milkings/cow. Initial data indicates that cows visit the AMS at all hours of a 24 h period but fewer visits are made between the hours of 2am and 7am (Jago *et al.* 2002).

The prototype farmlet has demonstrated a practical cow trafficking system for use with AMS within an extensive pasture-based farming system. However to date this has been achieved on a small scale and many questions remain regarding the logistics associated with generating a much higher cow-throughput and maximising cows/AMS, as well as managing larger herds. The research programme will seek to address these issues over the coming two years.

The potential for labour reduction

While AMS has the potential to significantly reduce the labour requirement on dairy farms, in practice many European farmers have found that this has not been the case. Some farmers report that the installation of an AMS results in a shift in the type of work rather than a major reduction in workload (Ian Ohnstad pers. comm.). However most report that the positive change in lifestyle and flexibility offered by an AMS has more impact than any effects on overall labour requirements. One reason for the lower than expected reduction in labour requirements may be because there are more labour units per cow in European systems and a greater overhead. By necessity European farmers spend a large amount of time cleaning barns and feeding stock and relatively less time milking. In comparison, on New Zealand farms, milk harvesting makes up a larger proportion of daily work time due to the higher reliance on pasture feeding therefore there is a greater potential for a realisation of labour saving.

Summary

Automated milking systems offer the New Zealand dairy industry a future alternative to current milk harvesting techniques with potential for addressing the on-farm labour issues facing the industry. Automatic milking systems have the potential to allow more flexibility in the daily routine of farm staff. They eliminate the highly repetitive nature of current manual milk harvesting systems allowing more time to address farm/animal management issues. Although now demonstrated on a small-scale prototype farmlet many farm management and configuration issues need to be revisited before the full potential of automated milking systems can be determined.

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