# Health, Longevity and Economic Merit Key Words in the Nordic Cattle Breeding Goal

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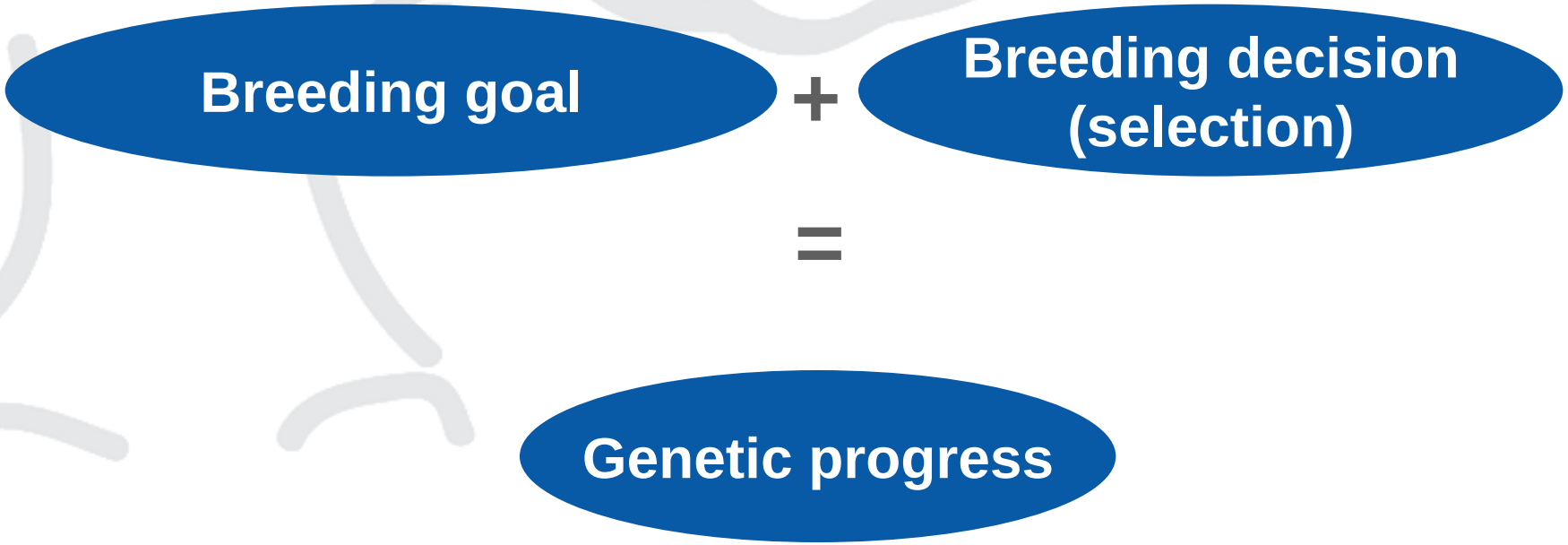
# How to achieve genetic progress?



# Total Merit Index

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

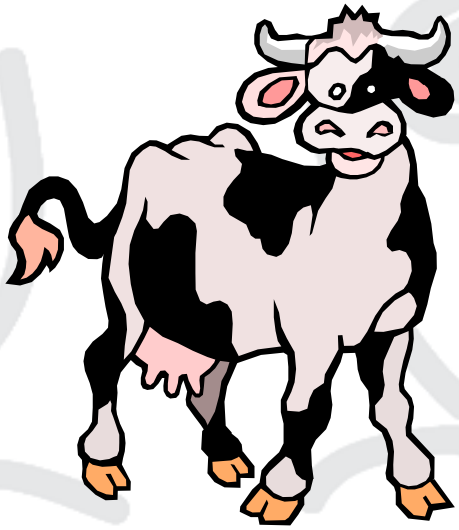
# Economic values

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

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

# Breeding goal

## Get maximum economic gain



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# Total Merit Indices - history

