Nordisk Avlsværdivurdering
(NAV)
Joint Nordic Genetic Evaluation

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Nordisk Avlsværdivurdering

- Responsible for estimation of BVs for cattle in Finland, Sweden and Denmark

- 2002 – Development has started

- 15 April 2005 – first results were published
Established 01.01.2002 by:

Finlands Husdjursavelsandelslag (FABA)
Svensk Mjölk
Dansk Kvæg
NAV - goals

Competitive position
Changes in structure
Nordic breeding profile
Increased population size
Optimal use of resources
NAV – board
6 persons

Denmark
2 persons

Sweden
2 persons

Finland
2 persons
NAVs board

- Finland
  - Jarmo Juga
  - Yrjö Kerkola

- Sweden
  - Lennart Andersson
  - Lars-Inge Gunnarsson (chairman)

- Denmark
  - Henrik Nygaard
  - Christian Ladefoged (vice chairman)
NAV - economics


- Payment after 1. ins. pr country
  - Denmark 46%
  - Finland 27%
  - Sweden 27%
NAV-decisions

- All decisions in relation to NAV-EBVs is taken by the NAV-board
  - Sub breeding goals
  - Presentation of EBVs
  - Start of routine evaluation
  - Etc.

- NAV-board decisions are based on recommendations from NAV-technical group
Project groups

Project workers (financed by NAV)
+
One person per country
- Back up with national knowledge about data
- Within country information
Cooperation - Network

- Study visits
- Physical meeting
- Video link
- Email / phone
NAV – Goal

- To use international accepted methods for estimation of BVs
- To focus on development of methods within the “Nordic traits” – mastitis, fertility etc.
- To improve our current breeding work by using new registrations
NAV – Goal

- To give the practical cattle breeding the best selection tool to achieve maximal genetic progress

or with other words

- How do we get the best possible methods for estimation of BVs within our Nordic Total Merit index in use in practice
Perspectives - Joint Nordic estimation of breeding values

- Simultaneously use of all data and relationships between Nordic animals
- All cows and sires can be directly compared
Perspectives – joint Nordic Estimation of breeding values

- Use ressources more efficient:
  - Development of new method
  - Routine evaluation
- Joint platform for practical breeding work
EBVs can be compared within the Nordic countries

1. Cow 9  Finland
2. Cow 5  Sweden
3. Cow 1  Denmark
4. Cow 2  Denmark
5. Cow 6  Sweden
Same traits measured in all countries

Practical advantage
- One BV per animal

Theoretical reasonable assumption
- INTERBULL-correlations high
- G x E studies no significant effects
- No effect within country even though we have 20 years with a significant increase in production

All models are validated with statistical tests
# Estimation of Breeding values before we got NAV

<table>
<thead>
<tr>
<th>Research</th>
<th>Development</th>
<th>Implementation</th>
<th>Routine evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLU</td>
<td>Swedish Dairy Ass</td>
<td>Swedish Dairy Ass</td>
<td></td>
</tr>
<tr>
<td>MTT</td>
<td>FABA</td>
<td></td>
<td>FABA</td>
</tr>
<tr>
<td>DJF / KVL</td>
<td>Danish Cattle</td>
<td></td>
<td>Danish Cattle</td>
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</tbody>
</table>
## Estimation of Breeding values after we got NAV

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</tr>
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<td>MTT</td>
<td>Dansk Kvæg</td>
<td>Dansk Kvæg</td>
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</tr>
<tr>
<td></td>
<td>Svensk Mjølk</td>
<td>Svensk Mjølk</td>
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<td></td>
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</tr>
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<td></td>
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</tr>
</tbody>
</table>

Nordisk Avlsværdivurdering
Estimation of breeding values in the future

- Decisions have to be taken Joint Nordic instead of within country:
  - Registration
  - Methods and models
  - Presentation of EBV’s
  - Sub breeding goals
  - Future research and development
Nordisk Avlsværdivurdering

Finished work:

– Implementation of routine evaluation of fertility traits, type traits, milk ability and temperament
– Joint presentation of breeding values
– Joint sub breeding goals (type, fertility, production, mastitis)
– Harmonisation of type traits
– New NAV-homepage (www.nordicebv.info)
## Mammary system - 2004

