Current status and future needs in cattle breeding programs

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VIKINGGENETICS

Breeding programmes in VikingGenetics

- VikingGenetics is responsible for the joint breeding programmes in Denmark, Sweden and Finland

- Breeding goal:
  - Including most traits with economic value
  - Balanced between production and health

- 3 main breeding programmes:
  - Holstein (585,000 cows)
  - VikingRed (220,000 cows)
  - Jersey (70,000 cows)

SWE
FIN
DEN

Pre-conditions for succesfull GS

- Low effective population size in all three breeds

- High quality and quantity of data registrations in large proportion of production herds

- Chip technology (54K and EuroG10K) and calculation methods

- Long tradition for research projects in collaboration with universities supporting development and implementation

- Good infrastructure in the cattle breeding sector

Current status

- Genomic selection fully integrated in (nearly) all selection decisions

  - Genomic selected young bulls

  - Genomic selected young female donors

Semen sale (%)	Before GS	2017
Daughter proven	70	4
Genomic selected	0	96
Young test bulls	30	0

Expectation to genomic selection

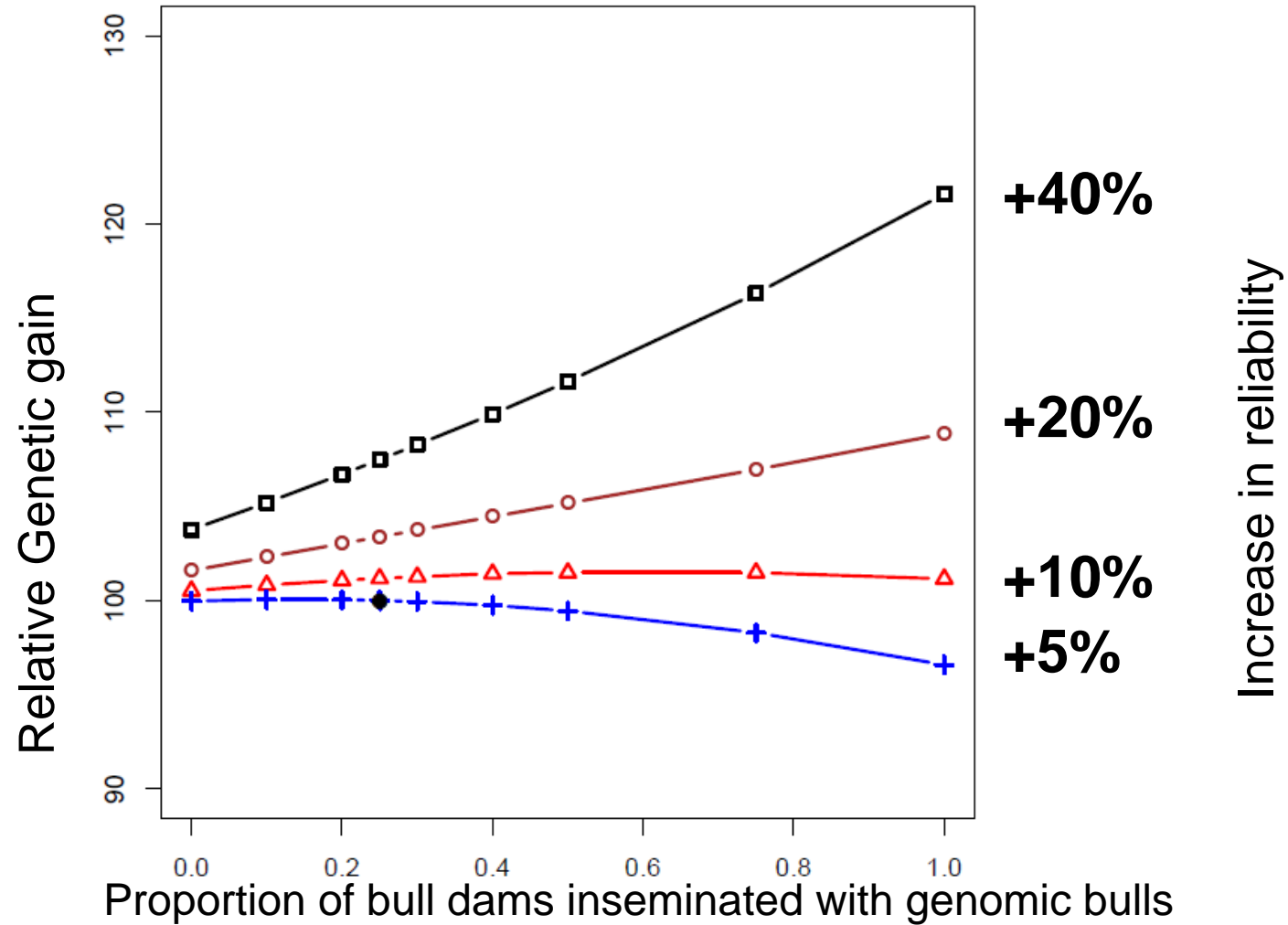- Expect higher genetic gain

Genomic test
Progeny/female ↑

Overall lower accuracy

