Using sensor data for animal health and welfare improvement workshop

Perspective of a breeding organisation

Gerben de Jong | 25 May 2023

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Introduction

- **Practical case**
  using AMS data measure to derive udder conformation traits
  – example from the Netherlands

- **Other opportunities/traits**

- **Dealing with quality**
  Management vs Genetic evaluation

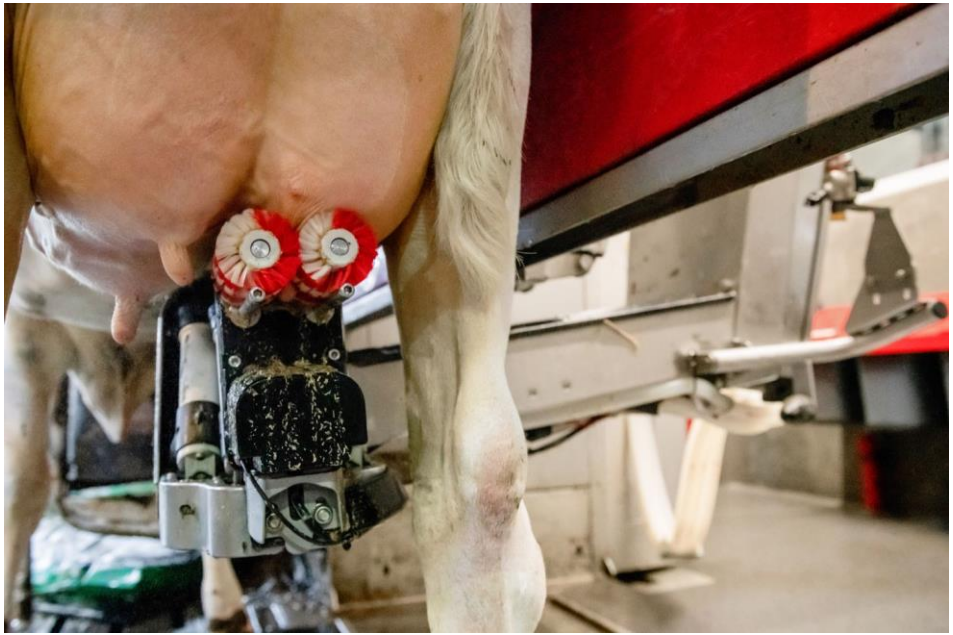
Usage AMS-data deriving udder conformation traits

The Netherlands
4805 farms with AMS (33%)
9825 AMS boxes

JoinData
more than 1,400 farms
Lely
2014 onwards
375,000 milkings per day

More animals
~33% has no information from herd classification
1st + every 20th milking

Data collection



'Achieve better breeding values for udder conformation by using more information'

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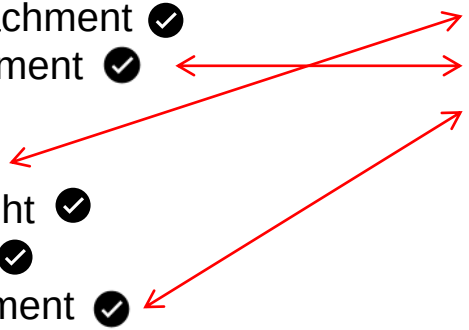
Udder traits

Herd classification

- front udder attachment ✓
- front teat placement ✓
- teat length ✓
- udder depth ✓
- rear udder height ✓
- udder support ✓
- rear teat placement ✓

AMS-data

- udder depth
- distance between front teats
- distance between rear teats
- udder balance ✓



- lactation 1

- divided into lactation 1, 2, and 3
  (4 x 3 traits)

