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Derivation of economic values for breeding goal traits in four different production systems (The optimal cow)

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Division of dairy cattle breeding goal?

- **Before the genomic era**
  - Many progeny tested bulls needed for substantial Δ G
  - Big populations needed
  - Break-even correlation appr. 0.85 (Depending on pop. size)
- **Today**
  - Good reference populations needed
    - Much smaller than the number of test daughters needed before
  - Genomic tests cost money
  - Break-even correlation >> 0.85

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Breeding goal - theory

- The ideal way:
  - Derive marginal economic value, keeping the remaining traits constant
- Wolfova and Wolf (2013, Animal)
  - On the issue of double counting
    - Do not include genetic correlations in the derivation
    - Include structural changes in the derivation

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Structural relationships an example

Improved health

Longer lasting cows

The consequence is lower weight on longevity, because the weights is put were it belongs to.

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Breeding goal - practice

- Experience from the NTM work:
  - Interactions between **yield**, **functional traits** and **longevity** are difficult to handle.

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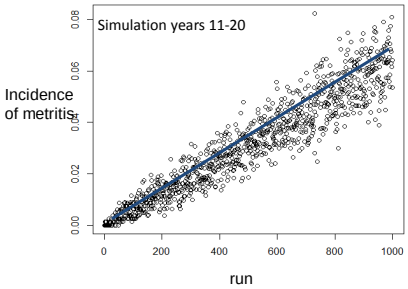
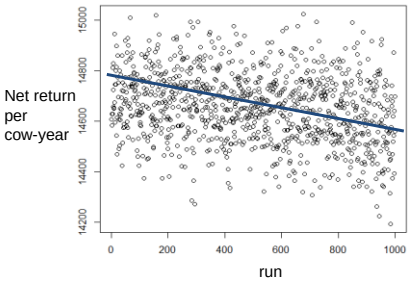
Method

- Mechanistic, dynamic and stochastic simulation in **SimHerd** (Østergård et al., 2014, Østergård et al., 2016 (JDS)
  - Phenotypic correlations included
  - Structural interactions included





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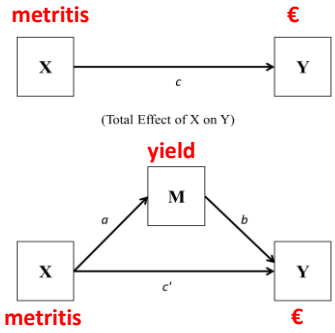
Method



- direct effect of X on Y = c
- indirect effect of X on Y = a * b
- direct effect of X on Y **with the effect of the mediator removed** = c'

Fairchild and MacKinnon, 2009

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Investigated production systems

- Conventional
  - Average Danish, conventional dairy herd in term of production, reproduction and health
- Organic
  - Organic milk level, slightly better health, higher prices for milk and feed
- Environment
  - High management level and use of beef semen to reduce young stock herd
- Hi-Tec
  - High management level due to low disease treatment threshold and automatic heat detection

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Results – Selected traits for HF

Relative economic values across environments within traits

Trait	Conv.	Organic	Hitec	Env.
Yield	100	121	93	98
Feed efficiency	100	123	103	101
Cow mortality	100	102	112	114
Milk fewer	100	338	202	99
Mastitis (infectious)	100	205	109	108
Digetal Dermititis	100	101	81	100
Conception rate, cows	100	48	82	133
Conception rate, heifers	100	110	106	65
Longevity	100	108	121	135

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Explanations - yield

Trait	Conv.	Organic	Hitec	Env.
Yield	100	121	93	98
Feed efficiency	100	123	103	101

- Organic: High EV's because of higher prices for organic milk and higher costs for organic feed

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Explanations - Health

Trait	Conv.	Organic	Hitec	Env.
Milk fewer	100	338	202	99
Mastitis (infectious)	100	205	109	108
Digetal Dermititis	100	101	81	100

- Organic: High EVs due to restrictions on use of antibiotics
- Hitec: High EV for milk fewer because of more older cows

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Explanations - fertility

Trait	Conv.	Organic	Hitec	Env.
Conception rate, cows	100	48	82	133
Conception rate, heifers	100	110	106	65

- Organic: Low EV for conception rate in cows due to high rearing costs
- Organic: High EV for conception rate in heifers, also due to high rearing cost
- Environmental: Low EV for conception rate in heifers because of fewer heifers in this production system

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Explanations - longevity

Trait	Conv.	Organic	Hitec	Env.
Longevity	100	108	121	135

- Hitec: High EV for longevity because older cows are more healthy in this system and therefore they are more valuable.
- Env: High EV for longevity because durable cows are important in order to keep the low replacement rate

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Part conclusions

- The derived EV's are VERY dependent on production assumptions
- The estimated correlations between the four different breeding goals are quite high
- Including farmer preferences may alter this
- Including G*E interactions may alter this

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Heterogeneity in farmer preferences for breeding goal traits - effects of herd characteristics and production system

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Mainly prepared by Margot Slagboom

Undersøgelsen er en del af Organic RDD 2-projektet SOBcows

STØTTET AF promilleafgiftsfonden for landbrug

gudp ICROFS Organic RDD AARHUS UNIVERSITET SEGES NATURMÆLK VIKING RYK NordGen DANSK HOLSTEIN

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Including farmer preferences

Weight in breeding goal = Economic value + Organic preferences

Economic model (Simherd)

The farmer survey

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Why survey to farmers?

