Present and Future
Innovations to improve Milk harvesting

IDF World Dairy Summit
Farming systems in the future
November 25, 2004

Kees de Koning

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Animal Sciences Group - Wageningen UR

Division: Applied Research

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Innovations to improve milk harvesting

- Developments
- Milk harvesting systems
- Automatic Milking Systems
- Experiences in Europe
- Concluding remarks

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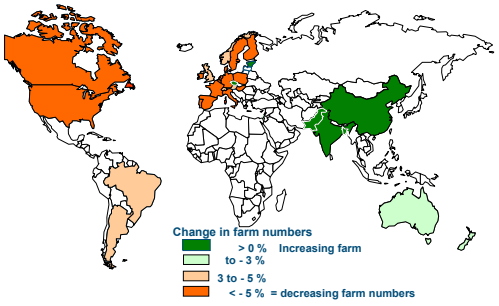
Number of dairy farms
Developments 1990 - 2001



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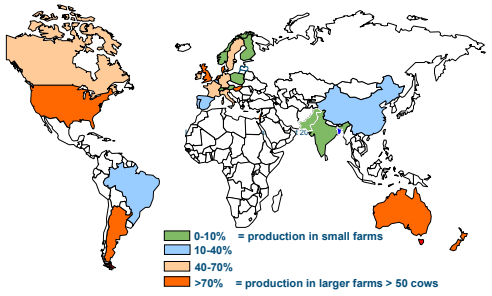
Hemme et al., IFCN Dairy Report 2003

Farm Size Status 2001



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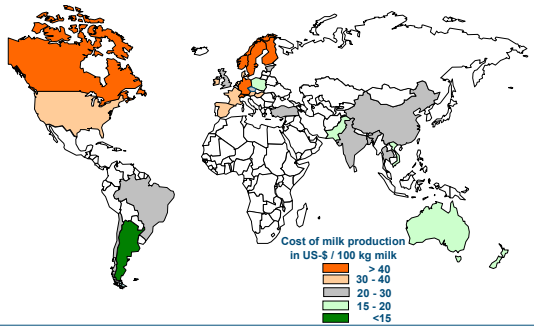
Hemme et al., IFCN Dairy Report 2003

„World dairy cost map in 2003“



Hemme et al., IFCN Dairy Report 2004

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Structural developments

- Internationalisation and globalisation
- General developments in society
  - From agricultural to industrial to knowledge based
- Cost of production factors land and labour
- Dairy industry developments
  - Requirements
  - Payment systems
- Product quality and food safety
- Concern on animal health

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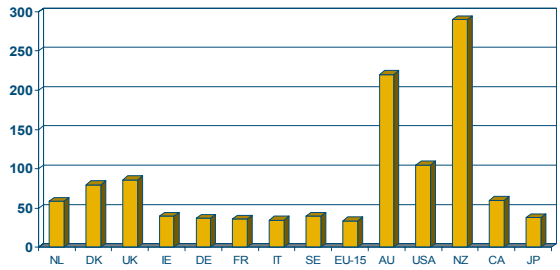
Number of dairy cows per herd (2003)



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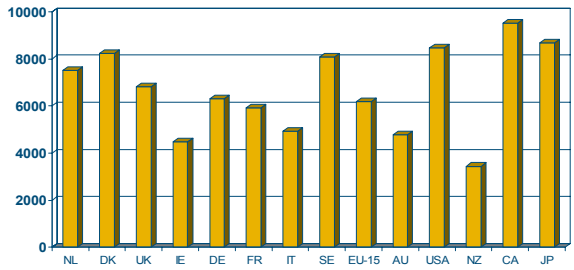
Average yield per cow (2003)



