Genomic breeding values

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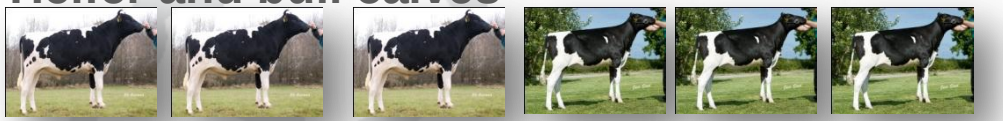
Outline

- Genomic information in EBVs – 2nd May
- Publication rules and reliabilities
- Results

Reference population

DNA information and
Phenotypic information

Heifer and bull calves



DNA information

Conversion equation

Selected animals

Breeding values!
Nomenclature - internationally

So far

- EBV –based on phenotypes
- DGV –based on genomic information
- GEBV – combine phenotypes and genotypes

Breeding values!
Nomenclature – in practice

So far

- **EBV – based on phenotypes**

2nd May

- **EBV – based on phenotype (all animals) and genomic information (for some animals)**

Breeding values!

2nd May we have:

- **EBVs – based on phenotype (lots of animals)**
- **EBVs – based on phenotype and genomic information (a few animals)**

The EBVs from the two "categories" are comparable and the SD reflects the reliability

Before 2nd May – EBVs based on registrations in practice only

- Yield
- Insemination
- Disease treatments
- Calving
- Longevity
- Type classification

Genomic EBVs in practise 2008-2011 - DGVs

EBVs based on genomic information – DGVs

Shown as plus and minus

NAV

Breeding values!

Combined breeding values (GEBV)

Replace traditionel EBVs (based on phenotypic values only)

Combined GEBVs 2nd May 2011

Traits

- **NTM traits (combined indices)**

Category of genotyped animals

- **AI bulls (no progeny test yet)**
- **Heifers**
- **Cows (traits based on pedigree only)**

Reliability genomic information	
RDC	0.30-0.40
Holstein	0.40-0.50
Jersey	0.20-0.30

Reliability varies by trait

Reliability

NAV does not yet publish a reliability for GEBVs based on genomic information at the 2nd May evaluation, because

- **Methods used to calculate reliabilities for GEBVs including genomic information varies a lot world wide**

But

- **SD on GEBVs reflects the reliability**

Publication of breeding values

Category of animals	Status	Published breeding value
Bulls without a progeny test	Culled	None
	AI bulls with a Nordic herd book number	**GEBV** when at least 20 month old at publication date
Bulls with Nordic or foreign progeny test	AI bulls with a Nordic progeny test	EBV
	Foreign AI bulls with a Nordic herd book number and a progeny test abroad	IB EBV for all international traits available. **GEBV** for traits with pedigree information only

Publication of GEBV (genotyped animals)

Category of animals	Published Breeding value
Heifers	**GEBV**
Cows	**GEBV** for traits with pedigree information only (e.g. other disease, fertility, calving) and EBVs for all other traits

Genotyped bulls

Birth year	HOL		RDC		Jersey	
	HB	No HB	HB	No HB	HB	No HB
2007	353	96	219	0	55	4
2008	288	550	236	51	48	33
2009	272	845	224	353	57	131
2010	56	946	167	782	25	205
Total all years	**6459**	**2653**	**5594**	**1188**	**1318**	**373**

Selection intensity increase by birth year

Genotyped females

Birth year	HOL	RDC	Jersey
>2007	479	99	95
2007	225	116	66
2008	404	205	94
2009	531	353	123
2010	402	281	47
Total	2054	1074	425

Results – heifers and bull calves

Correlations – all breeds

- DGV-GEBV 0.94 to 1.00
- Ranking of animals nearly the same

Significant increase in reliability for genotyped heifers

Phenotypic info

Earlier

Genomic info

Phenotypic info

2nd May

NTM - heifers

NTM	GEBV-pedigree index	
	Correlation	Mean
HOL	0.40-0.60	-4 to -5
RDC	0.50-0.80	-4 to -5
Jersey	0.60-0.90	-4 to -5

Mean difference due to Bull Dam yield bias

Changes in EBV for genotyped heifers (66% within limits)

Pedigree

Protein: 100
Fertility: 100
NTM: 0

GEBV

Protein: 90 – 102(Bull dam bias)
Fertility: 94 - 106
NTM: -10 til 2

Changes in EBV for genotyped cows

(so far only traits based on pedigree only – 66% within limits)

