

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

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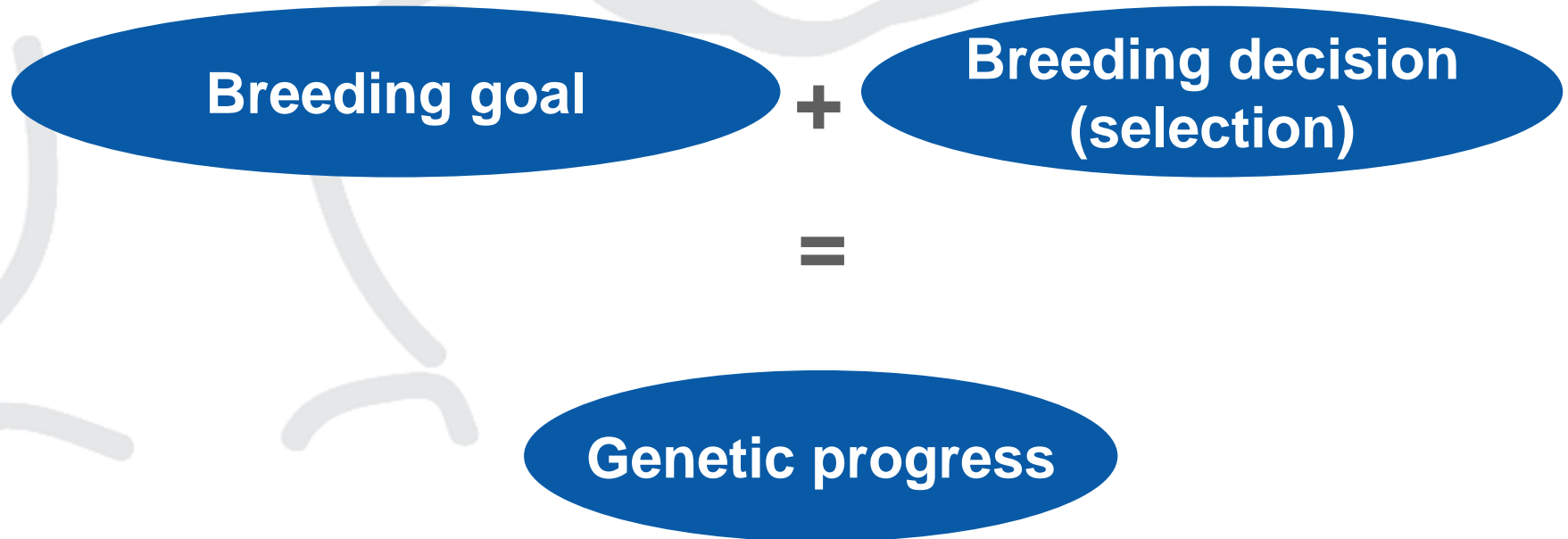
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How to achieve genetic progress?



Total Merit Index

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

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Economic values

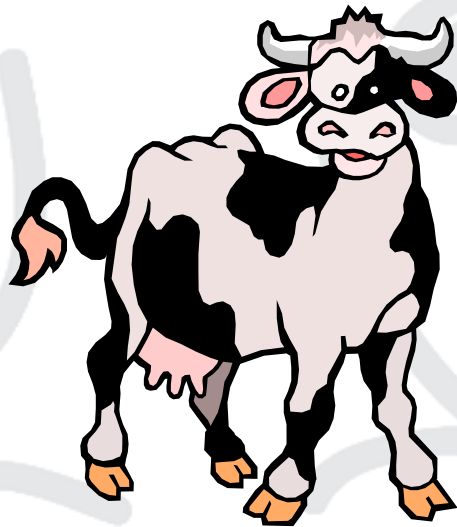
The value of one unit improvement in the trait – keeping the remaining traits constant

- **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

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Sweden

138.000 SRB

157.000 HF

Finland

156.000 FAY

71.000 HF

NORGE

SVERIGE

FINLAND

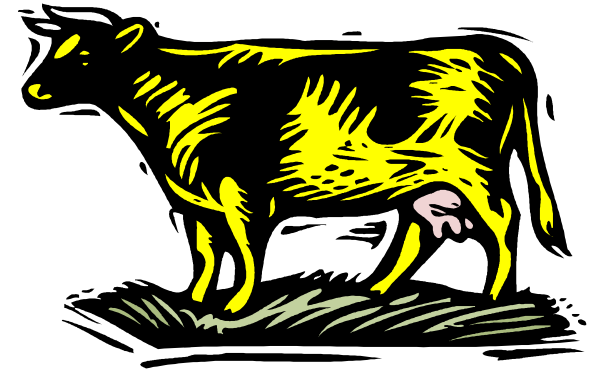
Oslo

Stockholm

Helsingfors

DANMARK

København



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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)