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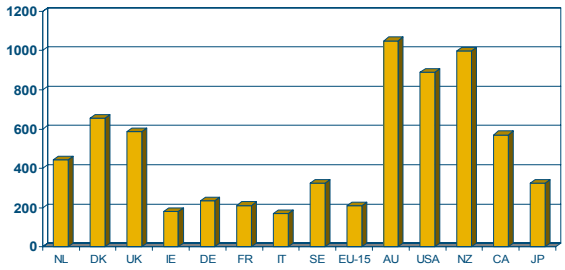
Average milk production per farm * 1000kg (2003)



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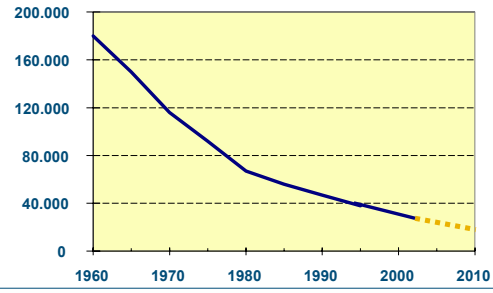
Number of dairy farms in The Netherlands



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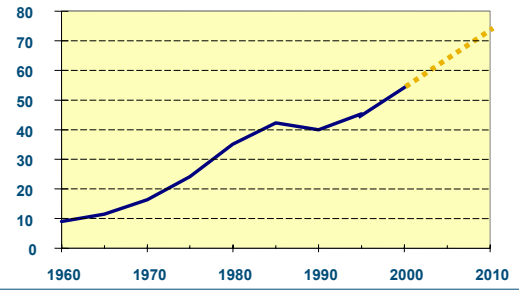
Development in Herd size (NL)



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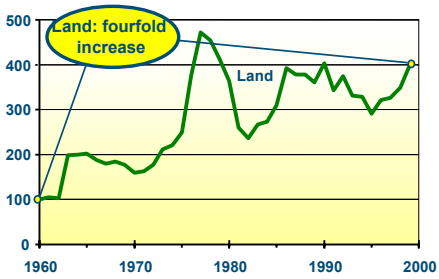
Developments: Costs of land



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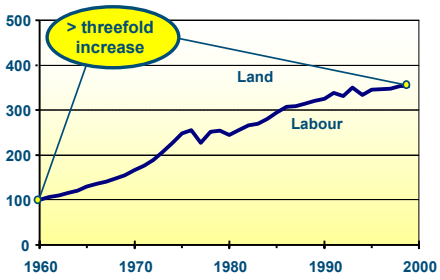
Developments: Costs of labour



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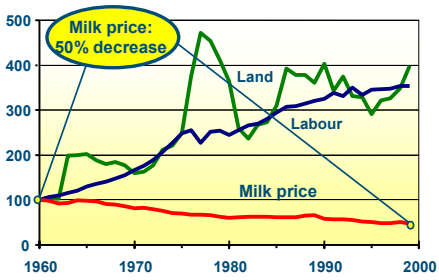
Developments: Price of milk



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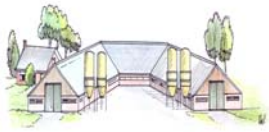
Past decades

- Prices of labour and land increased
- Milk price decreased



Productivity per manhour and per ha has to increase !

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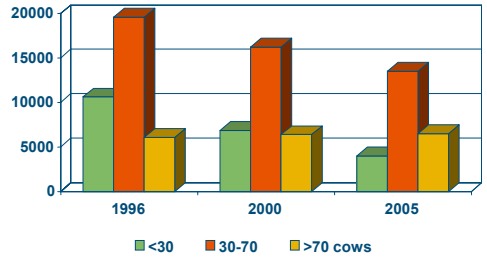
Farm size structure (NL)



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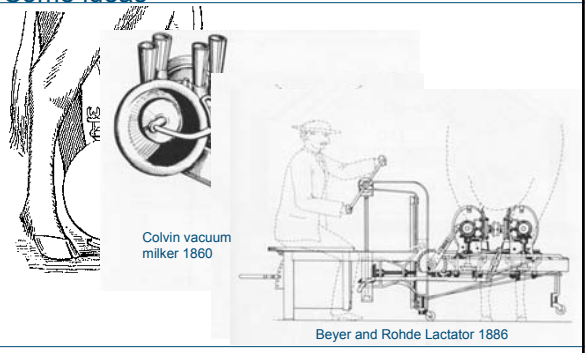
Innovations to improve milk harvesting

