AUTOMATIC MILKING: STATE OF THE ART

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Growth in AMI
World and US Growth rate has been EXPONENTIAL!!
300+ Farms in US  500+ in Canada
### Reasons for Choosing AMS

<table>
<thead>
<tr>
<th>Reason</th>
<th>Priority 1</th>
<th>Priority 2</th>
<th>Priority 3</th>
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<tbody>
<tr>
<td>Reduce Labor</td>
<td>18</td>
<td>10</td>
<td>5</td>
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<tr>
<td>Time Flexibility</td>
<td>7</td>
<td>10</td>
<td>4</td>
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<tr>
<td>Increase Milking Frequency</td>
<td>7</td>
<td>6</td>
<td>5</td>
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<tr>
<td>Lack Of Labor</td>
<td>7</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>New Investment In Milking Machine</td>
<td>9</td>
<td>2</td>
<td>4</td>
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<tr>
<td>Improve Udder Health</td>
<td>0</td>
<td>4</td>
<td>5</td>
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Single Box Systems
50-70 Cows per box w/ 1 to 32 boxes per farm
DeLaval VMS
Cleaning cup
Individual teat cups
Steam Backflush
Online Cell Counter (OCC) for VMS
Lely Astronaut A3/A4

The central unit new modular setup vacuum and cleaning system for up to two cow units.
walkthrough design called the I-flow concept.
Brush Cleaning
4 Teatcup Arm
Steam Backflush

Lely Pura steam cleaning system
The Lely Pura steam cleaning system kills 99% of all bacteria in the teat cups without the use of detergents, thus offering maximum security in respect of udder health, food safety and the environment.
Milk Quality Control - MQC quarter measures

- Milk color
- Conductivity
- Milk time
- Dead milking time
- Milking speed
- Temperature

information on
- mastitis,
- fat and protein
- lactose
Tradeoff Between Sensitivity and Specificity
Summary and Conclusion

 недо Sensing Systems are not perfect
   - Automatic diversion of abnormal milk is not practical

 недо Sensing Systems are good enough
   - A decision aid, Better than the average human
   - Greatly reduce human work compared to checking every cow, every milking

 недо Sensing Systems Will Continue to Improve
   - Market demands and competition will be the key drivers
GEA M1
(WestfaliaSurge)

Multi-Box System
Other Offerings – Multi and Single Box Systems
DeLaval VMR
700 cows per rotary  90 cows/hr
Batch or voluntary milking
Add technology incrementally
GEA DairyProQ
Continuous fully automatic milking
GEA DairyProQ
Continuous fully automatic milking

- 1 arm per stall
- Modular design for maintenance & Repair
- Pre and Post dip applied in teatcup.
- Free access to cow
- Available as semi-automatic option
Pros and cons of automatic milking in Europe

- K. M. Svennersten-Sjaunja

- More frequent milking and can be adapted to lactation stage
- Increased milk yield has been observed
  - Lack of increased production has also been reported
  - Probably due to less attention paid to the total management system
- Provides consistent milking routines,
- Initially reduced milk quality was observed
  - FFA could be due to increased milking frequency or handling of the milk, although this has not yet been determined
  - Total bacteria count probably due to mismanagement because later studies indicated that teat cleaning in AM is sufficient to reduce spores and dirt on the teats.
  - Somatic cell count (scc) variation and length of the milking interval seem to contribute
Pros and cons of automatic milking in Europe

K. M. Svennersten-Sjaunja

Positive effects on udder health and teat treatment were observed in some studies,

- possibly as an effect of quarter milking,

Good cow traffic is a prerequisite for successful AM system performance

- optimal number of visits to feeding area and milking station

Grazing is a common management routine

- possible as long as the distance from the milking parlor to pasture is short

With proper management routines, it is possible to achieve a production level and animal well-being in AM systems that are at least as good as in conventional milking systems.
BARN DESIGN AND MANAGEMENT
layouts without dead-end alleys and improved water capacity is beneficial for all cows
Smart Selection Gates
Forced Cow Traffic
Feed First – Milk First
No Selection Gate
Free Cow Traffic
Holding Area in Front of Robots
Grazing system
24/7 grazing with Lely Astronaut milking robots

