Nordic Total Merit Index (NTM)

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Nordic Cattle Genetic Evaluation

Sweden
138.000 SRB
157.000 HF

Finland
156.000 FAY
71.000 HF

Denmark
40.000 RDM
362.000 HF
58.000 Jersey

NAV

NAV

Established 01.01.2002 by:

Faba breeding

Swedish Dairy Association

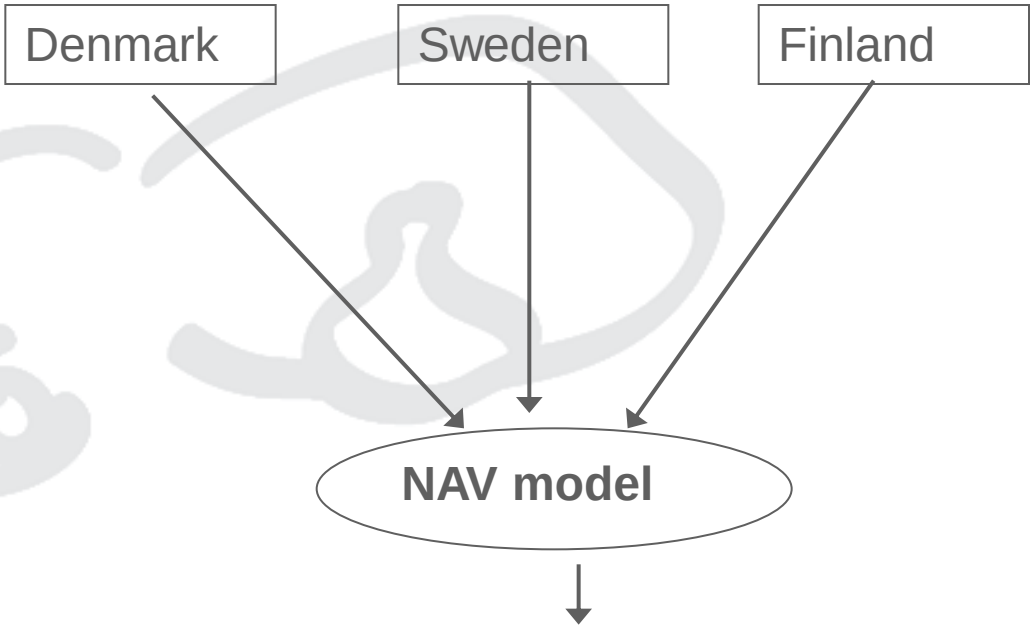
Danish Cattle

Nordic Cattle Genetic Evaluation - history

- 2002 - Established
- 2002 – Development has started
- 2005 – first EBVs published – type, milk ability, temperament and fertility
- 2006 – Yield and mastitis
- 2007 – Calving
- 2008 – Other diseases and NTM(Nordic Total Merit)
- 2009 – Growth
- 2010 - Longevity

Genetic evaluation

Data



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NAV- EBVs

Joint ranking of animals

- **Expressed on rolling ”cow base” – mean 100**
- **Expressed with a standard deviation of 10**

Joint EBVs a basis for a joint TMI

Process – joint Nordic breeding goal

Economic basis 2007

(Best possible estimates for the current economic situation in Finland, Sweden and Denmark)

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Expectations for the future – traits getting bigger/smaller value 5-10 years ahead

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Joint Nordic Breeding Goal

Total Merit Index

- Most efficient way to weigh economic important traits together
- Maximizes genetic/economic progress

Total Merit Indices - history

- 1975-1985 TMI- introduced in Nordic countries including production and functional traits
- 1985-2007 TMI's in Nordic countries gradually improved more traits – better methods
- 1990-2000 TMI – based on few traits popular in many countries
- 2008 Joint Nordic TMI – called NTM
- Today – everyone see the need for having a TMI including all economic important traits

Economic values

The value of one unit improvement in the trait – keeping the remaining traits constant

- **Future production circumstances**
  5 – 10 years ahead

Nordic Total Merit Index (NTM)

Three step procedure:

1) Economic values for single traits 2007-2008

44 single traits – single conformation traits not included

- Based on "current" situation (Spring 2007) !!