$$\Delta G = \frac{i \cdot r_{IA} \cdot \sigma_A}{L}$$

Younger breeding candidates

- Same selection accuracies in young males and females

- Favorable interaction effects

Young bull schemes are superior for >+10 rel.
Simulations - Jersey

Favorable effects by continuingly increasing reliability and donor program
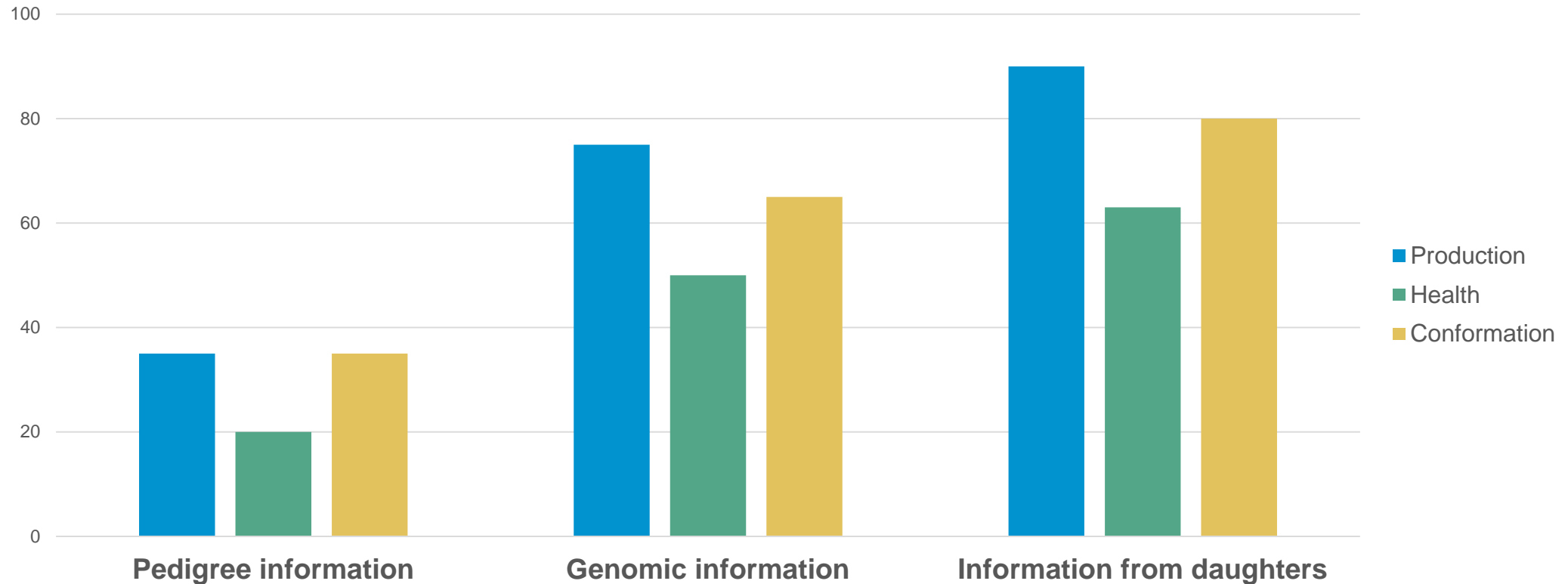
ADAM *Simulations - Holstein*

Genomic Reliability	# Donors	# Sires	ΔG relative	ΔF/gen relative
36%	0	50	31.1€ (=100)	0.44%(=100)
36%	200	50	125	127
50%	200	50	142	99
50%	200	100	133	54

Donors 14 month, 10 progeny

Reliabilities of breeding values

Reliabilities of breeding values - Holstein sires

Size of reference population

	No. of sires	No. of cows	Source	LD project**
VikingHolstein	35,681	40,443	VG + Eurogenomics*	15,000
VikingRed	9,208	40,988	VG + Norway	10,000
VikingJersey	2,692	20,857	VG + USA/Canada	7,000

Updated: 2018-10-26

* EuroGenomics includes proven bulls from the Netherlands, France, Germany, Spain and Poland
** No. of females financially supported by VikingGenetics to maintain/improve strong reference group

Genomic breeding programme

	No. of genomically tested bull calves	No. of progeny tested sires/year	No. of flushing contracts	No. of bought heifers to VikingEmbryo
VikingHolstein	3,000	90	450	40
VikingRed	2,800	85	200	80
VikingJersey	425	35	50	35