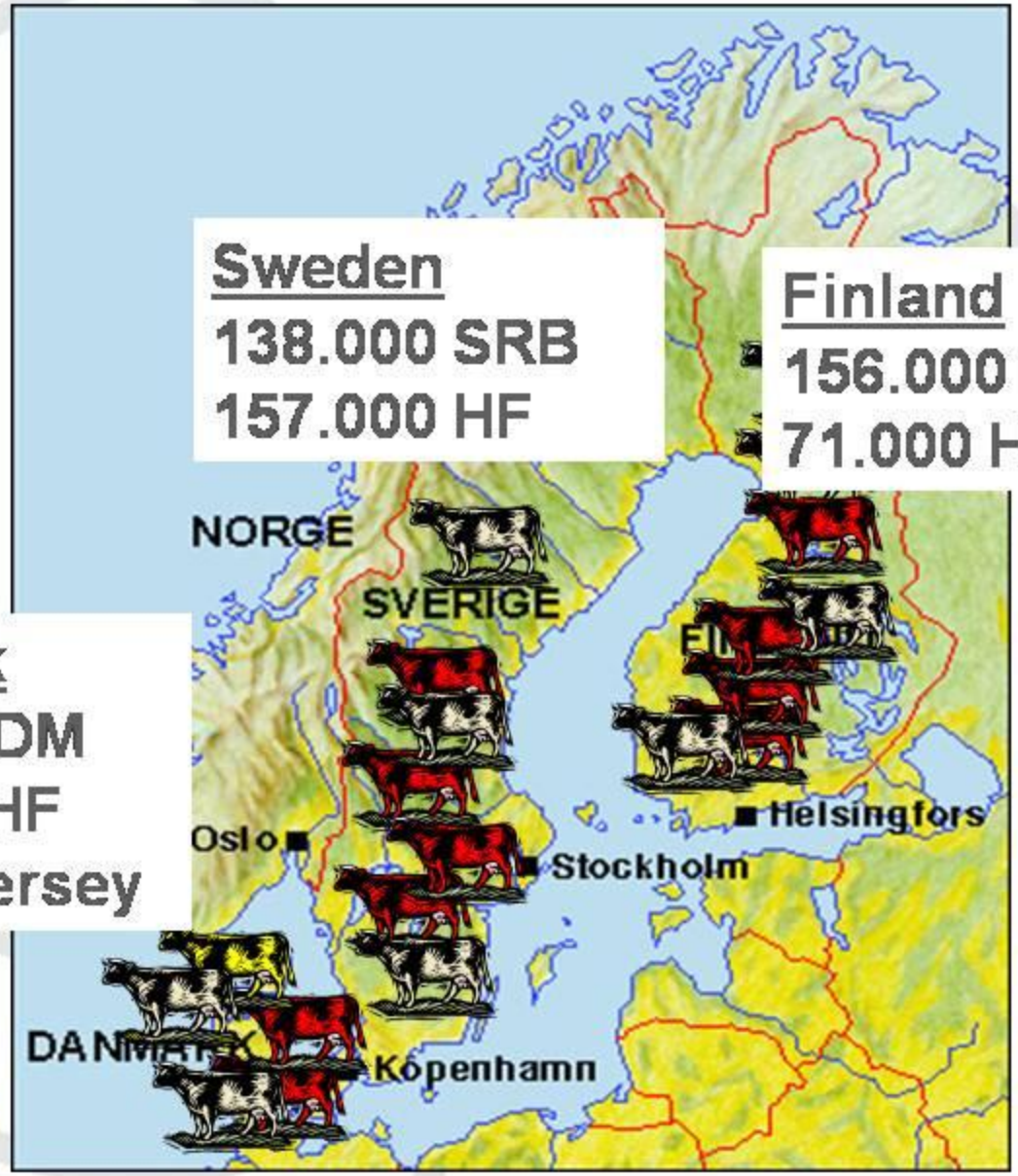
- 1975-1985 TMI- Introduced in Nordic countries including production and functional traits
- 1985-2007 TMI's in Nordic countries gradually improved more traits – better methods
- 1990-2000 TMI – based on few traits popular in many countries
- 2008 Joint Nordic TMI – called NTM
- Today – everyone see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