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Joint Nordic Breeding Goal



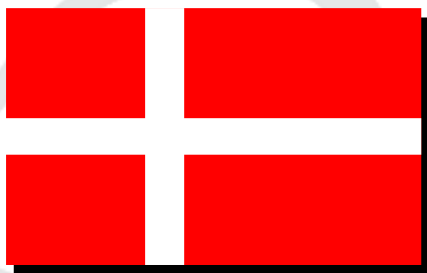
- Driven by a wish from NCGE
- AI-company across borderlines

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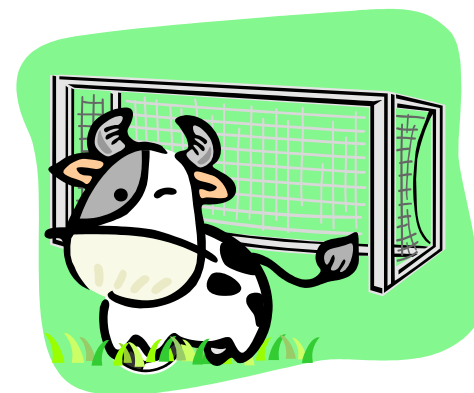
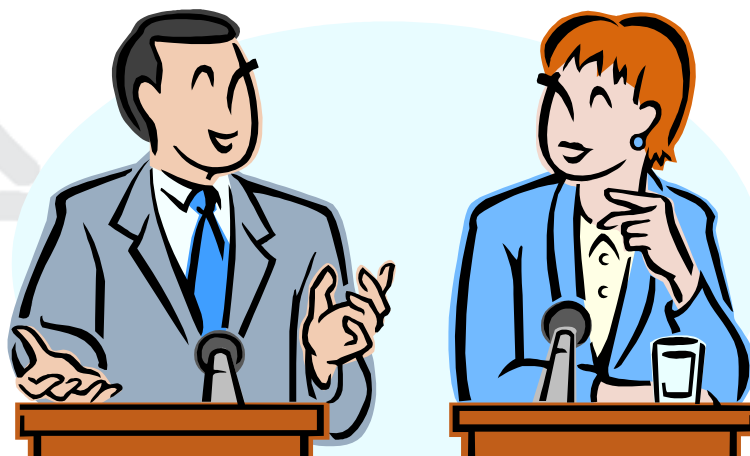


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Joint Nordic Breeding Goal – a positive debate lead to the NTM



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Process – joint Nordic breeding goal

Economic basis 2007

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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



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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**

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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)**



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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.



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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



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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

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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
Growth	0.06	0.06
Fertility	0.31	0.31
Birth	0.15	0.15
Calving	0.17	0.17
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