EBV

Protein: 100
Fertility: 100
NTM: 0

GEBV

Protein:100
Fertility: 94 - 106
NTM: -3 til -3

EBV young AI bulls

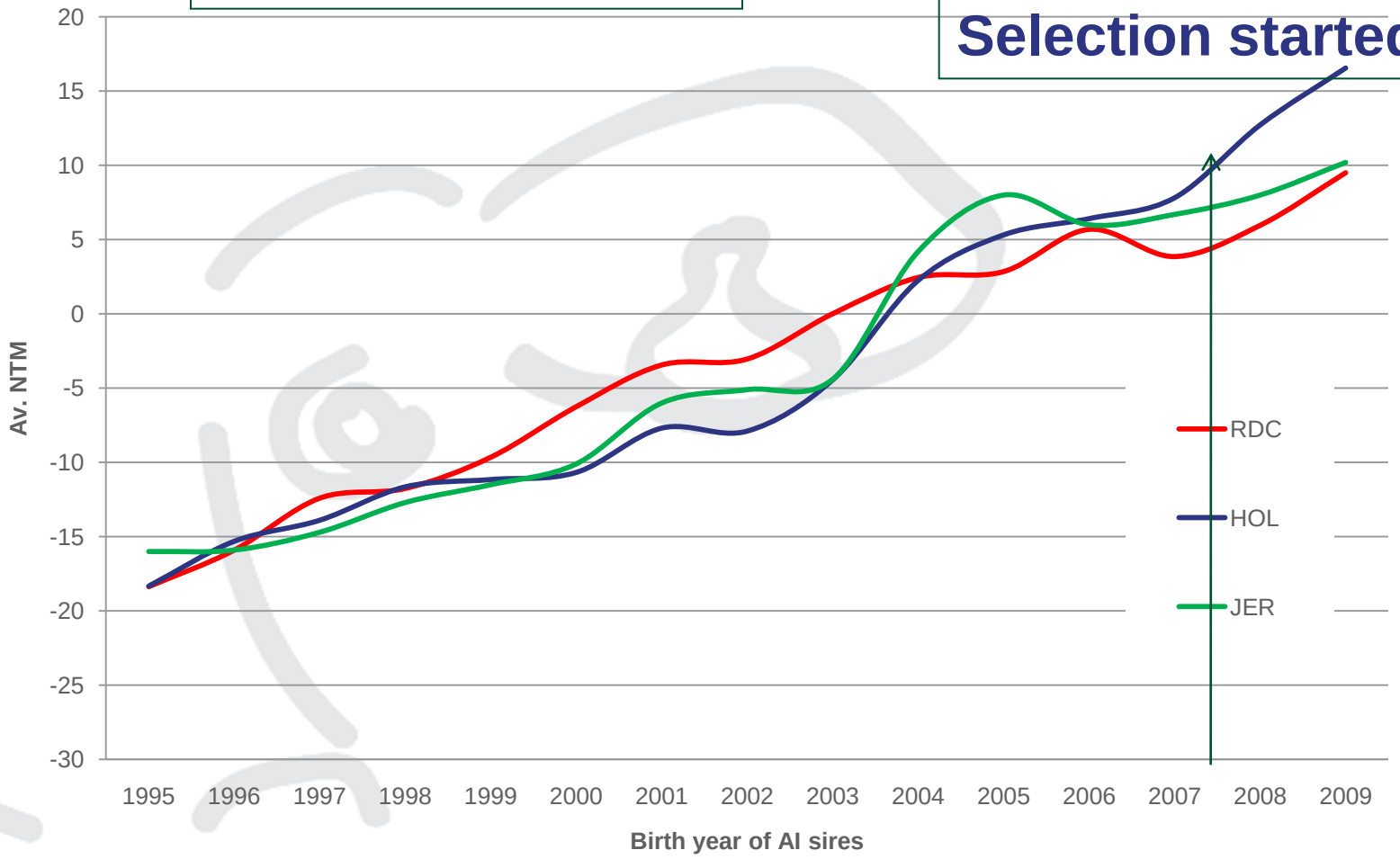
Genomic info **Traditional info**

No EBV **GEBV**

Earlier **2nd May**

Genetic trend NTM

Genomic Selection started



Aprox. standard deviation on NTM

	Holstein	RDC	Jersey
Young bulls only genomic information	7-8	6-7	5-6
Progeny tested bulls	10	10	10

Higher SD corresponds to higher reliability
Reliability on genomic information across breeds:
Holstein> RDC > Jersey

Results – Top bulls

	HOL – top 50	RDC – top 40	Jersey- top 20
% Young bulls >20mth	62	30	13
% Progeny tested	38	70	87
Min NTM	+24	+18	+15

Results – Top heifer/cows born 2006 or later

	HOL	RDC	Jersey
	Top400	Top200	Top100
Genotype	13%	7%	28%
No genotype	87%	93%	78%

RDC and Jersey

- **Reliability on GEBVs for young animals are a bit less than for Holstein**
  - A bit lower reliability on EBVs for GenVikPLUS bulls
  - A bit lower reliability on EBVs for heifers
- **A bit bigger changes in EBVs for bulls, when a bull get a progeny group.**

Which animals to select?

Do as usual – select the animals with highest NTM

But take the lower reliability at GenvikPLUS bulls into account

5-8 GenVikPlus bulls has same expected change in EBV as one progeny tested bull

Focus less on single bulls and more on a group of bulls (5-8)

Expected changes transition from young genomic tested bull to a progeny tested bull (95%)

Young bull

Protein: 100
Fertility: 100
NTM: 0

Progeny tested bull

Protein: 86 til 114
Fertility: 88 til 112
NTM: -13 til 13

Combined GEBVs - future

Traits

- **NTM traits (combined indices) - All single traits**

Category of genotyped animals

- **AI bulls calves – all AI bulls**
- **Heifers**
- **Cows (traits based on pedigree only) – all cows**

Expected changes in EBVs for progeny tested bulls using GEBVs (95%)

Now

Protein: 100
Fertility: 100
NTM: 0

Future

Protein: 96 til 104
Fertility: 92 til 108
NTM: - 6 til 6

Questions?