# 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

Nordisk Avlsværdi Vurdering • Nordic Cattle Genetic Evaluation

# 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

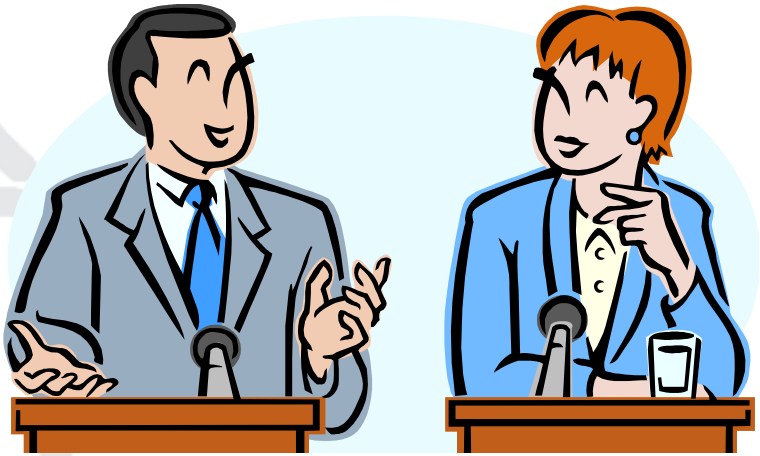
**2007** Calving

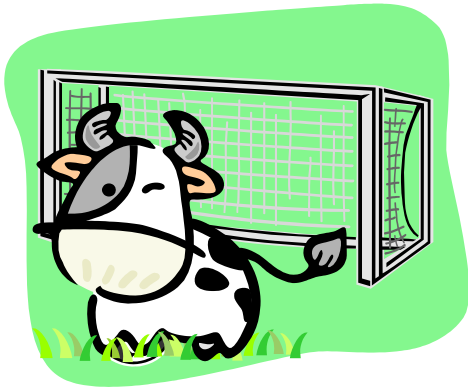
**2008** Other disease and Total Merit Index (NTM)

# Joint Nordic Breeding Goal

- Driven by a wish from NCGE
- AI-company across borderlines

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





# Process – joint Nordic breeding goal

**Economic basis 2007**

**+**

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

**=**

**Joint Nordic Breeding Goal**

# 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**

# Economic value of milk production traits

## 305-day breeding values (9 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***

# 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

# 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

# Use of economic values

**If estimated breeding values (EBV) and economic weights are calculated at the same absolute scale (e.g. kg, % units)**

**Then**

**The weights to be given to the EBVs are the economic values on the absolute scale**

**But**

**Our EBVs are presented as indices standardised to a standard deviation of 10**

# The index weights therefore depends on:

- **Economic values (e.g. these calculated with the TMI program) for the traits included in the index**
- **Standardisation factor**
  - **Heritability for the traits included in the index**
  - **Number of measurement included in the index**

| Trait | Index weights for NTM |
|---|---|
| Yield | 0.75 |
| Growth | 0.06 |
| Fertility | 0.31 |
| Birth | 0.15 |
| Calving | 0.17 |
| Udder health | 0.35 |
| Other diseases | 0.12 |
| Body | 0.00 |
| Feet & legs | 0.15 |
| Udder | 0.18 |
| Milk ability | 0.08 |
| Temperament | 0.03 |
| Longevity | 0.11 |

| Trait | Index weights | Basis 2007 |
|---|---|---|
| Yield | 0.75 | 0.75 |
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| Udder health | 0.35 | 0.35 |
| Other diseases | 0.12 | 0.12 |
| Body | 0.00 | 0.00 |
| Feet & legs | 0.15 | 0.08 |
| Udder | 0.18 | 0.09 |
| Milk ability | 0.08 | 0.08 |
| Temperament | 0.03 | 0.03 |
| Longevity | 0.11 | 0.11 |

# NTM - Holstein

- **Overall aim NTM:**
  - **High yielding cow**
  - **Improved genetic level for functional traits – health & fertility**
  - **Leads to improved longevity**

