

# Joint Nordic Genetic Evaluation a journey



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Symposium, Jokionen Finland

13 September 2023

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## NAV – Nordic Cattle Genetic evaluation

NAV is:

A network organization doing joint Nordic genetic evaluation built by organizations responsible for national genetic evaluation in Denmark, Sweden and Finland:

- Landbrug og Fødevarer
- Växa
- Faba



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## Nordisk Avlsværdivurdering

- Responsible for genetic evaluation of dairy and beef cattle in Finland, Sweden and Denmark
- 2002 – Organization established, and development started
- 15 April 2005 – first joint EBVs published

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## Perspectives – when NAV was established in 2002

- Use data and relationship between Nordic animals in one evaluation
- All cows and bulls direct comparable

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## Perspectives - – when NAV was established in 2002

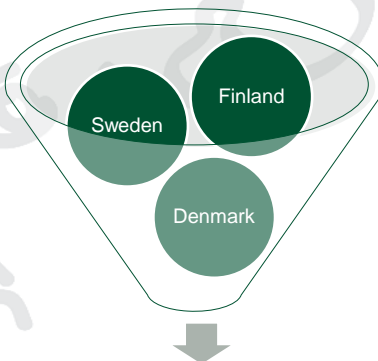
- **More efficient use of resources:**
  - Method development
  - Routine evaluation
  - Joint platform for breeding work – needed in “old” days with progeny testing

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## A journey – decision process about genetic evaluation

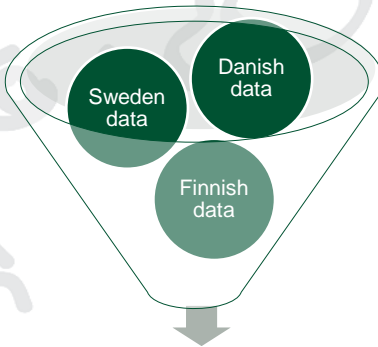


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## A journey – phenotypic data



**Harmonisation of traits:**

- Type traits
- Claw health

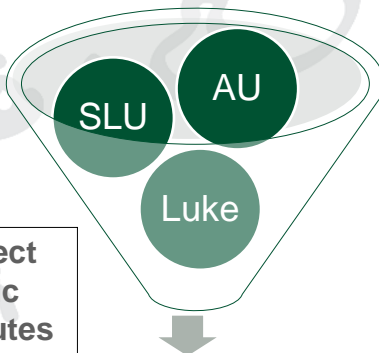
**Investments at national level**

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## A journey – Research cooperation supporting NAV



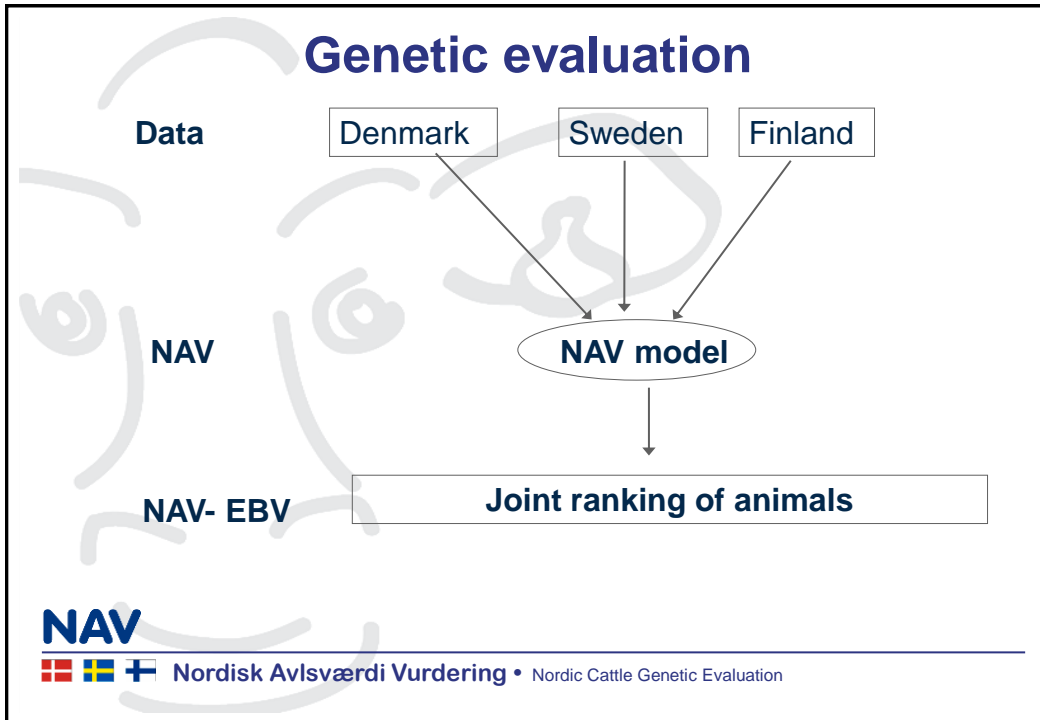
NAV R&D project involving Nordic research institutes