2) Breeding goal adjustments 2008

Input from breed organisations and others on

- *Perspective for the future*
- *"Non-economic" value*

3) Implementation in practice ultimo 2008

Economic basis - survey of traits analysed

- **Yield:** Milk, Protein and Fat production
- **Beef production:** Net daily gain, EUROP form score
- **Calving traits:** Calf vitality and calving ease
- **Fertility:** Periods Calving to 1st AI, 1st to last, Number of AI's
- **Udder health:** Frequency of mastitis and SCC
- **Other health traits:** Metabolic, Feet & legs, reproductive diseases
- **Longevity**
- **Conformation:** Body, Feet& legs, Udder
- **Milking speed, Temperament**

Method:
Economic profit model

- Deterministic data simulation (Excel – farm accounting)
- Results expressed as: Marginal profit per cow per year
- Many assumptions: Economic, technical, biological

Method:
Economic profit model

Strengths

- Transparency – interactions can be understood
- Possible to run many alternatives

Method:
Economic profit model

Shortcomings

- **Insufficient modelling of cow culling process**
- **All cow replacement costs attached to longevity**

  ”repaired” by transfer of value from longevity

Production scenarios (countries) and breed groups

	RDC	Holstein	Jersey
DNK	RDM	HOL	JER
SWE	SRB	HOL	
FIN*	AYS	HOL	

* For Finland both a southern and northern scenarios was considered

Production scenarios and breed groups

Basic levels per breed and country, e.g.

- **Weight, Calving age, Yield**
- **Stillbirth rate, Calving difficulty**
- **Fertility, Frequency of diseases**

Milk production traits

Results depend on:

- **Sales value of milk – marginal feed costs**
- **Distribution of 1st, 2nd and later lactations**
- **Lactation yield of culled cows and staying cows**
- **Calving age, calving interval, days dry**
- **Milk used for calf feed**
- **Milk discarded due to diseases**

Input examples

Assumed average phenotypic milk production, 305 day yield (kg)

	RDM DNK	SRB SWE	AYS FIN	HOL DNK	HOL SWE	HOL FIN	JER DNK
Milk, 1st lact.	7217	7755	7477	7808	8558	7995	5345
Milk, 2nd lact.	7891	8470	8528	8863	9843	9162	6006
Milk, 3rd lact.	8212	8790	8902	9239	10074	9648	6246
Protein, 1st lact.	**254**	**271**	**258**	**260**	**284**	**268**	**214**
Protein, 2nd lact.	280	296	293	299	326	309	247
Protein, 3rd lact.	289	303	300	308	331	320	255
Fat, 1st lact.	303	335	320	317	337	311	313
Fat, 2nd lact.	333	363	361	361	389	356	355
Fat, 3rd lact.	346	377	377	379	403	378	371

Input examples

Assumed average phenotypic culling rates within lactations

	RDM DNK	SRB SWE	AYS FIN	HOL DNK	HOL SWE	HOL FIN	JER DNK
1st lact.	33 %	34 %	25 %	30 %	31 %	25 %	29 %
2nd lact.	38 %	39 %	35 %	40 %	40 %	35 %	34 %
3rd+ lact.	43 %	44 %	50 %	50 %	50 %	50 %	39 %

Results:
€ / kg standard milk

	DNK	SWE	FIN	Average
RDC	0.17	0.17	0.23	**0.19**
HOL	0.17	0.17	0.21	**0.18**
JER	0.16			**0.16**

Comments to yield results

- DNK and SWE value of yield is very similar
- FIN south value of yield is slightly larger than DNK and SWE
  - FIN south is the larger part of Finland
  - Northern Finland has an even larger value

Fertility

Fertility traits evaluated:

- First to last AI for heifers and cows
- Number of AI's for heifers and cows
- Calving to first AI for cows

Factors of importance

- AI Costs
- Work (AI and heat surveillance)
- Beef production profit (extra calves)
- Milk production profit (extra milk production)

Not included: Cost of off-season calving

Economic value
Mastitis and other diseases

Breeding value of “Frequency of 1st cases”

- 1st, 2nd and 3rd lactation

Value depend on:

- Total number of cases (number of repeated treatments)
- Cost of veterinary treatment
- Extra work
- Discarded milk

Longevity

Effects

- Distribution of lactations and milk production
- Number of calving per year (beef production)

70% of variation in longevity is explained by fertility, udder health, other diseases, conformation of udder and of feet &legs

A perfect model would distribute value to these traits

Sensitivity analyses

- Sales value of milk increased by 10%
- Feed cost was increased by 10%
- Sales value of beef was increased by 10%
- Price differences between EUROP form classes was increased by 10%
- Value of pregnant heifer was reduced to the slaughter value
- Labour costs was increased by 10%
- Veterinarian cost was increased by 10%
- 20€ was added to cost per insemination

Sensitivity analyses

- Sales value of milk increased by 10%
  - EV Yield: + 16 - 18%
  - EV Fertility: slightly up
  - EV Udder health: + 2-3%
- Feed cost was increased by 10%
  - EV Yield: - 7-8%
- Sales value of beef was increased by 10%
  - EV Daily gain: Approx. + 30%
  - EV stillborn: Approx. + 10%
  - EV longevity: Approx - 6%