| Trait | Correlation with NTM |
|---|---|
| Yield | 0.49 |
| Growth | 0.00 |
| Fertility | 0.39 |
| Birth | 0.28 |
| Calving | 0.37 |
| Udder health | 0.46 |
| Other diseases | 0.47 |
| Body | -0.04 |
| Feet & legs | 0.12 |
| Udder | 0.40 |
| Milk ability | 0.09 |
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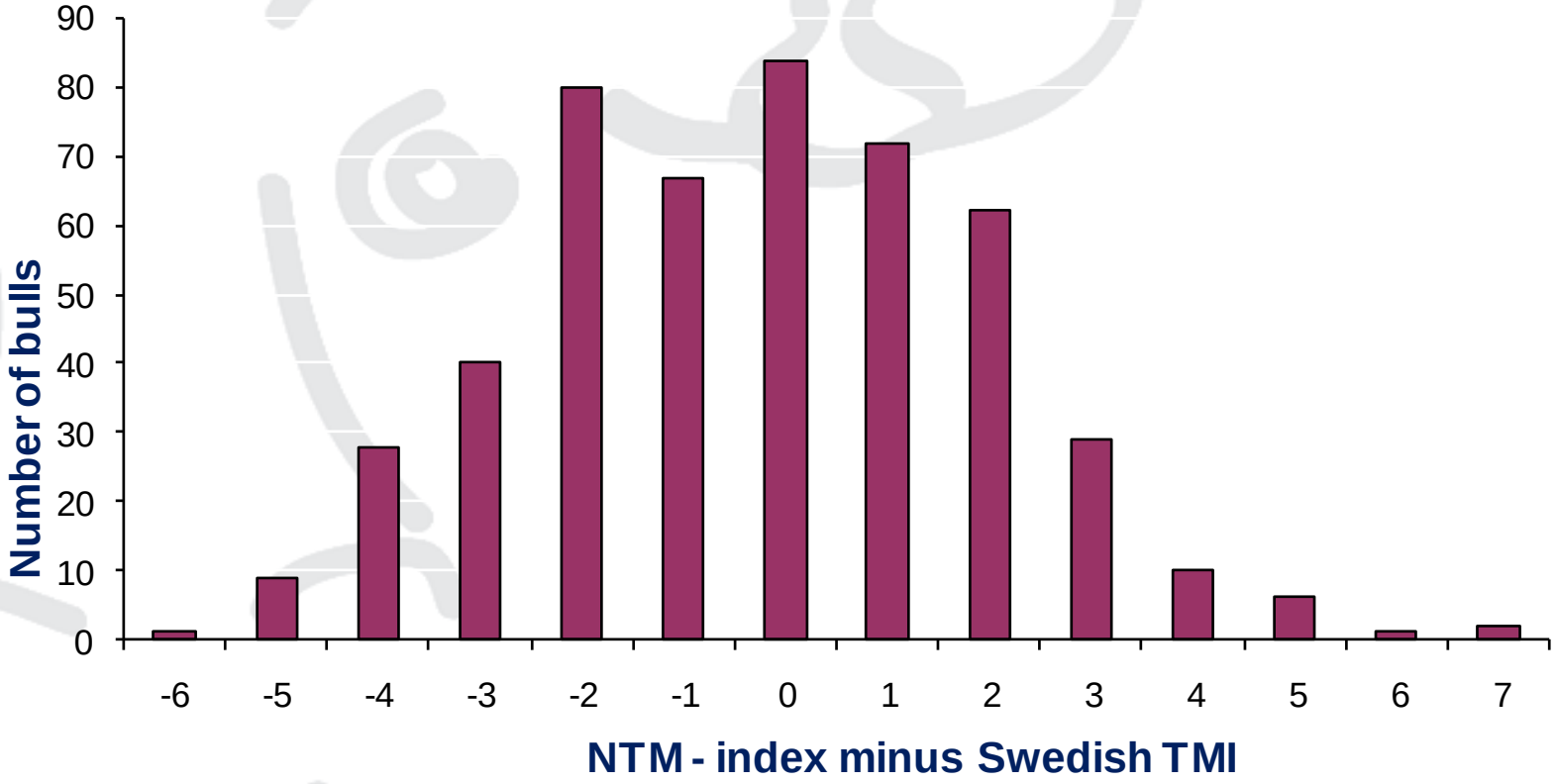
# Changes in TMI EBVs for 491 Swedish Holstein bulls born 1999-2003



| Trait | Economic value of an index unit, € |
|---|---|
| Yield | 7.61 |
| Growth | 0.61 |
| Fertility | 3.12 |
| Birth | 1.52 |
| Calving | 1.67 |
| Udder health | 3.50 |
| Other diseases | 1.22 |
| Body | 0.00 |
| Feet & legs | 1.52 |
| Udder | 1.83 |
| Milk ability | 0.84 |
| Temperament | 0.30 |
| Longevity | 1.14 |
| NTM | 10.15 |