.requires a completely different set-up for both cow routing and the dairy farm.

stimulate cows to visit

fed in the robot

fresh pasture after milking

Grazeway gates are used.
French study
Institute De L’Elevage, 2012

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<tr>
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<th>Confined</th>
<th>Grazing</th>
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<tr>
<td>Milking's box /day</td>
<td>149</td>
<td>138</td>
</tr>
<tr>
<td>Milking's /cow/day</td>
<td>2.06</td>
<td>1.86</td>
</tr>
<tr>
<td>Production (kg/cow)</td>
<td>29.4</td>
<td>27.6</td>
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![2012 fodder calendar](image1)

![Feeding costs to produce 1000 litres of milk in 2012](image2)
THE GREENFIELD PROJECT

• Revisiting current milk harvesting methods
• Taking advantage of established European automated milking technology
• A long-term research program looking for opportunities for New Zealand farmers
The cow control center of the farm

- Cows enter through one-way cow operated gate
- Cows exit through computer-controlled gate
- Cows are sent to the AMS or back to pasture depending on when they were last milked
Distribution of Milkings

1st September 2001 - 1st May 2002
n=16,393 milkings
REGULATIONS
Appendix Q to the Pasteurized Milk Ordinance (PMO)

AMI for the Production of Grade "A" Raw Milk approved in 2003

- AMI shall identify and discard milk with abnormalities.
- Points of contact with abnormal milk will be cleaned and sanitized after milking such an animal.
- Box shall be kept as clean as any milking and equipment cleaning area.
- All ventilation air must come from outside the cattle housing area.
The Issue

- Allowing cleaning of tank valve and t-piece connection assembly and bleed valve (pick up or outer valve).
  - Screened outlet to prevent contamination is difficult to verify automatically - outlet could be plugged by operator or failure.
  - Supply specific proof that milk in the tank is not at risk of product contamination (public health) with single-seal separation (inner valve).
Other Issues

Jeter and teat cup protection
- In process component
- Cover, Shielding, Location, Self cleaning
Other Issues

- Well Water backflow prevention
  - Central point well protection
  - Cross contamination between AMS units
  - Hot/Cold separation within AMS unit
- Cover for AMS stall when not in dedicated milking area
  - Positive pressure ventilation requirement
- Conversion from EU standard components to US FDA approved
ISO Terms and Divert Decision Points

**Undesirable**
- unsuitable for sale, e.g. colostrum
- Decision before milking

**Withheld**
- milk that may contain antibiotic residues
- Decision before Milking

**Abnormal**
- visibly changed in color or texture
- Decision during fore-milking, milking or after milking
Automatic Diversion of Abnormal Milk

Where an automatic milking unit has provisions to detect abnormal milk from an individual animal and prevent its milk from being mixed with milk intended for human consumption, the abnormal milk detection method together with recommended limit values shall be described in the user's manual.
ISO Annex C: test for changes in homogeneity

- foremilk at either the quarter or udder level with
- clots larger than 2 mm
  - visible on a 0.1 x 0.1 mm pore filter media
- AND California Mastitis Test score >3

Note: needs to be evaluated further

Further discussion (Mein and Rasmussen, 2008; Claycomb et al, 2009, Kamphuis et al 2013).
The “Double-Standard” Problem

- AMS cannot be held to a higher or different standard than conventional milking
- The ‘gold standard’ for detection of milk abnormalities (Human inspection of foremilk) very imprecise
  - Uniformity of application even more variable
- Language for the EU Hygiene Directive
  - "milk from an animal is checked for abnormalities by the milker or a method achieving similar results..."
  - "abnormal milk be defined based on milk homogeneity'.
- Reference method using a filter with a pore size of 0.1mm and visual inspection for clots was suggested.
- Definition of ‘abnormalities’ in milk may continue to evolve
The Cows Like Them

"Satisfied? ... I warned you not to invite the cows in for a few drinks."
The People Like Them