Sensitivity analyses

- EUROP form value increased by 10%
  - EV EUROP form score: + 10%

- Value of pregnant heifer reduced
  - EV stillborn: - 30 to 40% (Jersey more)
  - EV fertility: - 50 to 70%
  - EV longevity: Approx - 50%

- Labour cost increased by 10%
  - EV of functional traits: + 2 to 4%
  - EV conformation: + 10%

Sensitivity analyses

- Veterinarian cost increased by 10%
  - EV calving ease: + 5 to 7%
  - EV disease traits: + 5 to 7%
- Cost per AI increased by 20 EURO
  - EV first to last ins: + 30 to 40%

Index weights from model

Trait	HOL	RDC
Yield	1.00	**1.00**
Growth	0.08	**0.11**
Fertility	0.41 (0.32)	0.28 (0.23)
Calving - direct	0.20	0.15
Calving - maternal	0.22	0.13
Udder health	0.46 (0.35)	0.34 (0.29)
Other health	0.16 (0.11)	0.13 (0.10)
Body	0.00	0.00
Feet & legs	0.10 (0.04)	0.07 (0.06)
Udder	0.12 (0.09)	0.14 (0.09)
Milking speed	0.11	0.07
Temperament	0.04	0.03
Longevity	0.15 (0.49)	0.09 (0.28)

(Figures before redistribution of values for longevity)

Process – joint Nordic breeding goal

Economic basis 2007

Best possible estimates for the current economic situation in Finland, Sweden and Denmark

We did not find very big country differences

(Work done by project group of geneticists)

Process – joint Nordic breeding goal

Expectations for the future – traits getting bigger/smaller value 5-10 years ahead

- Like looking in the crystal ball
- Signals about economic, animal welfare, future rules for keeping cows, ethical views etc.

Process – joint Nordic breeding goal

Joint Nordic Breeding Goal

- Final decisions made at a workshop involving representatives from all Nordic Breeding organizations
- Result - NTM-index close to the theoretical recommendations

Index weights from model and NTM (scaled)

Trait	HOL		RDC	
	Model	NTM	Model	NTM
Yield	0.75	0.75	0.92	0.92
Growth	0.06	0.06	0.10	0.00
Fertility	0.31	0.31	0.26	0.26
Calving - direct	0.15	0.15	0.14	0.14
Calving - maternal	0.17	0.17	0.12	0.12
Udder health	0.35	0.35	0.31	0.32
Other health	0.12	0.12	0.12	0.12
Body	0.00	0.00	0.00	0.00
Feet & legs	0.08	0.15	0.06	0.09
Udder	0.09	0.18	0.13	0.32
Milking speed	0.08	0.08	0.06	0.06
Temperament	0.03	0.03	0.03	0.03
Longevity	0.11	0.11	0.08	0.08