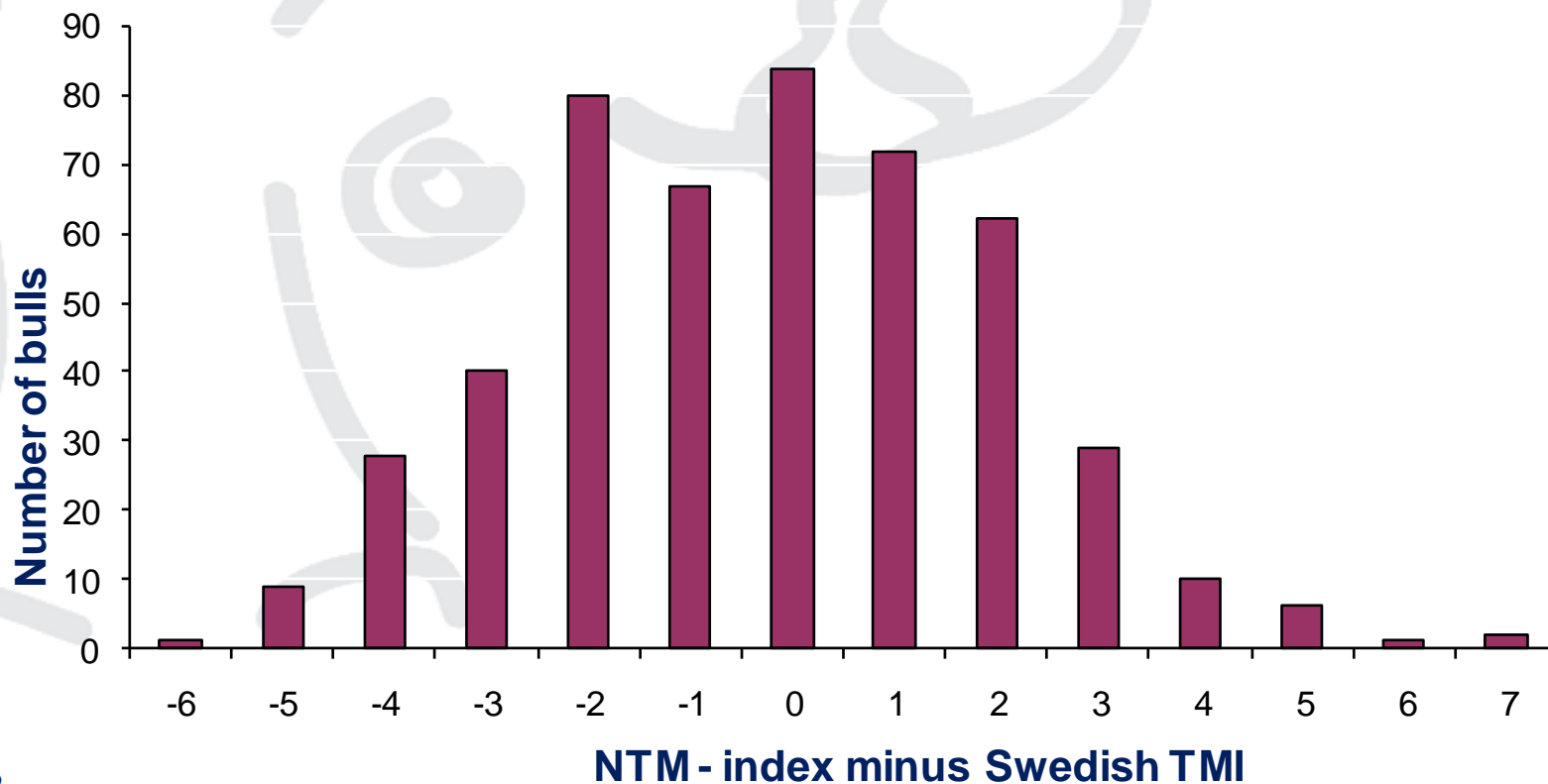
Trait	Correlation with NTM
Yield	0.49
Growth	0.00
Fertility	0.39
Birth	0.28
Calving	0.37
Udder health	0.46
Other diseases	0.47
Body	-0.04
Feet & legs	0.12
Udder	0.40
Milk ability	0.09
Temperament	0.03
Longevity	0.51

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Changes in TMI EBVs for 491 Swedish Holstein bulls born 1999-2003



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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

