Automatic milking systems (AMS)

Main concepts of AMS:

- **Automatic** → Robot performs milking related tasks

- **Voluntary** → Cows move around the system based on incentives (feed)

- **Distributed** → Milking operation is 24/7
Key concepts

Milking Interval → Time between 2 consecutive milkings

Milking frequency → Number of milking events per day

Automatic milking systems (AMS)

Indoor systems

Corral based systems

Pasture-based systems
What had already been proven?

- AMS can be combined with pasture-based systems
- High pasture utilisation can be obtained with AMS

What could be improved?

Grazing and AMS
Grazing and AMS

Indoor AMS (< 24 h/d grazing)  Indoor AMS (24 h/d grazing)  Pasture-based AMS (24 h/d grazing)

Milking frequency (milking events/cow per d)

Milking intervals and Milking frequencies

Days in milk (d)

Milking interval (h)

Milking frequency (milkings/day)

Pasture-based AMS
Milking intervals – Milk yield

Concept of extended milking intervals $\Rightarrow > 16$ h

![Graph showing milking yield vs. milking interval]

Pasture-based AMS

Frequency of occurrence of milking intervals

![Bar chart showing frequency of milking intervals]

Proportion of observations (%)

Milking interval (h)

30%
Potential causes of extended milking intervals

Milking intervals were affected by:

→ Stage of lactation (↑)
→ Parity (↓)
→ Proportion of pasture in the diet (↑)
→ Pasture allowance (↑)
→ Distance to allocation (↑)
→ Pre-grazing pasture cover (↓)

Importance

By reducing the occurrence of “extended” milking intervals, we can increase milking frequency, and therefore milk production per cow, obtaining a real benefit of AMS
### 2 vs. 3 way grazing trial: Hypothesis

3-way grazing treatment:

- Frequency – size of allocations
- Smaller allocations
- Depleted quicker
- Cows would traffic out sooner
- Lower milking intervals
- Higher milk yield

### 2 vs. 3 way grazing trial: Trial design

2 way grazing

- 9 kg DM/c in each break
- 12 hr grazing in each break

3 way grazing

- 6 kg DM/c in each break
- 8 hr grazing in each break
2 vs. 3 way grazing trial: Results

↓ Milking interval - ↑ Milking frequency - ↑ Daily yield

- 31%

(Lyons et al., 2013, JDS)

Published research

Comparison of 2 systems of pasture allocation on milking intervals and total daily milk yield of dairy cows in a pasture-based automatic milking system

N. A. Lyons, K. L. Kerrisk, and S. C. Garcia

Abstract

Cows milked in pasture-based automatic milking systems (AMS) have greater milking intervals than cows milked in indoor AMS. Long milking intervals greater than 16 h have a negative effect on milk yield and udder health. The impact of 2 systems of pasture allocation in AMS on milking interval and yield was investigated at the FutureDairy AMS research farm (Elizabeth Macarthur Agricultural Institute, New South Wales). Melting cows more frequently without significant extra labor input and consequently achieving higher milk yields (Garcia and Fullerson, 2005; Stockdale, 2006). In 2001, the technology was introduced into pasture-based systems in a commercial installation in Victoria (Greenall et al., 2004) and with the establishment of the Greenfield Project in New Zealand (Jago et al., 2002). These were followed by the AMS research farm within the FutureDairy Project in Australia in 2006 (Garcia et al., 2007).
World's first AMR – FutureDairy Prototype

Voluntary 24/7 as from February 2011
2-way grazing system with ~ 200 cows

Aim: analyse if milking permission affected milking intervals

AMR: Milking intervals

Extended milking intervals → 33% of milking events

Only 16% of them had a previous refusal (~ 3 h)

Milking permission refusals → 10%

Of those → 52% extended milking interval

Milking refusals do not explain extended milking intervals but should not be ignored
AMR: Refusals

Refusals occurred towards the end of the access period

![Graph showing the proportion of cows entering (%) over the proportion of active access time elapsed (%).]

- Refusals occurred towards the end of the access period.
- The graph shows the proportion of cows entering (%) over the proportion of active access time elapsed (%).
- Markers indicate significant refusals.

AMR: Return time

![Graph showing the time (hh:mm) for access to holding yard and refusal times.]

- The graph displays the time (hh:mm) for access to holding yard, waiting time, time to return, and refusal time.
- The chart compares access for cows that were straight and previously refused.
**PRE vs. POST Feeding Trial: Hypothesis**

**PRE-fed cows:**

- Immediate reward
- Return quicker from pasture to the dairy
- Lower milking interval
- Higher milking frequency
- Higher daily milk yield

**PRE vs. POST Feeding: Trial design**

Whole herd (175 cows)

Pre – milking feeding

Post – milking feeding

Paddock

Feeding

Milking

Paddock

Paddock

Feeding

Milking

Paddock
PRE vs. POST Feeding Trial: Measurements

PRE

<table>
<thead>
<tr>
<th>Pasture time</th>
<th>Feeding time</th>
<th>Waiting time</th>
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</table>

POST

<table>
<thead>
<tr>
<th>Feeding time</th>
<th>Pasture time</th>
<th>Waiting time</th>
</tr>
</thead>
</table>

Milking interval

30 observation cows → 15 in each treatment group

Visual observations every 15’ during 4 x 24h periods → Grazing
PRE vs. POST Feeding Trial: Results

<table>
<thead>
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<th>PRE</th>
<th>POST</th>
<th>Significance</th>
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<td>(hh:mm)</td>
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<td>Waiting time</td>
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<td>Milking interval</td>
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<td>(hh:mm)</td>
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<tr>
<td>Daily yield</td>
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<tr>
<td>(kg milk/d)</td>
<td>19.29</td>
<td>19.45</td>
<td>NS</td>
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</table>

Difference in time spent on each area, but not on daily yield!

(Lyons et al., 2013, JDS)

Published research

**Effect of pre- versus postmilking supplementation on traffic and performance of cows milked in a pasture-based automatic milking system**

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**ABSTRACT**

Cows milked in a pasture-based automatic milking system tend to have a lower daily milking frequency in comparison with cows milked in indoor systems. Milking events with intervals beyond 16 h have been reported to have a negative effect on milk yield and udder health, and therefore it is important to minimize their occurrence. As feed is the main incentive to encourage cow traffic around the system, a study was conducted to compare pre (PRE) versus postmilking (POST) supplementary feed placement strategies in a trial (Greenall et al., 2004) and within the Greenfield Project in New Zealand (Jago et al., 2002). In 2006, the FutureDairy Project commissioned its AMS research dairy in Australia (Garcia et al., 2007).

Automatic milking systems rely on voluntary and distributed traffic of cows. Contrary to what happens in conventional milking systems, cows in AMS are not subject to discrete milking sessions given that milkings occur throughout the day and night. Failure to achieve these conditions could have an effect on technology uptake as well as profitability and success of farmers adopting this technology.
PRE vs. POST Feeding Trial: Results

No difference in grazing behaviour

Final comments

- Quantification of what is achievable in pasture-based AMS → Actual & future farmers
- Identification of factors that affect milking intervals
- Management of incentives (frequency, size and location)
- Challenges of box units – AMR to reduce extended milking intervals
- Differentiation between cows (SOL, Milk yield, parity)
- Larger herds dynamics
But even better to be at this stage now!

Thank you very much for your attention

Supervisors: Assoc. Prof. Sergio (Yani) Garcia and Assoc. Prof. Kendra Kerrisk