Gain from NTM for HOL

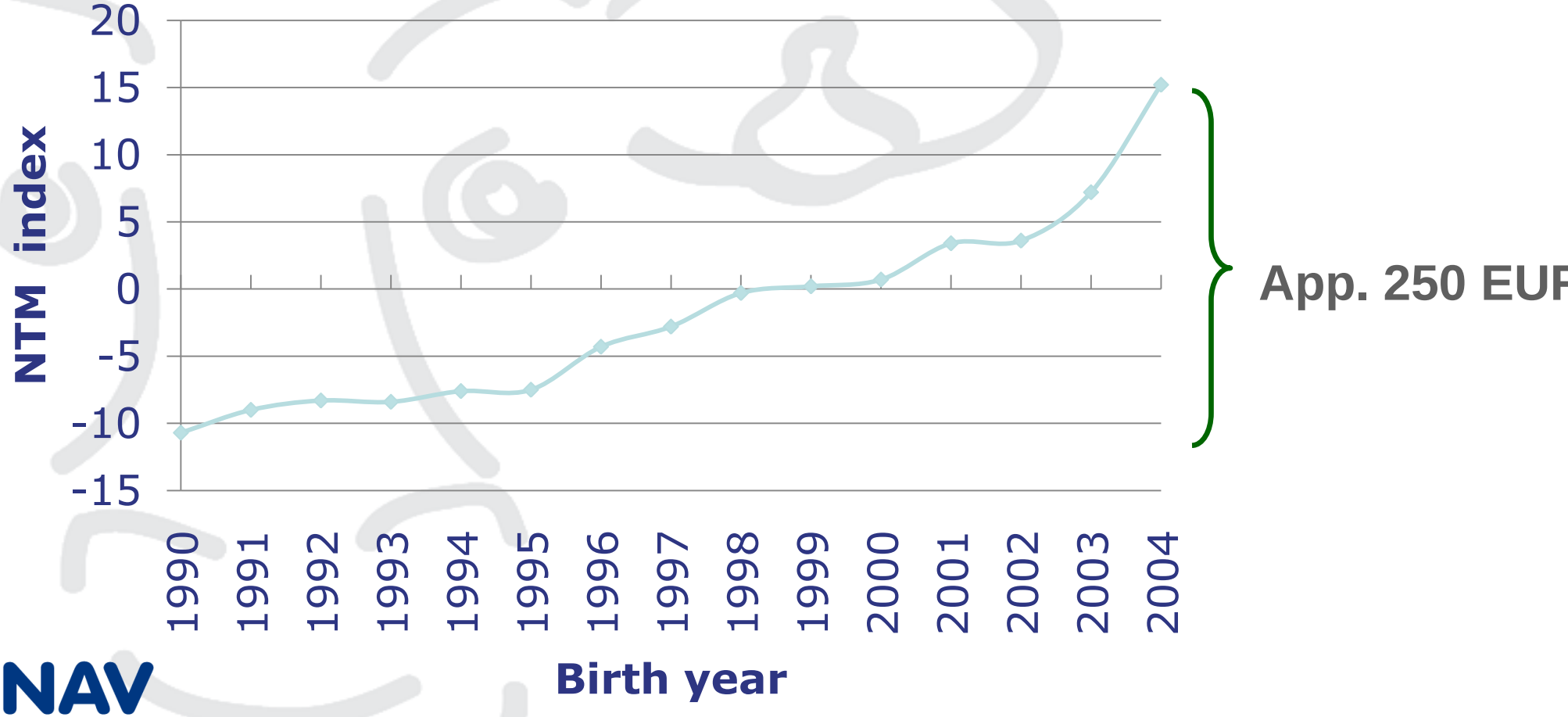
Correlations between EBV's for AI bulls born 2001-2003

Trait	Correlation with NTM
Yield	0.49
Growth	0.00
Fertility	0.39
Calving - direct	0.28
Calving - maternal	0.37
Udder health	0.46
Other health	0.47
Body	-0.04
Feet & legs	0.12
Udder	0.40
Milking speed	0.09
Temperament	0.03
Longevity	0.51

Economic value of one NTM unit per cow year

HOL	10.2 EURO
RDC	9.1 EURO
JER	7.8 EURO

Genetic trend for HOL



NAV

Nordisk Avlsværdi Vurdering • Nordic Cattle Genetic Evaluation

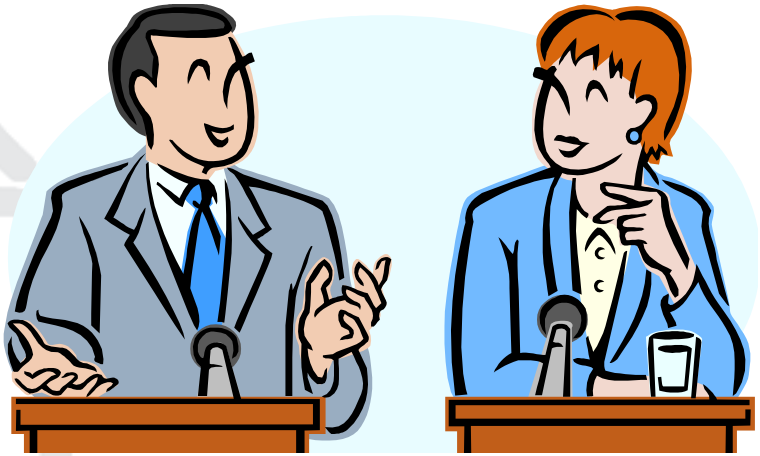
Overall aim of NTM

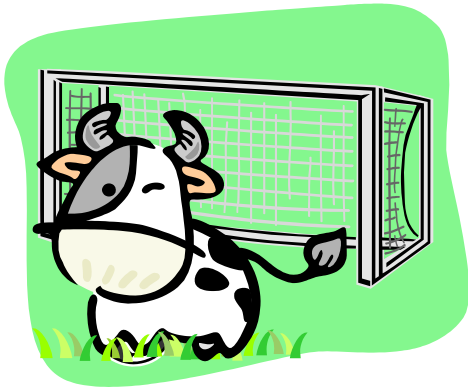
- High yielding cow
- Improved genetic level for functional traits – health & fertility
- Leads to improved longevity and economically enhanced dairy cows

Fullfilled!!

More information:
http://www.nordicebv.info/Publications/

Joint Nordic Breeding Goal – a positive debate lead to the NTM





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