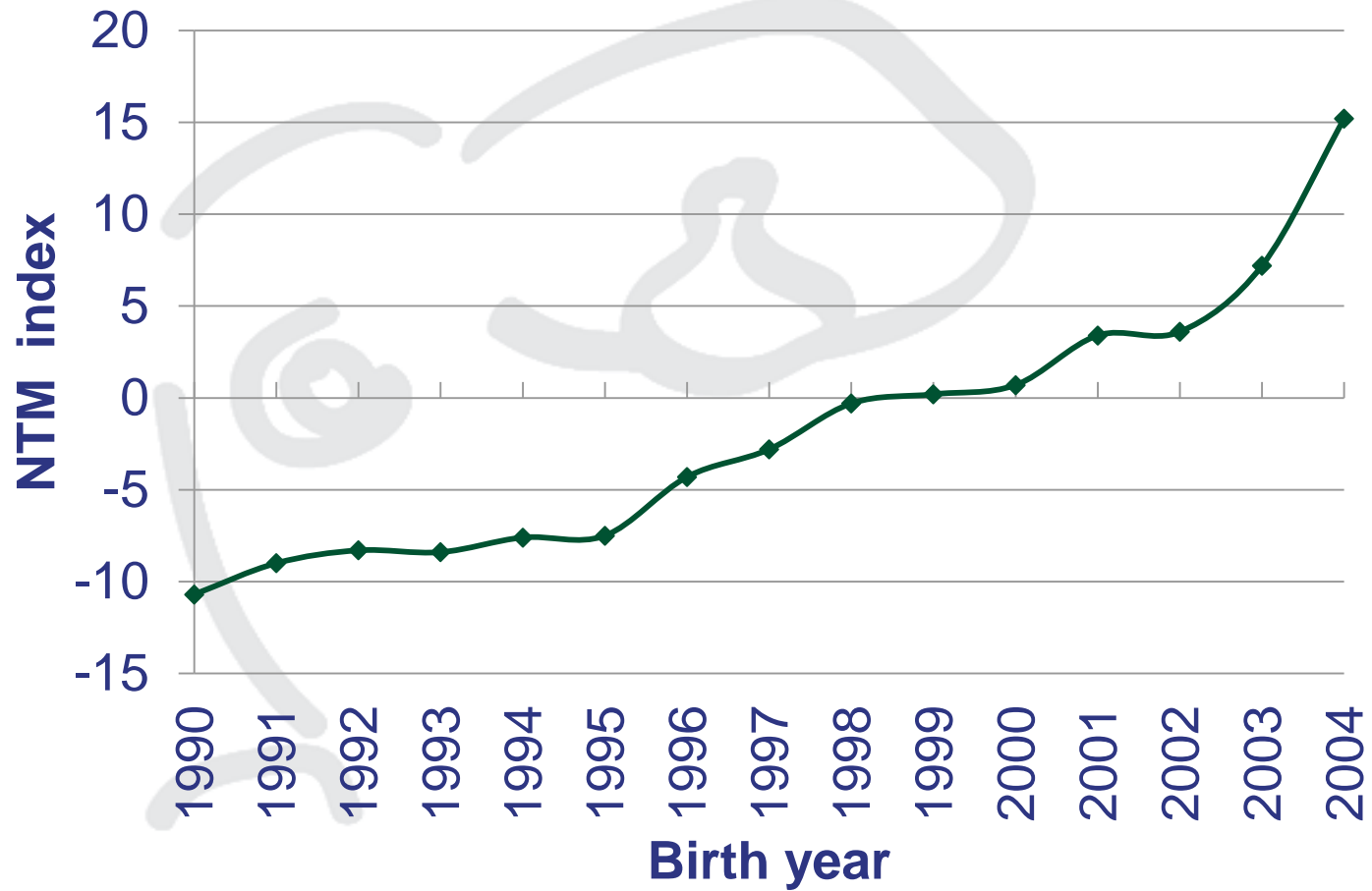
Economic value of an average progeny group

- 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 € ($2 \times 10.15\text{€}$)
- Comparing two Holstein heifers with a difference of 10 NTM units, the extra value of the best heifer is 202.9 € ($10 \times 20.29\text{ €}$)

Genetic trend NTM



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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 Breeding goal is the same with and without genomic selection

but:

- The composition of progress is different
 - More progress for functional traits relative to production 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

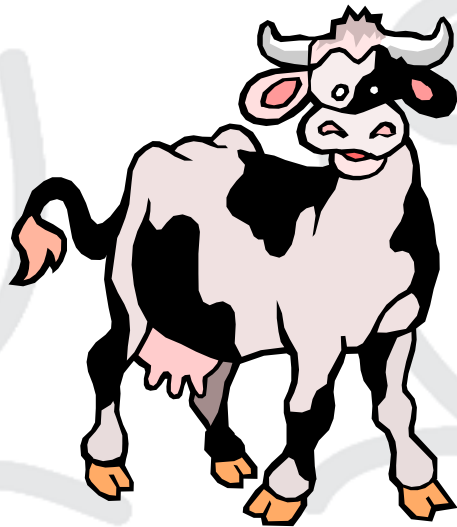
Trait	DGV* Birth	Cow-3 year	Bull – 5 year
Yield	55%	50%	90%
Fertility	56%	22% (PI)	70%
Mastitis	50%	25% (PI)	75%

