



# Automatic milking installations (robotic milking)

## 1. Introduction

The defining feature of an automatic milking installation (AMI) is that the cows decide when they will come to the milking area. Thus, automatic milking is much more than just another way of milking cows. It is an entirely new way of dairy farming because milking becomes a background operation.

## 2. Interpretation and relevance to Australian conditions

Given Australia's competitive edge in producing milk from pasture with relatively low inputs (by world standards) of capital, labour and concentrate feeds, should Australian dairy farmers also start to think seriously about automatic milking installations? The short answer is "yes". They have the potential to revolutionise the way of life on Australian dairy farms. It is only a matter of time!

We do not know how quickly the capital and operating costs of 'robots' will fall during the next 5 years in the thinly-spread and, therefore, high cost-to-service milking equipment industry which exists in Australia. Based on the astonishingly rapid reductions in costs of electronic equipment such as calculators and computers, however, the next generations of automatic milkers will become progressively less expensive. The overall costs (capital plus labour) only need to be halved to be equivalent to the 2001 estimates for conventional milking. As the differences between costs of automatic and conventional systems are reduced, an increasing number of Australian farmers will opt for voluntary milking for reasons such as:

- improvement in lifestyle, with more time for family and leisure activities
- less physical work, especially for older farmers or those with physical health problems
- increased opportunities for attracting and keeping skilled labour
- personal choice for innovators who want to try new ideas
- increased profitability based on increased milk production potential and lower labour costs.

## 3. Relationship to CowTime goals

The major potential benefit is that automatic milking will make dairy farming a more socially-attractive occupation, especially for younger people with good computing and management skills. Although theoretical modelling studies suggested labour savings of 30-40%, the reported reduction is closer to 10% in practice. The big change, however, is in the type of labour required. Firstly, herd management becomes less time-bound so the labour inputs can be more flexible. Secondly, the routine repetitive task of milking the herd fourteen times per week, or more, is replaced by the tasks of checking attention lists from a computer and observing cows regularly at times other than at milking.

## 4. Main features

### Encouraging cows to come for milking

Feed is the main motivator for cows to move voluntarily into the automatic milking installation. In most of the overseas systems, cows are motivated by the prospect of some tasty concentrate feed in the milking box. In a series of on-going studies in NZ, access to drinking water is used to help train cows to leave their grazing area and to enter the laneway leading to the milking robot. The NZ studies also suggest that the prospect of fresh pasture on the far side of the milking box provides a powerful motivation for cows to enter for milking (and to leave quickly after milking).

### Changes in milk yield

Average milk production per cow increased by 11% on Dutch farms that changed from conventional milking twice per day to voluntary at a frequency of about three times per day. In France, milk yields per cow increased by an overall average of 3% and by up to 9% in herds milked by robots for more than 2 years. These reported gains are less than the expected increase in herds that change from twice daily to thrice daily conventional milking. On average, the expected increase in milk yield is 15-20% for first lactation cows milked three times per day and 10-15% for mature cows compared with twice daily milking. Presumably, the average yield increase per cow is not as high for voluntary milking because some cows visit the AMI less frequently than the average of about 3 times/day. In a study in The Netherlands, for example, almost 10% of cows had an average milking frequency of 2 or less

even though cows with noticeably long intervals were fetched for milking three times per day. Such cows would not show the expected increase in average milk yield that occurs with more frequent milking. According to the "law of diminishing returns", it is unlikely that the lower yields of cows that visit the milking area less frequently will be offset by the higher yields of cows that are above-average visitors to the milking area.

It is much too early to predict whether milk production per cow will increase, decrease or stay the same in the NZ automatic milking studies where the average milking frequency is intended to be less than 2 times per day.

### Milk quality and udder health

Studies in several countries indicate an initial deterioration in somatic cell count, total bacterial counts, freezing point depression and free fatty acid levels in the first few months following the introduction of automatic milking, after which the situation usually improves.

More importantly, the great variation in results from individual farms suggests that:

- the initial deterioration is much less marked with the newer automatic installations
- the quality of on-farm management influences the extent to which udder health and milk quality deteriorate, or whether they do so at all.

### Cow behaviour

Reports from most 'robot' users suggest that cows become amazingly quiet within a few weeks or months of changing to a automatic milking installation. It has become clear that cows are much less frightened by machines than by people, presumably because the cows are free to choose their milking times and because the robot does not become angry or impatient with them!