- Economic models don't account for everything
  - Organic principles
- Create ownership
  - Ensure the breeding goal reflects farmers' requirements

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This study

- Aim: To quantify preferences of Danish dairy farmers for breeding goal traits and associations to herd characteristics and production system.
- Hypothesis: Heterogeneity exists within farmers' preferences and herd characteristics and production system can be linked to farmers' choices for trait improvements.

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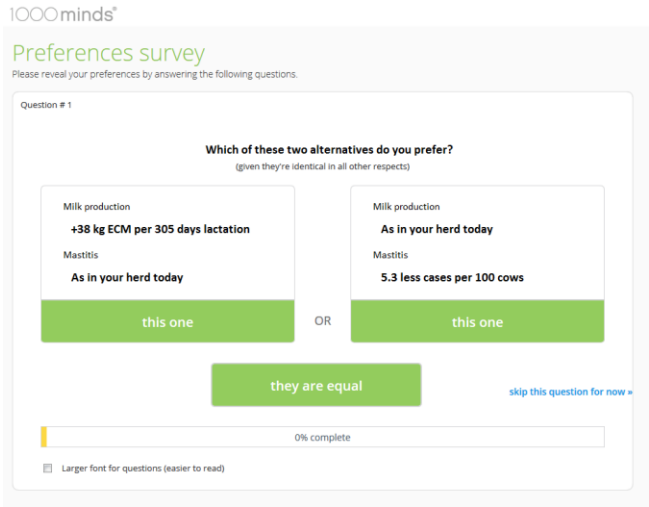
The survey



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The survey

- Improvements are economically equal
- Based on economic weights of simulation study for an organic system

Trait	Holstein	RDM	Jersey	
Feed efficiency	0.010	0.010	0.010	kg ECM per feed unit
Milk production	38	35	33	kg ECM per 305 days lactation
Cow fertility	39	10	8	Additional pregnancies per 100 inseminations
Heifer fertility	11	11	13	Additional pregnancies per 100 inseminations
Calving difficulty	-8.2	-8.6	-8.5	Cases per 100 cows
Mastitis	-5.3	-5.0	-5.1	Cases per 100 cows
Other diseases	-10.1	-10.9	-8.6	Cases per 100 cows
Leg and claw diseases	-13.5	-13.9	-17.9	Cases per 100 cows
Calf mortality	-12	-64	-23	Dead heifer calves per 100 cows
Cow mortality	-1.8	-1.8	-1.7	Cases per 100 cows years

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The survey

- Organic and conventional farmers
- Breed specific survey
  - Holstein, RDM, Jersey

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Response

- Trait rankings per farmer (1 highest - 10 lowest)
- Number of respondents

Herds	Holstein	RDM	Jersey
Organic (48%)	106	29	27
Conventional (13%)	290	58	49
Total (16%)	396	87	76

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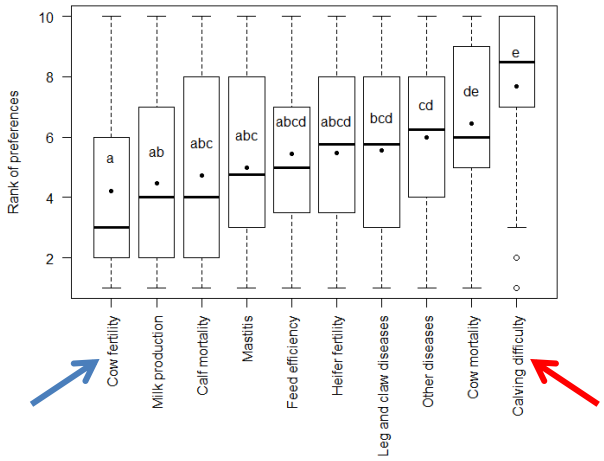
Organic Holstein



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Organic Holstein

- Cluster 1: Robustness
- Cluster 2: Production and mastitis
- Cluster 3: Production and fertility
- All trait ranks different between clusters
- No differences in herd characteristics

