Estimation of economic values of longevity and other functional traits in Finnish dairy cattle (CG2.25)

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Introduction

- Longevity and functional traits are very important due to economic, environmental and ethical viewpoints
- In Finland, longevity evaluations were introduced in 2003. Longevity is included in total merit index via its components of health and fertility traits, but longevity itself has not been included.
- Productive life of cows shortens every year – Are economic weights of traits influencing longevity too low in total merit index?
- The aim of this study was to evaluate the economic importance of production, fertility, longevity and other functional traits

Material and methods

- Breeds
  - Ayrshire
  - Holstein
- A modified version of the deterministic and dynamic model by Nousiainen et al. (2005) was used
  - bio-economic
  - constant herd size (21 cows)
  - random sampling of replacement cows from life history database (with replacement)
    - derived from Finnish milk recording scheme
    - 34 000 Ayrshire cows
    - 17 000 Holstein cows
  - daily time-stepping
  - accounts the changes in age structure of herds
- Biological traits
  - milk production
    - average solutions of genetic evaluation
  - body weight and growth
    - Richard's growth curve
  - feed consumption (milk recording scheme)
    - feeding recommendations that account both energy and protein requirements were used
  - other traits (disease risks, age at first calving, calving intervals, herd life, inseminations, stillborn calves)
- Economic parameters
  - revenues
    - milk (including subsidies)
    - calves
    - beef
  - costs
    - feed (based on silage, grain mix and rape seed meal)
      - In Finland the price of protein supplement is very high
    - labour
    - veterinary
    - disposal of dead cows
    - insemination
    - building, machinery, interest
    - other costs
- Calculation of economic values

$$EV_i = \frac{P_1 - P_0}{n \cdot (LEVEL_1 - LEVEL_0)}$$

EV_i = economic value of the trait i (€/unit)
P_1 = farm profit after genetic change (€)
P_0 = farm profit for basic situation (€)
n = number of cows per year
$LEVEL_1$ = level of trait after genetic change (unit)
$LEVEL_0$ = level of trait in basic situation (unit)

► **Random sampling** ► **Calculations of biological variables** ► **Summary of biological traits** ► **Economic calculations**

Results

	unit	AYRSHIRE €/unit	AYRSHIRE σ_{EBV}	AYRSHIRE €/σ_{EBV}	AYRSHIRE %	HOLSTEIN €/unit	HOLSTEIN σ_{EBV}	HOLSTEIN €/σ_{EBV}	HOLSTEIN %
Production traits:									
Milk	kg	**0.13**	498	**65**	*23.4*	**0.12**	570	**70**	*21.6*
Fat	kg	**3.40**	22.8	**77**	*27.8*	**3.10**	23.0	**71**	*22.0*
Protein	kg	**3.73**	14.6	**54**	*19.5*	**3.61**	17.4	**63**	*19.4*
Fertility traits:									
Days open	d	**-1.22**	7.0	**-9**	*3.1*	**-1.71**	7.6	**-13**	*4.0*
Fertility treatments	%	**-0.69**	1.8	**-1**	*0.4*	**-0.70**	2.2	**-2**	*0.5*
Functional traits:									
Productive herd life	d	**0.67**	65	**43**	*15.6*	**1.12**	65	**73**	*22.4*
Cell count	1000 cells/ml	**-0.19**	30	**-6**	*2.1*	**-0.33**	27	**-9**	*2.8*
Mastitis treatments	%	**-3.43**	5.4	**-18**	*6.6*	**-3.46**	5.6	**-19**	*6.0*
Other treatments	%	**-1.47**	2.8	**-4**	*1.5*	**-1.45**	3.0	**-4**	*1.3*

σ_{EBV} = standard deviation of estimated breeding value

- The economic value of increased milk production when fat and protein yields are kept constant was 0.12 – 0.13 €/kg. This is positive because in calculations about 30 % of the milk price (inc. subsidies) comes from liquid. When converted to energy corrected milk the economic value was 0.37 (Holstein) – 0.39 (Ayrshire) €/kg. This is slightly more than 0.36 €/kg reported by Kulak et al. (2004).
- Within milk production traits the value of fat was higher than the value of protein or milk liquid. This was unexpected result when the price of milk protein is 2.6 times higher than the price of fat. Extra fat production increases energy requirement which leads to lower need for protein supplementation!
- If the value of herd life 0.67 €/day is converted to culling rate, it is 2.5 times higher than the value 7.3 €/% estimated by Kulak et al. (2004). For Holstein breed the value was significantly higher.

Conclusion

- Pricing principles of milk, feed costs and different energy and protein requirements and their relationships influence the calculations of economic values of production traits
- The highest economic value per σ_{EBV} was for fat yield – caused by very low production cost of fat compared to protein
- ► Dairies should reconsider their pricing policies
- Value of fertility and health traits was greatly reduced compared to earlier Finnish studies of economic values (Voutilainen and Juga, 1998) because of replacement costs were allocated to herd life
- Productive herd life had very high economic value per σ_{EBV}. This might be caused by treating all replacement costs as variable costs.

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Photo: Tiina Tahvonen

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Photo: Sakari Äijö

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- Model
  - deterministic and dynamic model at farm level
  - constant herd size (21 cows)
  - random sampling of replacement cows from life history database (with replacement)
    - derived from Finnish milk recording scheme
  - daily time-stepping
- Biological traits
  - milk production (average solutions of genetic evaluation)
  - body weight and growth (Richard's growth curve)
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  - other traits (disease risks, age at first calving, calving intervals, herd life, inseminations, stillborn calves)
- Economic parameters
  - revenues (milk, calves, beef)
  - costs (feed, labour, veterinary, disposal of dead cows, insemination, building, machinery, interest, other costs)

► **Random sampling** ► **Calculations of biological variables** ► **Summary of biological traits** ► **Economic calculations**

Results

		AYRSHIRE				HOLSTEIN			
	unit	€/unit	σ_{EBV}	€/σ_{EBV}	%	€/unit	σ_{EBV}	€/σ_{EBV}	%
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- Value of fertility and health traits is greatly reduced when replacement costs allocated to herd life