- Developments
- Milk harvesting systems
- Automatic Milking Systems
- Experiences in Europe
- Concluding remarks

Milk harvesting: history

- Milking cows 3000 BC
  - Manual labour
- 19th century
  - Industrial development
  - Lack of labour / increased labour costs
  - First ideas to milk cows mechanically
  - Several approaches
  - Invention of liner and pulsator

Some ideas



Colvin vacuum milker 1860

Beyer and Rohde Lactator 1886

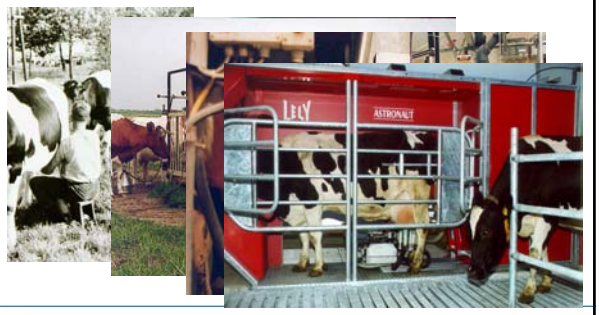
Milk harvesting: history

20th century – introduction milking machines

Focus on increasing capacity per manhour

- Bucket milking machines
- Pipe line systems
- Bulk tanks
- Milking parlours
- Automation (ID, ACR, sensors)
- Automatic milking

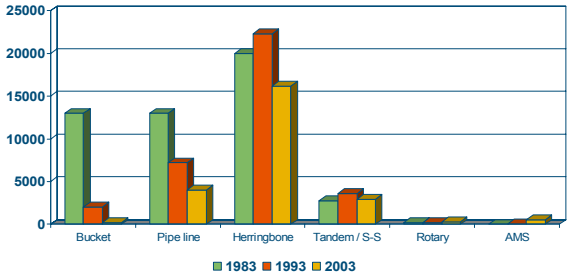
50 years development in dairying



Current milk harvesting systems

- Focus on productivity per manhour
- Use of technology
  - ACR and other ancillary equipment
  - Machine settings
  - Sensors and computer technology
- Rapid exit systems
- Design parlour / waiting area
- Cost / benefit analysis

Number of milking Systems (NL)



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Share of milking systems in NL (%)

Milking System	1983		
Bucket	26.3		
Pipe line	27.3		
Herringbone	40.4		
Side by Side/Tandem	5.6		
Rotary	0.4		
AMS	0.0		
Nr of farms	**49500**		

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Share of milking systems in NL (%)

Milking System	1983	1993	
Bucket	26.3	5.3	
Pipe line	27.3	21.1	
Herringbone	40.4	62.7	
Side by Side/Tandem	5.6	10.1	
Rotary	0.4	0.6	
AMS	0.0	0.04	
Nr of farms	**49500**	**35540**	

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Share of milking systems in NL (%)

Milking System	1983	1993	2003
Bucket	26.3	5.3	0.8
Pipe line	27.3	21.1	14.4
Herringbone	40.4	62.7	68.6
Side by Side/Tandem	5.6	10.1	12.5
Rotary	0.4	0.6	1.3
AMS	0.0	0.04	2.4
Nr of farms	**49500**	**35540**	**23595**

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Typical Dutch milking parlour

- One man milking system
- 2 * 6 herringbone parlour
- 12 clusters
- Maximum milking time 1,5 hours
- Low level milk line
- Automatic cluster removers
- (Electronic) milk meters
- PC management system
- Concentrate feeders / TMR feeding