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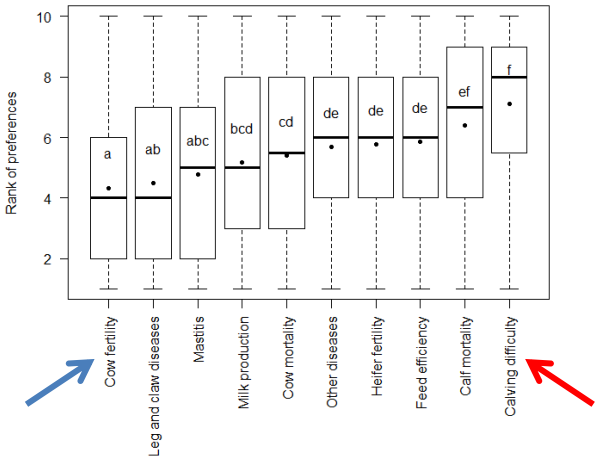
Conventional Holstein



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Conventional Holstein

- Cluster 1: Health
- Cluster 2: Survival
- Cluster 3: Production and fertility
  - Comparable to cluster 3 organic Holstein
- Differences in herd characteristics
  - Statement 4, 5 and 6

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Summary Holstein

- Clear farmer types found
- Roughly the same farmer types for organic, conventional and organic + conventional
- Organic farmers more emphasis on production traits
- Some differences in herd characteristics

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RDM

- Different weights in the survey
  - Based on economic weights for a RDM herd
- 29 Organic herds
- 58 Conventional herds

} Low number of herds!

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Organic and conventional analysed together

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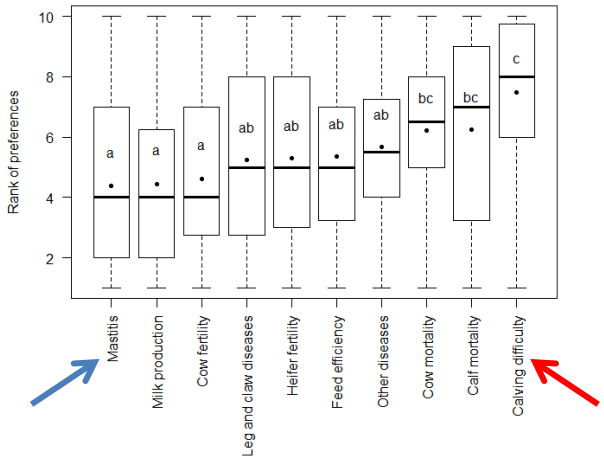
RDM



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RDM

- Cluster 1: Robustness
- Cluster 2: Production and health
- Cluster 3: Production and fertility

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RDM

- Differences in herd characteristics
  - Crossbreeding between dairy breeds
  - ECM
  - Herd size
  - Percentage of organic farmers

More robust cows, more crossbreeding?

Item	All farmers	Cluster 1: Robustness	Cluster 2: Production and health	Cluster 3: Production and fertility	Kruskal-Wallis p-value
Crossbreeding	16%	33%	17%	6%	0.04
ECM	9167	9723	9322	8733	0.01
Herd size	137	153	156	113	0.05
Organic	33%	17%	24%	50%	0.01

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RDM

- Differences in herd characteristics
  - Crossbreeding between dairy breeds
  - ECM
  - Herd size
  - Percentage of organic farmers

Rank production trait the lowest

Item	All farmers	Cluster 1: Robustness	Cluster 2: Production and health	Cluster 3: Production and fertility	Kruskal-Wallis p-value
Crossbreeding	16%	33%	17%	6%	0.04
ECM	9167	9723	9322	8733	0.01
Herd size	137	153	156	113	0.05
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RDM

- Differences in herd characteristics
  - Crossbreeding between dairy breeds
  - ECM
  - Herd size
  - Percentage of organic farmers

Lowest percentage of organic farmers

Item	All farmers	Cluster 1: Robustness	Cluster 2: Production and health	Cluster 3: Production and fertility	Kruskal-Wallis p-value
Crossbreeding	16%	33%	17%	6%	0.04
ECM	9167	9723	9322	8733	0.01
Herd size	137	153	156	113	0.05
Organic	33%	17%	24%	50%	0.01

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Part conclusions

- Heterogeneity exists within farmers' preferences
  - Clear groups of farmers found for all breeds
- Some herd characteristics can be linked to farmer groups
- Production system can be linked to farmer groups

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Overall conclusions

- Improved tools which can be used for making an update/revision of NTM? YES this can in combination with the present excel sheet be used for an update of NTM
- What can be learned from a breeding goal survey? Dairy farmers are diverse. Customised indices an obvious opportunity (– better than minimum selection at herd level).

  Division of breeds in lines require more investigations (e.g. SOBcows)