# Economic value of an average progeny group

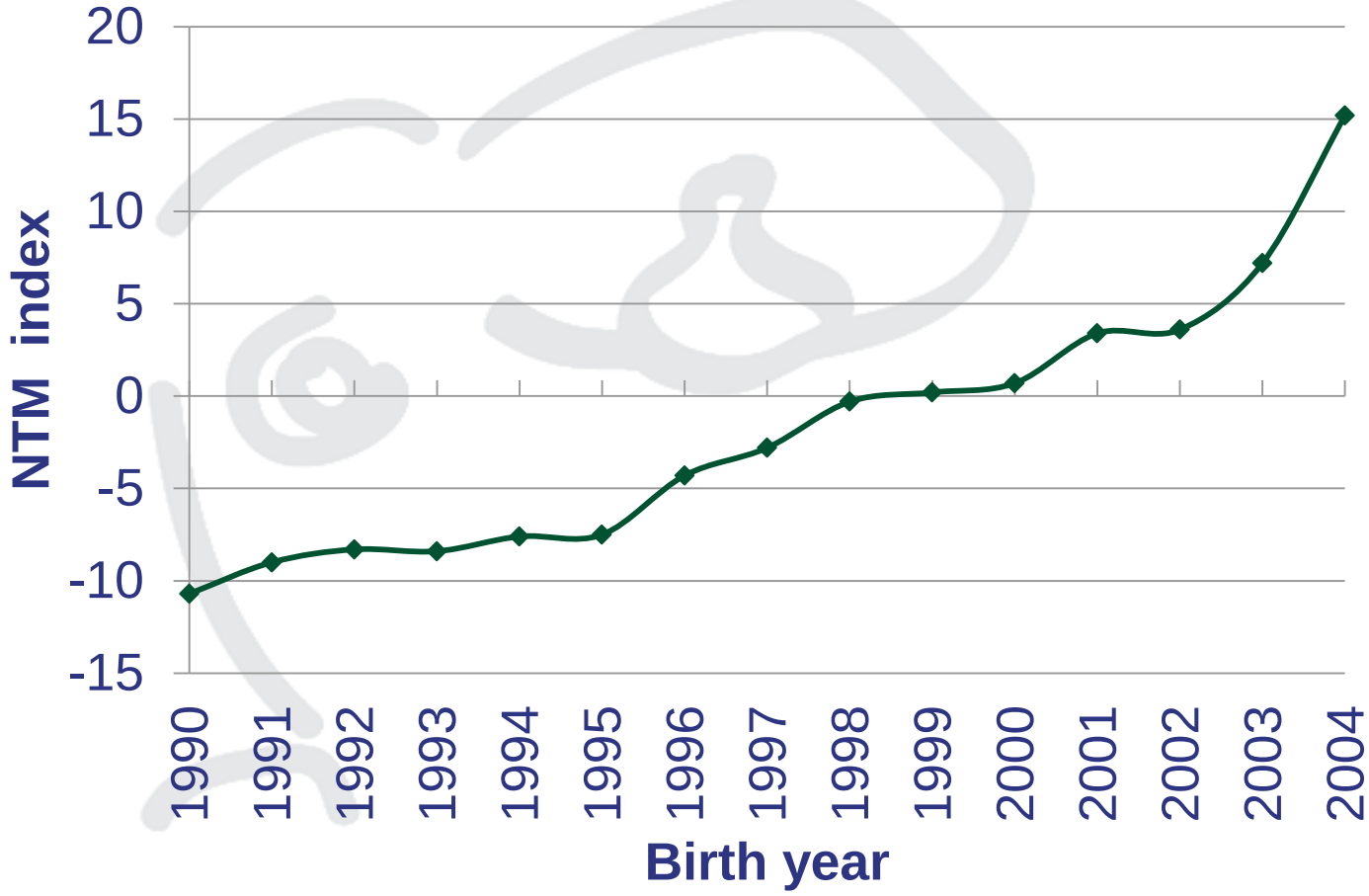
- **The value of one NTM index unit for a an average progeny is 10.15 €**