NAV SAC group

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## Nordic Cattle Genetic Evaluation - history



<p>2002</p> <p>2005</p> <p>2006</p> <p>2007</p> <p>2008</p> <p>2009</p> <p>2010</p> <p>2011</p> <p>2014</p> <p>2018</p> <p>2018</p> <p>2020</p> <p>2021</p> <p>2022</p>	<p><u>Established and development started</u></p> <p><u>Common definition of genetic base, standard deviation and sub breeding goal, first EBVs published, fertility, type, milk ability and temperament</u></p> <p>Yield and mastitis</p> <p>Calving traits</p> <p>General health and <i>NTM</i></p> <p>Growth (beef production)</p> <p>Longevity</p> <p>Claw health, claw health in <i>NTM</i>, <i>GEBVs</i></p> <p>Females in reference, Young stock survival</p> <p><i>NTM</i> upgrade</p> <p>Beef bulls used in dairy herds (<i>BXD</i>)</p> <p>Saved feed</p> <p>Pure beef cattle, dairyxdairy <i>GEBVs</i></p> <p>Single step first trait group</p>
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# Nordic Cattle Genetic Evaluation - history



- 2002 Established and development started
- 2005 *Common definition of genetic base, standard deviation and sub breeding goal, first EBVs published, [fertility, type, milk ability and temperament](#)*
- 2006 [Yield and mastitis](#)
- 2007 [Calving traits](#)
- 2008 [General health and \*NTM\*](#)
- 2009 [Growth \(beef production\)](#)
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- 2014 [Females in reference, Young stock survival](#)
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- 2022 [Single step first trait group](#)

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# What is done in the NAV cooperation today?

## Official genetic evaluation dairy cattle

- Holstein, Jersey, RDC, and Finncattle for NTM and traits included in NTM
- Genotyped dairy crosses for NTM and traits behind NTM

## Official genetic evaluation beef cattle

- Beef bulls used in dairy herds for NBDI and traits included in NBDI (growth, carcass, birth, youngstock survival, gestation length)
- Beef cattle for calving traits, growth and carcass traits

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# What is done in the NAV cooperation today?

## Development and implementation of :

- Better methods for genetic evaluation
- Establishing genetic evaluation for new traits or make use of new data sources.

## Note:

- Research and development in Sweden, Finland and Denmark contribute to NAV improvements by having research project within genetic evaluation.

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## Nordic TD model Interbull 2006, Kuopio, Finland



### Joint Nordic test day model: Variance components

*E A Mäntysaari, M Lidauer, J Pösö, I Strandén, P Madsen, J Pedersen, U S Nielsen, K Johansson, J-Å Eriksson, G P Aamand*

### Joint Nordic test day model: Evaluation model

*M Lidauer, J Pedersen, J Pösö, E A Mäntysaari, I Strandén, P Madsen, U S Nielsen, J-Å Eriksson, K Johansson, G P Aamand*

### Joint Nordic test day model: Experiences with the new model

*J Pösö, J Pedersen, M Lidauer, E A Mäntysaari, I Strandén, P Madsen, U S Nielsen, J-Å Eriksson, K Johansson, G P Aamand*

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## Nordic TD model challenges to solve 2002-2005

- Mix of TD records and 305 day record (Sweden)
- Blending foreign information
- Estimate variance components for a TD model considering milk recording data in three countries
- Software program – MIX99
- Acceptance by AI industry

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# Nordic udder health evaluation Interbull 2010, Riga, Estland

Yes  
We did it



Combining test day SCS with clinical mastitis and udder type traits: A random regression model for joint genetic evaluation of udder health in Denmark, Finland and Sweden

*E Negussie, M Lidauer, E A Mäntysaari, I Strandén, J Pösö, U S Nielsen, K Johansson, J-Å Eriksson, G P Aamand*

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# Genomic prediction

Validation  
is crucial



INTERBULL BULLETIN NO. 41. Paris, France, March 4-5, 2010

Interbull Validation Test for Genomic Evaluations  
Esa Mäntysaari, Zengting Liu and Paul VanRaden

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## Genomic prediction

2011 Nordic 2- step official

2016 Females included

2016 Single step work initiated

2022 Nordic single step first trait group official

2017 *Single step production traits inflation/bias a problem*

*Polygenic effect, erosion factor, pros processing*

.....