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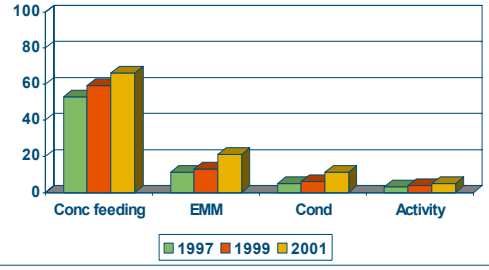
Computer systems (farms > 30 cows (2001)



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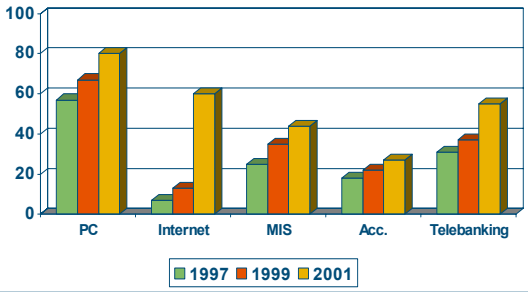
Use of computer technology (farms > 30 cows)



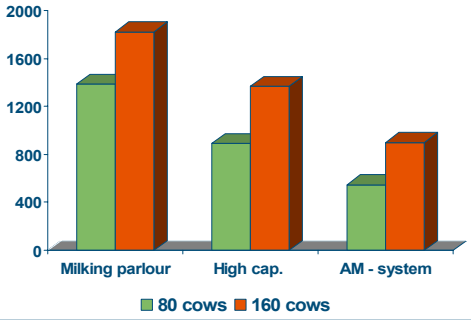
High capacity milking parlours

- Limited time per cow available
- Udder pre-treatment
  - Cleaning
  - Milk let down
  - Milking routine
- Attachment
- Control
- 120 cows per man hour = 30 seconds per cow
- Faster ≠ better !!

High capacity milking parlours

Parlour or automatic milking?

Labour requirements for milking (h/year)



Innovations to improve milk harvesting

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Automatic milking: History

- First patents early 70's
- First prototypes 1984-1986
- Institutes in Netherlands, Germany, UK, France
- Manufacturers of AM-systems
- Introduction in 1992
- 1992-1997: variable results and experiences
  - some farmers stopped (management, technical problems, milk quality, economical aspects)
  - research, extension, courses

Automatic milking - some historical pictures

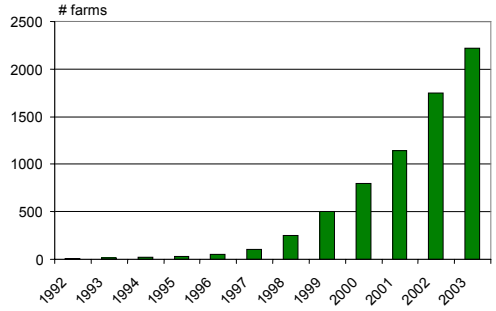
Original Manufacturers of AMS



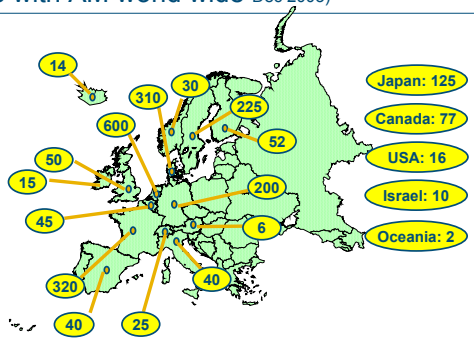
FULLWOOD DeLaval LELY


GEA INSENTEC

Development automatic milking (1992-2003)



Farms with AM world wide Dec 2003)



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Automatic millking in Europe

- First patents early 70's
- First prototypes 1984-1986
- Introduction in 1992
- 1992-1997: variable results and experiences
- Effect on milk quality, farm economy, many questions
- Idea of an integrated research project