***Lund & Su, 2009**

**Note the ratio between reliabilities:
Yield versus functional traits**

Breeding goal

Get maximum economic gain



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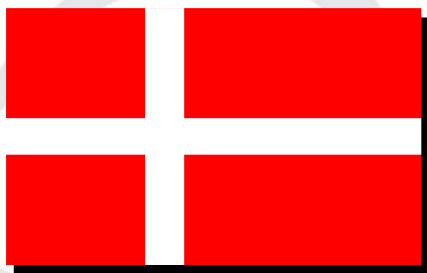


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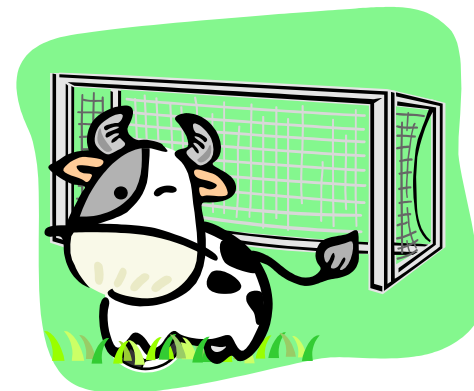
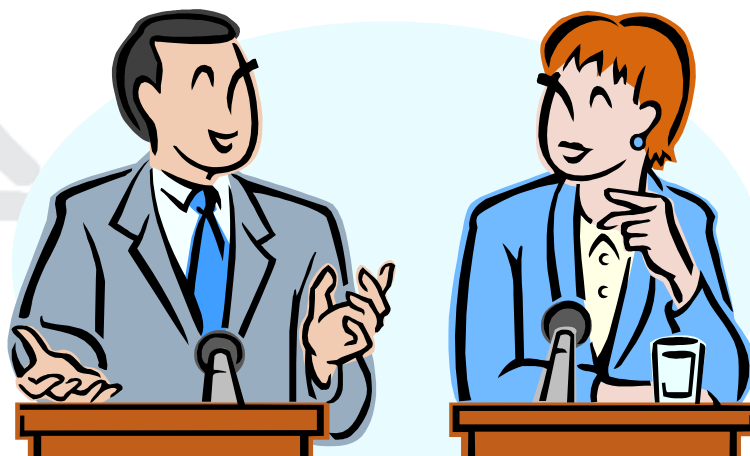


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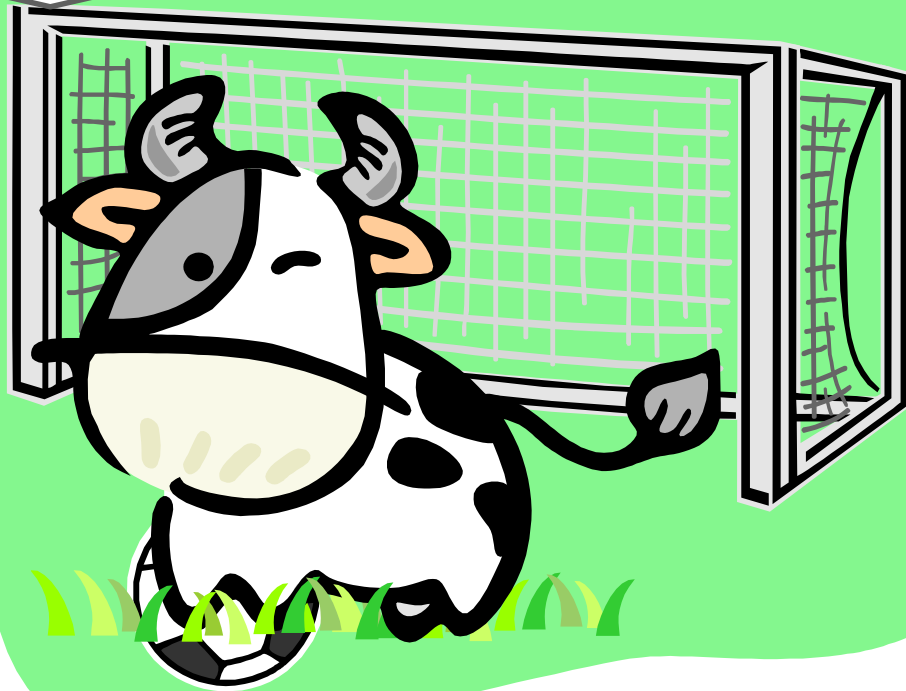


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Joint Nordic Breeding Goal - NTM

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



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