- **Comparing two Holstein bulls with a difference of 10 NTM units, the extra value of an average progeny of the best bull is 101.5 € (10*10.15 €)**

# Economic value of heifers

- The value of one NTM index unit for a female is 20.29 € (2*10.15€)
- Comparing two Holstein heifers with a difference of 10 NTM units, the extra value of the best heifer is 202.9 € (10*20.29 €)

# Genetic trend NTM



# Value of genetic progress

- **The value of the genetic progress from 1993-2003 is about 300 Euro per female**

# Future outlook
# Breeding goal and Genomic Selection

- The Br ding goal is the same with and witho ic selection

but:

- The composition o progress is different
  - More progress for functional traits r ld and type traits
  - More progress for later lactation traits relative to 1. lactation traits

Genomic selection can give a more balanced genetic progress

# Future outlook - Genomic selection
## Reliability of EBVs

| Trait | DGV* Birth | Cow-3 year | Bull – 5 year |
|---|---|---|---|
| Yield | 55% | 50% | 90% |
| Fertility | 56% | 22% (PI) | 70% |
| Mastitis | 50% | 25% (PI) | 75% |

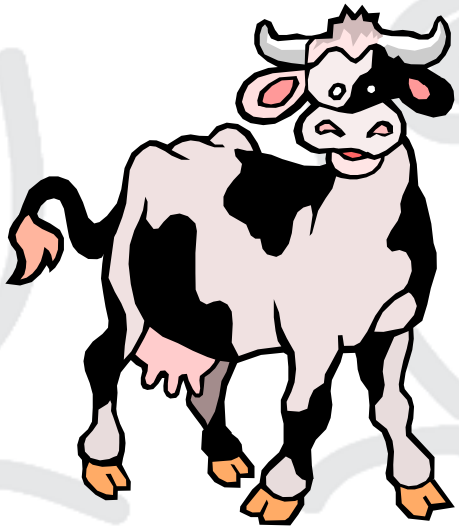
*Lund & Su, 2009

**Note the ratio between reliabilities:**

**Yield versus functional traits**

# Breeding goal

## Get maximum economic gain



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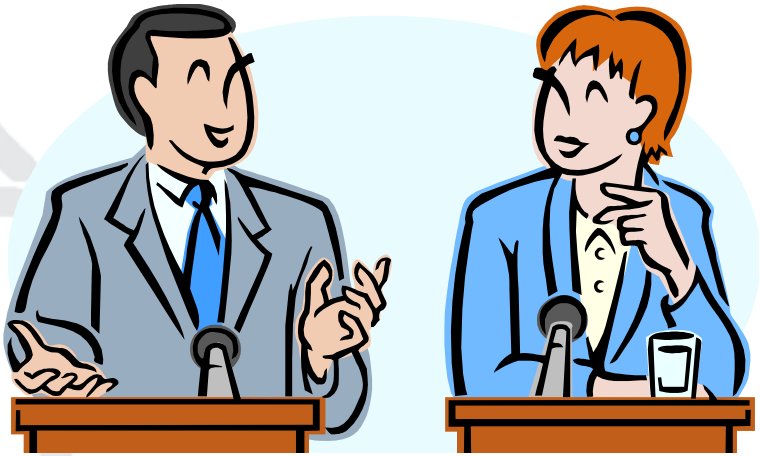
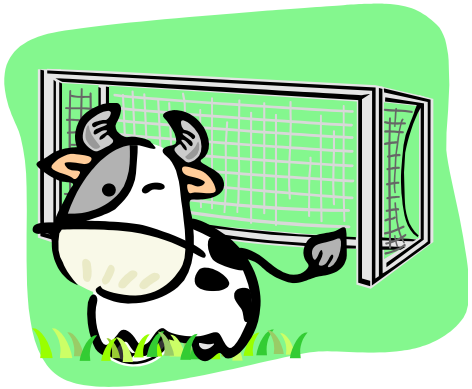
# Joint Nordic Breeding Goal – a positive debate lead to the NTM





# Joint Nordic Breeding Goal - NTM

- High yielding cow
- Improved functional traits – health & fertility
- Improved longevity