Potential Benefits and Concerns

Benefits
- Quality of life
- Labour saving/relief
- Animal welfare
- Udder health

Concerns
- Milk quality
- Economical aspects
- Grazing

EU-project "Implications of automatic milking"

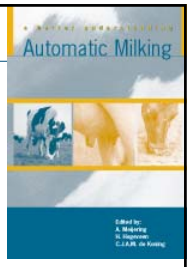
Objectives
- To identify determinants for the adoption of automatic milking
- To assess the implications of the adoption of automatic milking
- To generate solutions for adverse effects
- To disseminate results

From dec 2000 till June 2004

The project work packages

1. Socio-economic aspects
2. Public acceptance
3. Redefinition of acceptable milk quality
4. Milk quality
5. Prevention of antibiotic residues
6. Effectiveness of automatic udder cleaning
7. Optimal cleaning of equipment
8. Health
9. Welfare assessment
10. Grazing
11. Operational management support

Dissemination



- 28 Research reports
- Progress and final reports
- Articles & Presentations
- Web-site www.automaticmilking.nl
- Proceedings Symposium March 24-26, 2004
  Lelystad, The Netherlands

Automatic Milking: consumer's perception

- Not really an issue for consumers (Maris & Roe, 2004)
- General: positive image for milk and dairy
- Consumers worried about food scares and safety in general
- Followed by animal welfare in general
- Automatic Milking: milk quality, animal welfare
- Concerns about grazing

Automatic Milking: Reasons to invest

- Labour reduction: 29%
- Labour flexibility: 27%
- Get rid of hired labour: 15%
- Improving technical parameters: 12%
- Future, challenge: 8%
- Other activities: 9%

Social reasons (67%) > economic reasons (33%)
(Mathijs et al, 2004)

Automatic milking: Economical aspects

- Labour saving ~ 20%
- Variable results
- Depending on:
  - Increase milk yield, labour saving
  - Reference milking system
  - Labour redeployment
- Efficiency of the system
  - Capacity of the system
- Economic results variable

Room for Investment (RFI value)

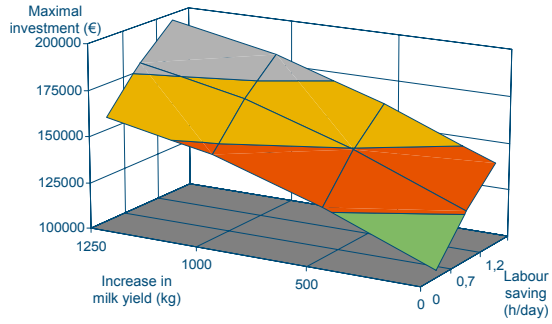
Annual accumulated returns from:

- additional milk +
- labour reduction +
- savings by not investing in a milking parlour

divided by

- Annual costs of an AM-system (depreciation + maintainance in %)

RFI value (20% annual costs)



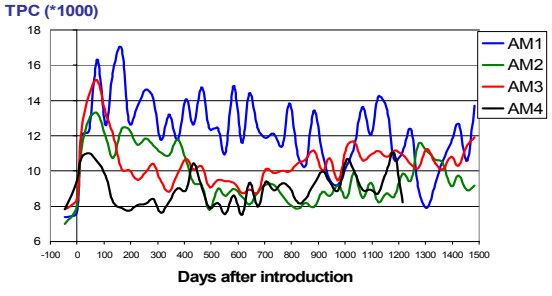
Automatic Milking: Milk Quality

- Milk quality is influenced by AM
- Transition period
- TPC and BMSCC more or less equal
- FFA and FP-levels increase and stay higher
- Other parameters – no differences

- Risk factors found:
  - Technical and management factors
  - Equal to conventional milking

Differences installation dates + 3 years

total plate count (NL)



Automatic Milking: Cleaning procedures

- Same principle
- 2 times versus 3 times cleaning per day
- Small but significant increase in TPC
- Significant increase in Coliform, Psychotrophic and Thermoduric Counts
- Farm effects