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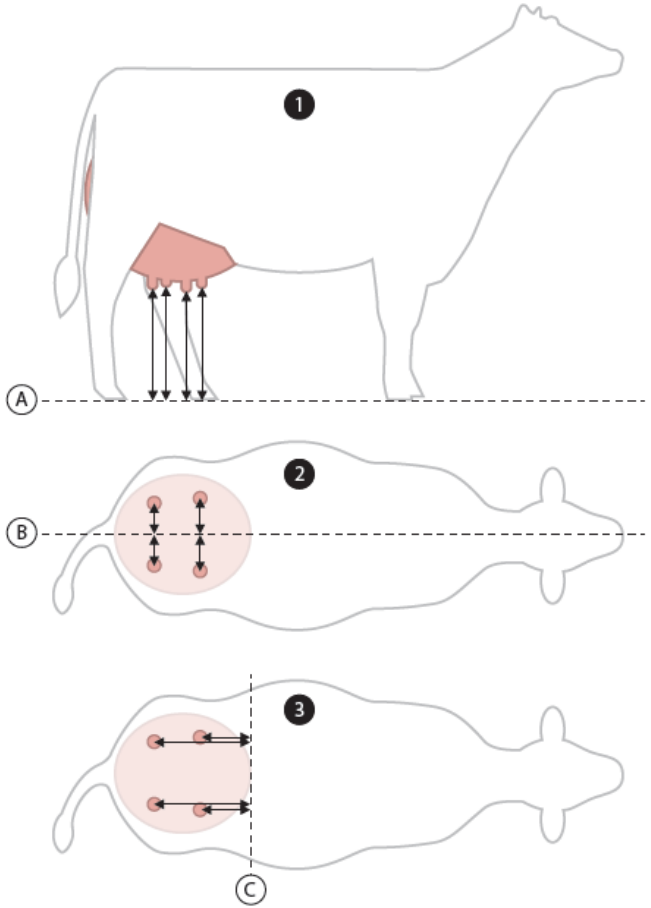
Teat coordinates

Coordinates in millimetres

- Z
- X
- Y



1 Z-coordinates; depth relative to the floor (A)
2 X-coordinates; width relative to midline cow (B)
3 Y-coordinates; length relative to position milking robot arm (C)

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Udder balance

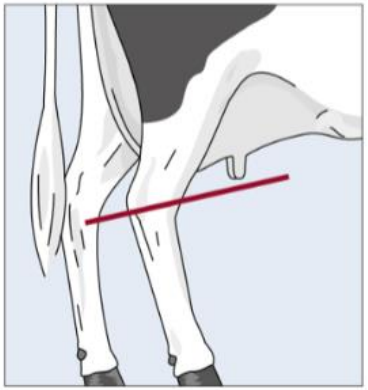
Average difference in udder depth between rear udder and front udder

