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

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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
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.
Breeding goal - practice

• Experience from the NTM work:
  – Interactions between yield, functional traits and longevity are difficult to handle.
Method

- Mechanistic, dynamic and stochastic simulation in SimHerd (Østergård et al., 2014, Østergård et al., 2016 (JDS))
  - Phenotypic correlations included
  - Structural interactions included
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
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
## Results – Selected traits for HF
Relative economic values across environments within traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>Conv.</th>
<th>Organic</th>
<th>Hitec</th>
<th>Env.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>100</td>
<td>121</td>
<td>93</td>
<td>98</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>100</td>
<td>123</td>
<td>103</td>
<td>101</td>
</tr>
<tr>
<td>Cow mortality</td>
<td>100</td>
<td>102</td>
<td>112</td>
<td>114</td>
</tr>
<tr>
<td>Milk fewer</td>
<td>100</td>
<td>338</td>
<td>202</td>
<td>99</td>
</tr>
<tr>
<td>Mastitis (infectious)</td>
<td>100</td>
<td>205</td>
<td>109</td>
<td>108</td>
</tr>
<tr>
<td>Digital Dermatitis</td>
<td>100</td>
<td>101</td>
<td>81</td>
<td>100</td>
</tr>
<tr>
<td>Conception rate, cows</td>
<td>100</td>
<td>48</td>
<td>82</td>
<td>133</td>
</tr>
<tr>
<td>Conception rate, heifers</td>
<td>100</td>
<td>110</td>
<td>106</td>
<td>65</td>
</tr>
<tr>
<td>Longevity</td>
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<td>135</td>
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Explanations - yield

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

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

• 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
• YES this can in combination with the present excel sheet be used for an update of NTM
• Division of breeds in lines require more investigations (e.g. SOBcows)
SOBcows
Specialized Organic Breeding goals and Breeding schemes within dairy production

26th of April 2016

M. Kargo, L. Hjortø, M. Slagboom, J. R. Thomasen, A. Buitenhuis, L. Hein, J. Pedersen, A Munk and others
Overall goal

• To enhance the size and the profitability of the organic dairy production
  – By adapting the breeding material to organic production circumstances
  – By indicating sustainable methods for sustainable niche production based on animals with specific genetic characteristics
Definition of organic breeding goals

• Margots presentation
Breeding Schemes

• Can one or more of the breeds be divided in more lines?
  • Are the breeding goals sufficiently different?
  • Are the populations big enough?

• Criteria:
  • Genetic gain
  • Rate of inbreeding
Division of dairy cattle breeding goal?

• **Before the genomic era**
  – Many progeny tested bulls needed for substantial ΔG
  – 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
The drive of genetic gain – before GS

Registered production cows

Number of progeny tested YB

Accuracy

Selection intensity

Anders Christian Sørensen and Jørn Thomasen
Genomic young bull scheme
The drive of genetic gain – using GS

Production cows
Reference population

Genotyped bull calves
GVP

Selection intensity
Accuracy

Anders Christian Sørensen
and Jørn Thomasen
Illustration of line division

United population

Organic

Conventional

Time
Questions to be answered within each breed

- Effect of breeding goal
- Effect of G by E interactions
- Reference population
  - Conventional
  - Conventional and Organic
- Recruitment strategy
  - Conventional
  - Conventional and Organic
WP1 - Status

• Farmer survey finished
• In the process of defining breeding goals based on organic principles
• Gains for different BG will be simulated
• Based on that, BG’ for further simulation will be selected
• Collaboration with SLU, Sweden
WP2

• Breeding values for Health promoting fatty acids
  – Traditional
  – Genomic

• Business plan for organic niche production based on health promoting fatty acids
Application note 64 FOSS

- C14:0
- C16:0
- C18:0
- C18:1
- SFA
- MUFA
- PUFA
- SCFA (C4, C6, C8 & C10)
- MCFA (C12, C14 & C16)
- LCFA (C18 or longer)
- Trans FA

- SFA
  - SCFA
    - C14:0
  - MCFA
    - C16:0
  - LCFA
    - C18:0

- MUFA
- PUFA

- C18:1

- Trans FA
  - App. 2.7%

- n.o.i.
  - Good
  - Bad?
MUFA

Lisa Hein, Lars Peter Sørensen and Jørn Pedersen
Means of fatty acids

Lisa Hein, Lars Peter Sørensen and Jørn Pedersen
WP2

• Review on the value of fatty acids carried out
• Collection of fatty acids content in milk since May 2015
• Strategy for genomic test in place May 2016
• Report on fatty acids – May 2016
• Breeding values for fatty acids August 2016
• To be included in the BG
• Starting work on business plan for milk with health promoting qualities in the autumn
WP3

• 22 heifers of original Danish breeds transferred to 5 Naturmælk herd
  – Still 10 to be moved