Automatic Milking: abnormal milk

Test "State of the Art" (Rasmussen et al, 2004)

- 6 models tested
- Sensitivity ranged from 13 to 50%
- Specificity ranged from 87 to 100%

Conclusion: Current systems are designed to produce alarm lists and are not ready to separate automatically

Impact on Grazing

- Consumers concern in NW Europe
- Different grazing strategies
- Technically possible
- Effect on milking frequency
- Labour requirements
- Less grazing

Impact on management

- Fysical labour replaced by management tasks
- Increased decision-making tasks
- Sensor and computer technology
- Labour reduction ~ 20%
- Work is less time-bound
- Person "on call" at all times
- Herd observation very important

It takes ~6 months to get used to it!

Impact on cows

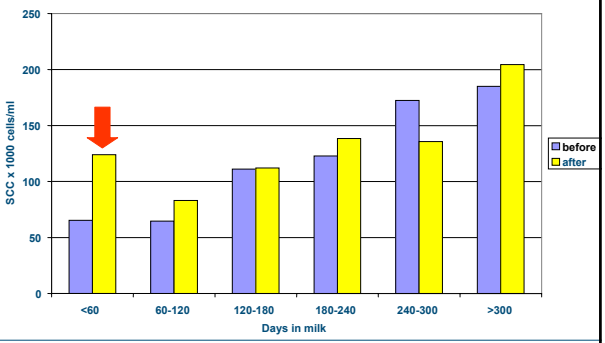
- Max. 5-10 % not suitable
- Voluntary visits at non-regular times needs training
- No effects on health and welfare
- Udder and claw health be monitored
- Feed intake be monitored; roughage be always available
- Urge to fetch cows highly variable
- Increase in milk yield highly variable (-6% to +35%)

Cows get used much faster than the herdsman!

Impact on Animal health

- Studies in 3 countries on 45 farms (Hillerton et al, 2004)
- No major effects (nor negative of positive)
- Period before transition important
- Transition period
  - Fresh cows - 2nd and 3d lactation
  - No problems for heifers
- Risk factors more or less equal to conventional milking

Somatic Cell Counts,
Effect of DIM (Poelarends et al, 2004)



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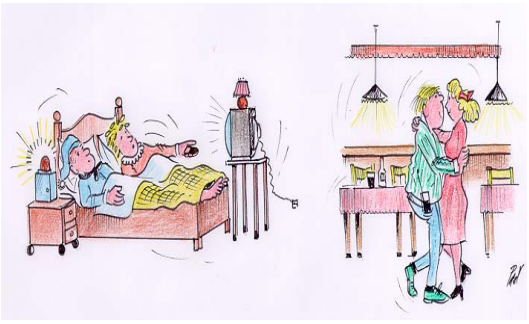
General experiences automatic milking



Future developments

- Labour output and efficiency
- High capacity milking systems vs AM
- Further growth AMS expected
  - Countries with high labour costs, high milk prices
  - Family farms vs. Large farms
- Technical developments / sensor technologies
  - Improved management strategies
  - Integration with feeding systems
- Increased capacity – reduced annual costs

Individual Feeding System

- Individual rations
- Labour reduction
- Effect on yield
- With AM-system and milking parlour

Utilisation of AM-systems

2004

- Europe 0,5 – 5 % market share
- North America : < 0.7 %
- Mainly ‘family farms’, moderate size

2020

- Growth in countries with high labour costs
  - Up to 30-40% in NW Europe
- North America
  - Systems for large farms
- Oceania – new approaches with grazing strategies

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Robots in milking parlour ?

- Pre treatment
- Automatic attachment
- Control / check
- Costs involved
- Market?

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New technologies ?

Source: IceRobotics

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Grazing Strategies – Mobile robots?

Source: Wageningen UR, Animal Sciences Group

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Thanks for your attention