- Using more sires to reduce risk and managing inbreeding

- More focus on internal donor program
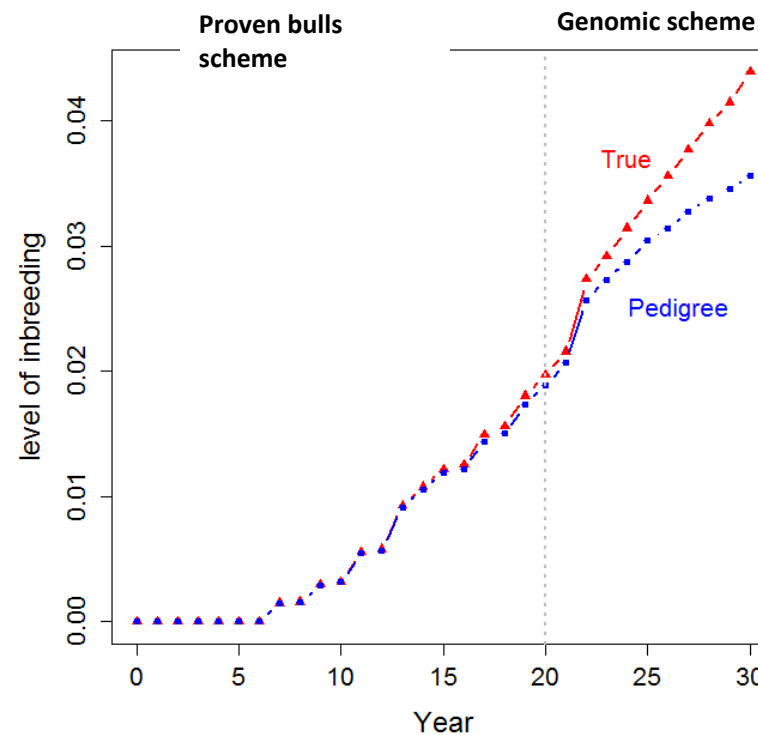
Managing inbreeding