### AMI capacity / performance

Tables of AMI performance based on European management systems are provided by the manufacturers and an example is tabulated below:

AMI Time budget	Hours per 24 hour day
Idle time	2.00
Complete system cleaning (3x)	1.00
Small cleanings (average 3)	0.50
Net Milking time	20.50

AMI Capacity	8,000kg cow production	10,000kg cow production
Average process time per cow	7.5 mins	8 mins
Cows per unit per hour	8 cows	7.5 cows
Milkings per 20.5 hour day	164 milkings	154 milkings
2.6 milkings per cow per day	63 cows per unit	59 cows per unit
2.7 milkings per cow per day	61 cows per unit	57 cows per unit
2.8 milkings per cow per day	59 cows per unit	55 cows per unit

## 5. Potential challenges with implementation

Farmers who have changed to automatic milking report their biggest challenges as:

- learning to let go the task of milking, learning how to utilise the extra time to manage the farm as a business and to monitor the herd in other ways;
- leaving the cows alone to learn (from other experienced cows) how to enter the milking system voluntarily;
- being obliged to become competent with computers and learning how to access and understand the information needed to manage the herd; and
- Good maintenance will decrease the number of failures but someone needs to be on call at all times, day and night. Clearly, the successful deployment of automatic milking installations in Australia will need to be supported by a regional network of skilled technicians. These networks are not yet widely in place in Australia.

## 6. Robustness of this information

Because automatic milking is such a new and rapidly-evolving way of dairy farming, it is likely that ideas, costs and recommendations will be quite different for the next generation of robots. For example, present cost-estimates are based on the assumption that a single-box robot is capable of milking no more than 55-65 cows (150-200 milkings per day at an average of about 3 times per day for a capital cost of about A\$250,000 for a single robot). Similarly, a two-stall robot milking installation costing about A\$500,000 is recommended for a herd size of 90-100 cows because it has a maximum capacity of 270-320 milkings per day.

Robotic research in NZ is taking a quite different approach, however (Woolford et al 2002). The NZ goal is to milk 200-240 cows using only two robots. The research goals are that cows should get most of their nutritional requirements from pasture and, on average, they will be milked less than twice per day. Perhaps this approach could offer a cost-effective alternative for Australian farms because our pasture-based cows produce much less milk than the heavily fed cattle in the Northern Hemisphere.

AMI Capacity in the New Zealand experiment	5,000kg cow production
Average process time per cow	9 mins
Cows per unit per hour	6.6 cows
Average number of milkings undertaken per AMI per 24 hours	146 milkings
Cows on average have 1.3 milkings per cow per day	112 cows per unit

Other, more cost-effective solutions will be developed by innovative farmers, technicians or researchers. If the productivity/cost ratio for AMI technology improves by about two-fold, it will become comparable with that for an efficient conventional milking system. As already pointed out, the cost of automatic equipment is likely to fall relative to the cost of labour during the next 5-10 years. Furthermore, the potential exists for significant improvements in cow throughput and, therefore, in productivity (measured in litres of milk harvested per day). According to one American expert, "the most expensive parts of a single-box AMI are typically idle for more than half the time". And furthermore, "multiple box systems have suffered efficiency losses because of the difficulties of managing voluntary cow movement in large groups". Clearly, there's plenty of room for improvements in the next few years.

Meanwhile, Australian farmers need go no further than the Winnindoo farm of Max and Evelyn Warren, at Rosedale in Victoria, to see how a large herd of cows moves easily, quietly and voluntarily around the farm and into the milking area. You can catch a glimpse of the future of Australian dairy farming at the Warren's farm. It's a pretty exciting vision.

## 7. References and further reading

Proceedings of the First North American Conference on Robotic Milking, Toronto, Canada, March 2002, especially the following papers:

"Automatic milking experience and development in Europe." Kees de Koning, Yvonne van der Vorst and Albert Meijering, Research Institute for Animal Husbandry, Lelystad, The Netherlands.

"Global acceptance of robotic milking systems." A. van't Land, Lely Industries, The Netherlands.

"Evolution of automated milking in the USA." Douglas J. Reinemann, University of Wisconsin, USA

"Managing the change to a robotic milking system." John Baines, Fullwood Ltd, UK.

Woolford, M. (2002) "The use of robotic milking machines in pastoral dairy systems" in Dairyfarming Annual 2002, Proceedings of Massey Dairy Farmers Conference, Massey University, Palmerston North, NZ

Max and Evelyn Warren's automatic dairy can be visited through the web at [www.roboticdairy.com](http://www.roboticdairy.com)

**CowTime Guidelines for milk harvesting** – Chapters 1 & 11. edited by Klindworth, D. et al (2003). Available on the CowTime website [www.cowtime.com.au](http://www.cowtime.com.au)

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