<table>
<thead>
<tr>
<th></th>
<th>SWE</th>
<th>DNK</th>
<th>FIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fore udder</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rear udder height</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rear udder width</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Udder support</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Udder depth</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teat length</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teat thickness</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teat place. (front)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teat place. (back)</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Udder balance</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
# Mammary system - 2005

<table>
<thead>
<tr>
<th>XX</th>
<th>SWE</th>
<th>DNK</th>
<th>FIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fore udder</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rear udder height</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rear udder width</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Udder support</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Udder depth</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teat length</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teat thickness</td>
<td>X</td>
<td>X</td>
<td>1.1.2006</td>
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<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teat place. (back)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Udder balance</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Data

- Harmonization of type traits
  - Classified traits (Finland 4 new, Denmark 1)
  - Use of scale (classifier workshop held in May 2005)

- Harmonization of editing rules
### Joint sub index

**Weight in yield index**

<table>
<thead>
<tr>
<th></th>
<th>Milk</th>
<th>Fat</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordic</td>
<td>-1</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Both Holstein and Red breeds
# Sub breeding goal - Fertility

<table>
<thead>
<tr>
<th>Information</th>
<th>Sub breeding goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.ins-last ins heifers</td>
<td>X</td>
</tr>
<tr>
<td>Number of ins heifers</td>
<td>X</td>
</tr>
<tr>
<td>Calv.-1.ins cows</td>
<td>X</td>
</tr>
<tr>
<td>1.ins-last ins cows</td>
<td>X</td>
</tr>
<tr>
<td>Number of ins cows</td>
<td>X</td>
</tr>
<tr>
<td>Fertility treatment cows</td>
<td>X</td>
</tr>
<tr>
<td>Heat strength cows</td>
<td></td>
</tr>
</tbody>
</table>
Current Methods

- NAV-EBVs based on methods already used in at least one of the countries:
  - SI-AM for type
  - MT-Linear SM models for fertility
  - MT-ML-Linear SM models for mastitis
Yield traits

MT-TD for yields traits

- **Denmark**
  - Multi trait and lactation
  - Testday
  - Better heterogeneous variance correction

- **Sweden**
  - Multi-lactation
  - Better heterogeneous variance correction
  - Test day data as soon as possible
  - Blending of foreign information

- **Finland**
  - Heterogeneous variance
  - Heterosis
  - Blending of foreign information

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*Nordisk Avlsværdivurdering*
General about methods

- Use the best methods which can be handled in practice
- Update of genetic parameters
- We have to use our data as efficient as possible
- Focus on supporting the strength of Nordic cattle breeding – functional traits
General about methods

- Better methods and use of data for functional traits e.g. fertility, mastitis/disease and calving traits

- Improve our total Merit Index calculations
  - Economic values
  - Use of genetic correlations
  - But total merit index is still a national responsibility
Nordic routine evaluation

- Presentation of breeding values
  - Common base
  - Common standard deviation
- Number of routine runs per year
  - Dates for publishing EBVs
- Breeders in Denmark, Finland and Sweden can see the same BVs at the same time
# Presentation of EBVs

<table>
<thead>
<tr>
<th></th>
<th>Until 15 April 2005</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>Sweden</td>
<td>100</td>
<td>7</td>
</tr>
<tr>
<td>Finland</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>Denmark</td>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td>Denmark type</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Nordic presentation of EBVs

- Common base
  - Cow base – 2 birth years
  - Average 100 all traits
  - Same base for cows/heifers and sires
  - Base update at each routine run
Standard deviation

- Express the variation around a mean
- Standard deviation 10
  - 67% of the sires has EBVs between 90 and 110 for traits without genetic changes over years
Ayrshire- avlsmæssig udvikling

Indeks for hunlig frugtbarhed

Fødselsår

Danmark
Sverige
Finland

Nordisk Avlsværdivurdering
Genetic level red breeds, mean EBV for bulls born 1996-97

<table>
<thead>
<tr>
<th></th>
<th>Milking speed</th>
<th>Temperament</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>100</td>
<td>109</td>
</tr>
<tr>
<td>Finland</td>
<td>100</td>
<td>98</td>
</tr>
<tr>
<td>Sweden</td>
<td>103</td>
<td>100</td>
</tr>
</tbody>
</table>
Genetic level red breeds, mean EBV for bulls born 1996-97