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## Genomic selection – significant contribution eg Interbull papers,



*Validation of Genomic and Genetic Evaluations in 305d Production Traits of Nordic Holstein Cattle, 2017*

*M. Koivula, I. Strandén, G.P. Aamand and E.A. Mäntysaari*

*Nordic Holstein single-step test day model using left truncated genomic data, 2022*

*Minna Koivula, Ulrik Nielsen, Ismo Strandén, Gert Aamand, Esa Mäntysaari*

*Usability of different genetic evaluation validation tests in a population subjected to a strong genomic selection and in testing the single-step genomic evaluations. 2022*

*Esa A. Mäntysaari, Andrei A. Kudinov*

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## Interbull technical committee

- A key player in setting international standards for genetic evaluations
  - MACE/GMACE
  - Genetic parameters
  - Validation - Interbull method I, II and III, mendelian sampling test, Genomic validation



a key player from 2003-2023

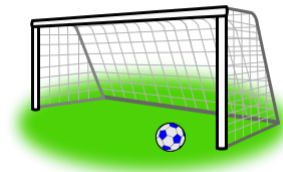
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## Breeding goal Nordic Total Merit (NTM)



Give Nordic cattle farmers:

- Maximum earnings in 5-10 years
- Balanced breeding progress

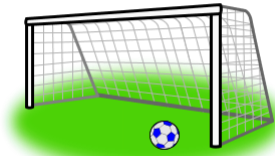
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## Breeding goal - NTM



Introduced in 2008 – upgraded in 2018

- Future production condition
- Lower replacement % (32%)
- Wide use of sex-sorted semen and beef semen
- Payment system for milk - increased value of fat compared to protein and more concentrated milk

*Aim include all traits of economical importance*

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## Correlation NTM and single traits



	HOL	RDC	Jersey
Yield	0.69	0.70	0.69
Growth	0.07	-0.05	0.05
Fertility	0.24	0.20	0.24
Birth	0.18	0.26	-0.01
Calving	0.20	0.18	0.24
Udder health	0.30	0.30	0.46
General Health	0.26	0.21	0.38
Claw health	0.16	0.23	0.17
Feet and legs	0.20	0.27	0.13
Udder	0.19	0.18	0.15
Milking speed	0.05	0.12	0.08
Temperament	0.08	0.07	0.04
Longevity	0.37	0.47	0.38
Young stock survival	0.20	0.28	0.33
Saved feed	-0.01	0.17	0.05

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## International cooperation 2023+



- International cooperation
  - Continue offering GEBV service for all dairy breeds
  - Look at possibilities for cooperation about genetic evaluation to be more efficient in R&D and routine operations
  - Harmonisation of traits is a key element initiated by Holstein Eurogenomics countries

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## Jersey - 2023



European countries with Jersey populations	Evaluated together with DFS Jersey
UK	
Albania	
Italy	
Switzerland	
France	★
Holland	
Russia	
Hungary	
Germany	
Ireland	
Norway	★
Poland	
Czech	

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## Future cattle breeding

- Dairy cattle
  - Intense use of sexed dairy semen and beef cattle (Y-sexed) semen in dairy herds
  - Balanced breeding goal even more important in the future key traits: health, fertility, calving, and climate impact
  - Traditional cattle breeder focus on “cow size” will change

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## Future cattle breeding

- Beef cattle
  - Breeding plans have to be more efficient to deliver high genetic merit beef semen to dairy herds

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## Genetic evaluation future challenges

- Phenotypes
  - "Smarter" phenotypes for traditional traits – more "automatic" registration, images etc.
  - Large scale phenotyping for feed intake, methane, and more new traits
- Methods
  - Efficient handling of "automatic" phenotypes
  - Improved use of genotypes – sequenced data?

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## Future phenotypes

- The "best" phenotypes are those used for management today and breeding tomorrow
- Phenotypes recorded for breeding purposes only are expensive - number of phenotypes are limited leading to low GEBV reliability and relative limited in the breeding goal e.g. feed efficiency today

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## Future Nordic Breeding goals



- **Dairy cattle**
  - **Breeding goal – continue upgrading - reflect future expectations**
- **Beef cattle**
  - **Clear definition of breeding goal to meet the need for high genetic merit beef semen in dairy herds.**

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## Joint Nordic Genetic Evaluation a journey

Thank you, Esa, for a fantastic joint Nordic journey

- **You have contributed significantly**
- **It is appreciated a lot**
- **It has been a pleasure to work with you and be with you**



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**Thanks a lot from NAV  
and  
all the best for the future**



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