Higher breeding value = higher rear udder relative to front udder

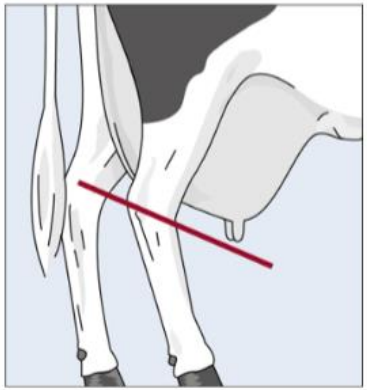
Optimum trait

Moderate correlations with current udder traits

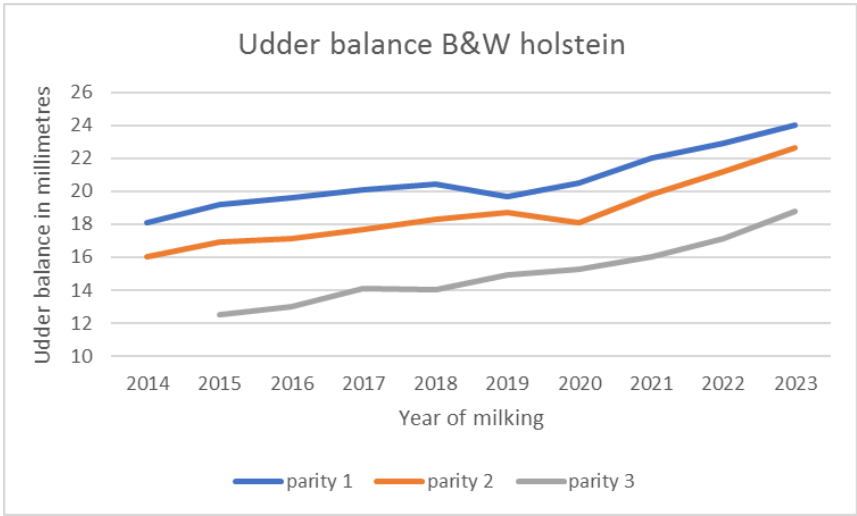
- front udder attachment 0.25
- front teat placement 0.29
- teat length 0.25
- udder depth 0.24
- rear udder height 0.53
- udder support 0.34
- rear teat placement 0.36



Negative udder balance



Positive udder balance



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Heritabilities

Traits based on herd classification	h^2		Traits based on AMS	h^2
front udder attachment	0.25		udder depth 1	0.56
front teat placement	0.31		udder depth 2	0.56
teat length	0.38		udder depth 3	0.52
udder depth	0.39		distance front teats 1	0.60
rear udder height	0.26		distance front teats 2	0.53
udder support	0.22		distance front teats 3	0.45
rear teat placement	0.29		distance rear teats 1	0.45
			distance rear teats 2	0.38
			distance rear teats 3	0.33
			udder balance 1	0.45
			udder balance 2	0.42
			udder balance 3	0.43

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Genetic correlations

Between traits based on herd classification and AMS data

Trait	parity 1	parity 2	parity 3
udder depth	0.98	0.97	0.97
front teat placement	0.98	0.98	0.97
rear teat placement	0.99	0.99	0.96

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Reliabilities

Trait	Reliability current EBV	Reliability new EBV	Difference in reliability	Correlation
front udder attachment	78.1	81.7	3.6	0.98
front teat placement	78.7	82.7	4.0	0.97
teat length	81.3	81.7	0.4	0.99
udder depth	81.4	83.9	2.5	0.98
rear udder height	77.1	78.6	1.5	0.99
udder support	75.3	79.2	3.9	0.97
rear teat placement	77.8	81.8	4.0	0.97

*bulls born from 2010 onwards

*difference between current breeding values and new breeding values is the inclusion of the correlated traits based on AMS data

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AMS data and conformation

- **Opportunity new trait – udder balance**
- **High genetic correlation – same trait as golden standard (classifiers traits)**
- **High heritability – high quality data**
- **Data on more animals – higher reliability bulls proof**
- **Data fast available – first milking instead of first classifier visit**

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Other opportunities traits - AMS

- **Based on AMS:**
  - Milking speed
  - Visit frequency – follow behaviour of cow
  - Milk robot efficiency kg milk/minute box time
  - Habituation – how fast is heifer getting used to visit the AMS

  } breeding values in the Netherlands

  - Failed milkings or interrupted milkings – behaviour
  - Indicator SCC
  - Fat and protein percentages

Other opportunities - conformation

- **Body Condition Score**

- **Images of body : body conformation traits**
  body weight

- **…….**

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Quality data -> Purpose of data/scores

Usage for management vs genetic evaluation

For management higher accuracy and precision is needed

Solved in genetic evaluation by
- Heritabiliy
- Amount of data
- Genetic correlation

Farmers need to rely on the one number/score

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Summary

- **AMS-data can be used easily for genetic evaluation of udder conformation traits**
  - **high quality data**
  - **new traits**

- **AMS data can deliver info on several other existing and new traits**

- **Sensor data can be used for genetic evaluation and selection when:**
  - easily and routinely available
  - relation with trait of interest
  - certain level of accuracy (h2 vs amount of data)