<table>
<thead>
<tr>
<th></th>
<th>Body</th>
<th>Feet and Legs</th>
<th>Mammary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>110</td>
<td>108</td>
<td>107</td>
</tr>
<tr>
<td>Finland</td>
<td>93</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>Sweden</td>
<td>99</td>
<td>100</td>
<td>101</td>
</tr>
</tbody>
</table>
# Number of evaluations

<table>
<thead>
<tr>
<th>Country</th>
<th>Until 15 April 2005</th>
<th>NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>4</td>
<td>7(4)</td>
</tr>
<tr>
<td>Denmark</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>
# NAV-status

<table>
<thead>
<tr>
<th>Type</th>
<th>INTERBULL test</th>
<th>Routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility</td>
<td>September 2004</td>
<td>April 2005</td>
</tr>
<tr>
<td>(Pilot Sept 04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>September 2005</td>
<td>January/April 2006</td>
</tr>
<tr>
<td>Mastitis</td>
<td>March 2006</td>
<td>April 2006</td>
</tr>
<tr>
<td>Calving traits</td>
<td>September 2006</td>
<td>October 2006</td>
</tr>
</tbody>
</table>
Nordisk Avlsværdivurdering

Current work:

- Clarification and implementation of routine evaluation for milk production January/April 2006
- Development work mastitis and calving traits
- Working group automatic registrations on national databases eg. Milking time
- Joint Nordic use of computer program (EVA) for optimisation of genetic progress and inbreeding control
Future work:

– Including Swedish TD in yield evaluation and update genetic parameters for yield traits
– Further harmonisation of statistical model across countries
– NAV-EBVs for longevity, other diseases and beef production
– Harmonisation of (new) traits
– Better methods for estimation of EBVs – functional traits
– Use of new registrations
Future Estimation of breeding values

National
- Total merit index – overall breeding goal
- Publishing EBVs and support

Nordic
- Editing of data
- Estimation of breeding values
- INTERBULL contact
- Sub breeding goal
Breeding values could only be compared within country.

Back gård

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of daughters</th>
<th>P-index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1,408</td>
<td>Danish</td>
</tr>
<tr>
<td>Sweden</td>
<td>24,366</td>
<td>Swedish</td>
</tr>
<tr>
<td>Finland</td>
<td>1,993</td>
<td>Finnish</td>
</tr>
</tbody>
</table>
From national to Nordic SRB-bull Backgård

National

Danish EBVs
1.408 daughters

Finish EBVs
1.993 daughters

Swedish EBVs
24.366 daughters

Nordic

27.767 daughters
Backgård – before 15.4.2005

Danish, Finnish and Swedish EBVs could not be compared:

- Information from different daughters
- Sub breeding goals are different
- Differences in genetic level
- Differences in standard dev. of EBVs
Danish, Finnish and Swedish EBVSs can be compared directly for:

- Fertility traits (same sub breeding goals)
- Type traits (same sub breeding goals)
- Temperament and milk ability
Oct. 2005 EBVs for fertility and mammary system the same in Denmark, Sweden and Finland

Number of daughters:
- Denmark: 27,767
- Sweden: 94
- Finland: 113
Danish, Finnish and Swedish EBVSs can not be compared directly for all other traits since:

- Sub breeding goals are different (expect for yield)
- Differences in genetic level
- Differences in standard dev. of EBVs and definition of base are the same
Estimation of breeding values in the future

- Decisions have to be taken Joint Nordic instead of within country:
  - Registration
  - Methods and models
  - Presentation of EBV’s
  - Sub breeding goals
Conclusion

- Think Nordic:
  - Registration, sub breeding goals, new ideas in relation to estimations of breeding values (use Nordic data in research)

- 15 April 2005
  - The first joint Nordic EBVs
  - Nordic presentation of all EBVs
    - Standard deviation, genetic base
Conclusion

- A part of the national work in relation to EBVs will be NAV work in the future

- NAV work is solved in a network
EBVs can be compared within the Nordic countries

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cow</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>Finland</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Sweden</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Denmark</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Denmark</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Sweden</td>
</tr>
</tbody>
</table>
Conclusion

- NAV want to give:

The practical cattle breeding the best selection tool to achieve maximal genetic progress