The economic value of saved feed in dairy breeding goals

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Background for feed efficiency

• Feed costs account for approximately 88% of the variable farm costs

• Genetic variation is well documented in lactating cattle
The overall aim – Saved Feed

Opportunities:

1. Improve metabolic efficiency
2. Consider maintenance costs
Feed efficiency traits

- Dry matter intake (DMI)
- Residual feed intake (RFI)

Feed intake → Dry matter intake (DMI) → Residual feed intake (RFI) → Feed intake

+ Milk + meat
+ Fetus growth
÷ Feces + urine
÷ Heat losses
÷ Gaseous losses
# Feed efficiency traits – pros and cons

<table>
<thead>
<tr>
<th>Trait</th>
<th>Ability to detect efficient animals</th>
<th>Genetic evaluation</th>
<th>Relation to mobilization</th>
<th>Double counting</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI</td>
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<td>RFI</td>
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However, the overall problem is lack of feed intake records.
**Saved Feed** (mod. of Pryce et al., 2015)

\[
EBV_{\text{Saved Feed}} = V_1 \times EBV_{\text{Maintenance}} + V_2 \times EBV_{\text{RFI}}
\]

- Units of EBV: kg dry matter per annual cow
- For maintenance the economic value = feed price
- But is the economic value of RFI = feed price?
Aim of this project

• Calculate the economic value of RFI
• We simulated the effects of:
  • Variation on feed efficiency
  • The effect of 1 versus 2 RFI traits within lactation
Methods

• Simulations performed in SimHerd (Østergaard et al., 2005)

  › The general framework of SimHerd is **dynamic** (discrete weekly time-stepping)
Methods

- Simulations performed in SimHerd (Østergaard et al., 2005)
  - Discrete events have individual variation at cow level - **stochastic**
Methods

• Simulations performed in SimHerd (Østergaard et al., 2005)

  › The herd performance is simulated conditionally independent of the individual animal, makes the model **mechanistic**
Feed efficiency in SimHerd

- \( \text{RFI} = \text{DMI}^{\text{actual}} - \text{DMI}^{\text{predicted}} \)

- \( \text{DMI}^{\text{actual}} = \frac{((\text{BW}/200+1.5)+\text{fetus growth}+4.0\times\text{ADG}+\text{ECM} \times 0.4)}{\text{Feed efficiency}} \times \text{kg DM/SFU} \)

- \( \text{DMI}^{\text{predicted}} = b_1 \times \text{ECM} + b_2 \times \text{BW}^{0.75} + b_3 \times \Delta \text{BW} \)

› Regression coefficients are from Li et al. (2017)
Simulation setup

- There were four scenarios (A-D):
  
  A. 1 RFI trait in lactation – variance not introduced
  
  B. 1 RFI trait in lactation – variance introduced
  
  C. 2 RFI traits in lactation - variance not introduced
    
    • Threshold at 84 DIM with a correlation of 0.55 between periods
  
  D. 2 RFI traits in lactation - variance introduced

- Each scenario had 5 simulations, where the DMI ranged -2 to 2 kg from mean DMI
Calculating economic values from SimHerd output

• Definition of an economic value (Groen et al., 1997):
  › The profit of one unit change in dry matter while keeping all other traits constant

• Then the economic value of RFI is:

\[
\frac{\text{Profit}_{\text{alternative}} - \text{Profit}_{\text{basic}}}{\text{Level}_{\text{alternative}} \times \text{Cows}_{\text{alternative}} - \text{Level}_{\text{basic}} \times \text{Cow}_{\text{basic}}}
\]
Results and discussion

• The economic value of RFI
  › Varied from 0.16-0.18 €/kg dry matter (P >0.05)
  › Corresponds to applied feed price (0.17 €/kg dry matter)
  › There were a difference in profit per annual cow of 1 versus 2 RFI traits (P <0.001)

• Our results are similar with economic value applied by Kokko (2017)
  › 0.17 €/kg dry matter
Conclusion

• The economic value of RFI corresponds to the applied feed price

 › Method of estimating breeding values is very important!
Perspectives

\[ \text{EBV}^{(\text{Saved Feed})} = V_1 \times \text{EBV}^{(\text{Maintenance})} + V_2 \times \text{EBV}^{(\text{RFI})} \]

- Can be based on current data from practice 😊
- Require feed intake records 😞
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