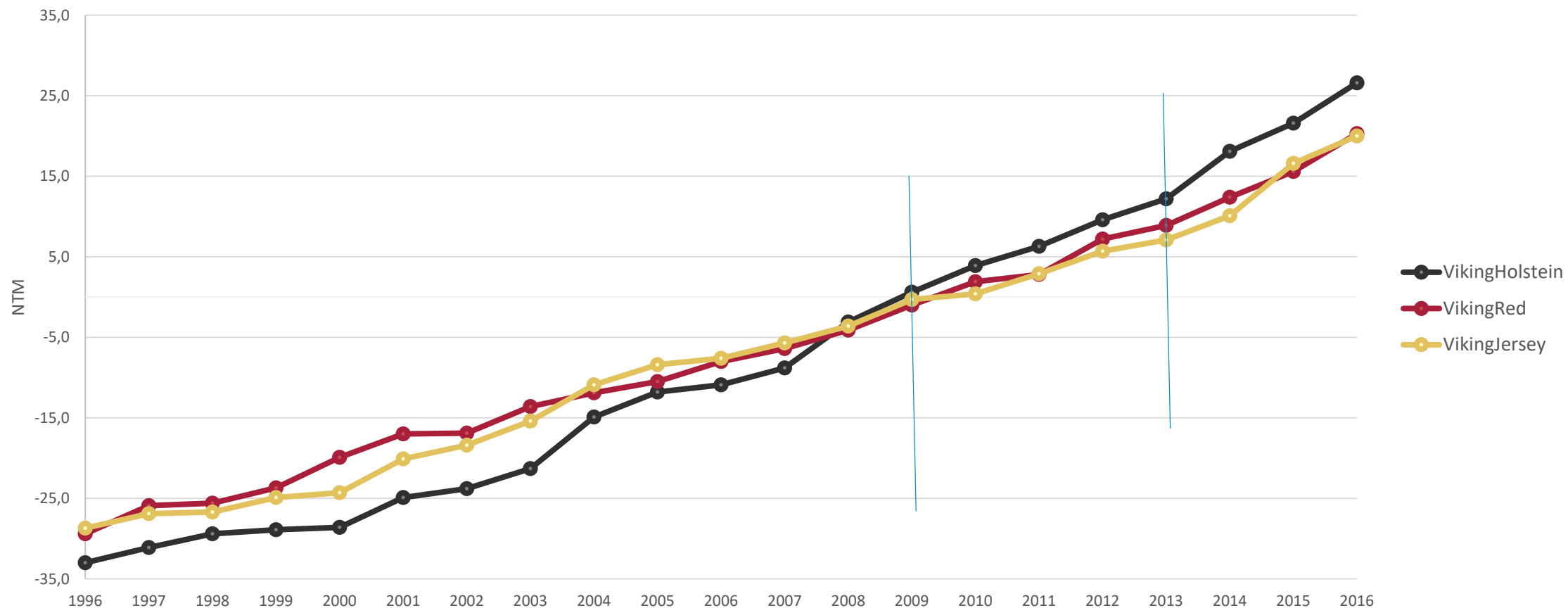Jersey coancestry, average and expected inbreeding over the time
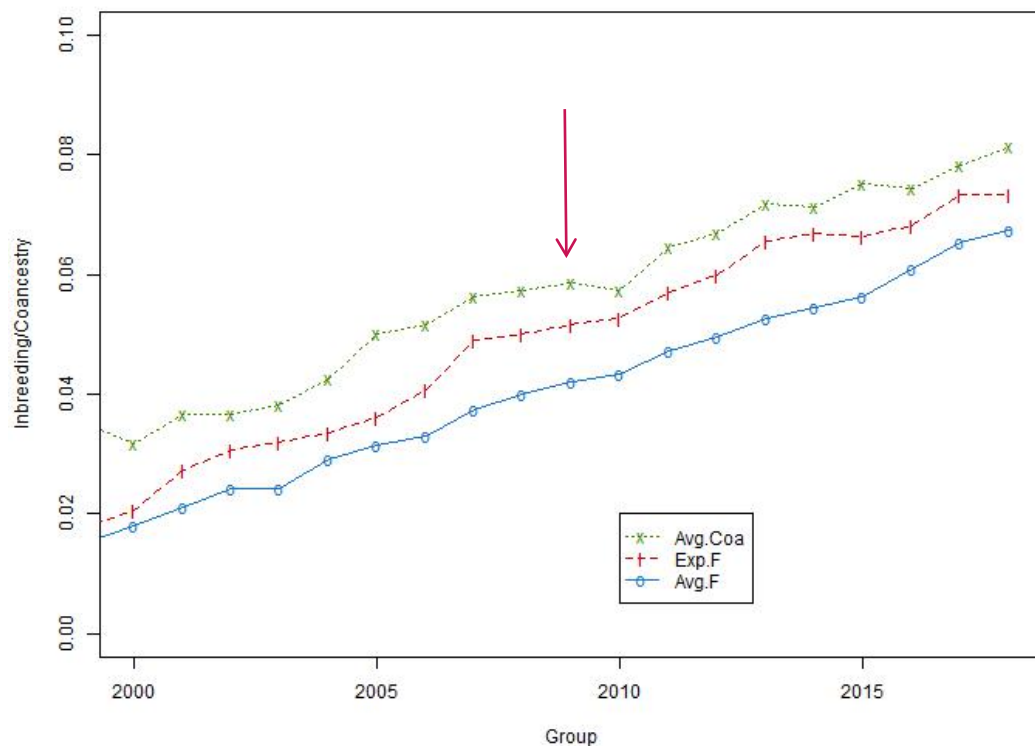
Prel. results, Tenhunen, 2018

Simulations in ADAM

In Prep., JDS

Genetic trend NTM - bulls

Future needs?

Future management tendencies in Scandinavia

1.
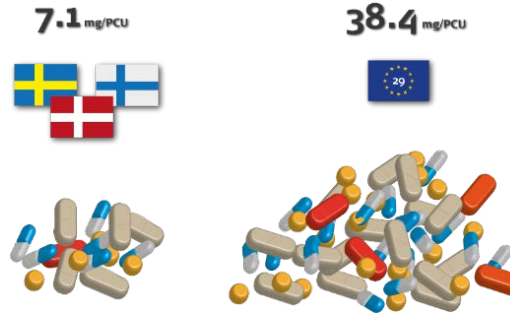Genomic test of all heifers in the herd

2.
Sexed semen in top 40%
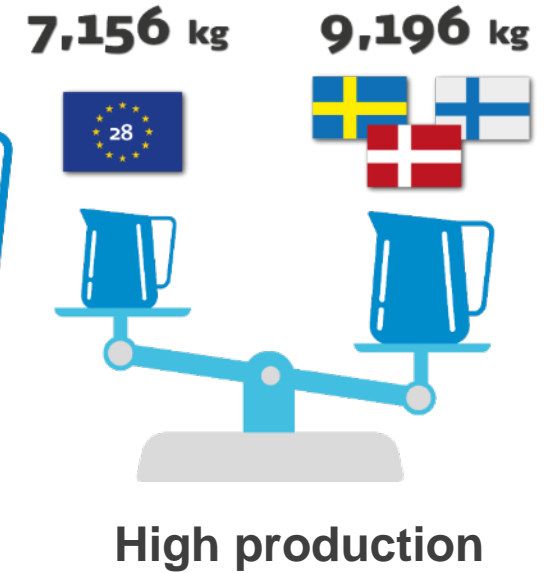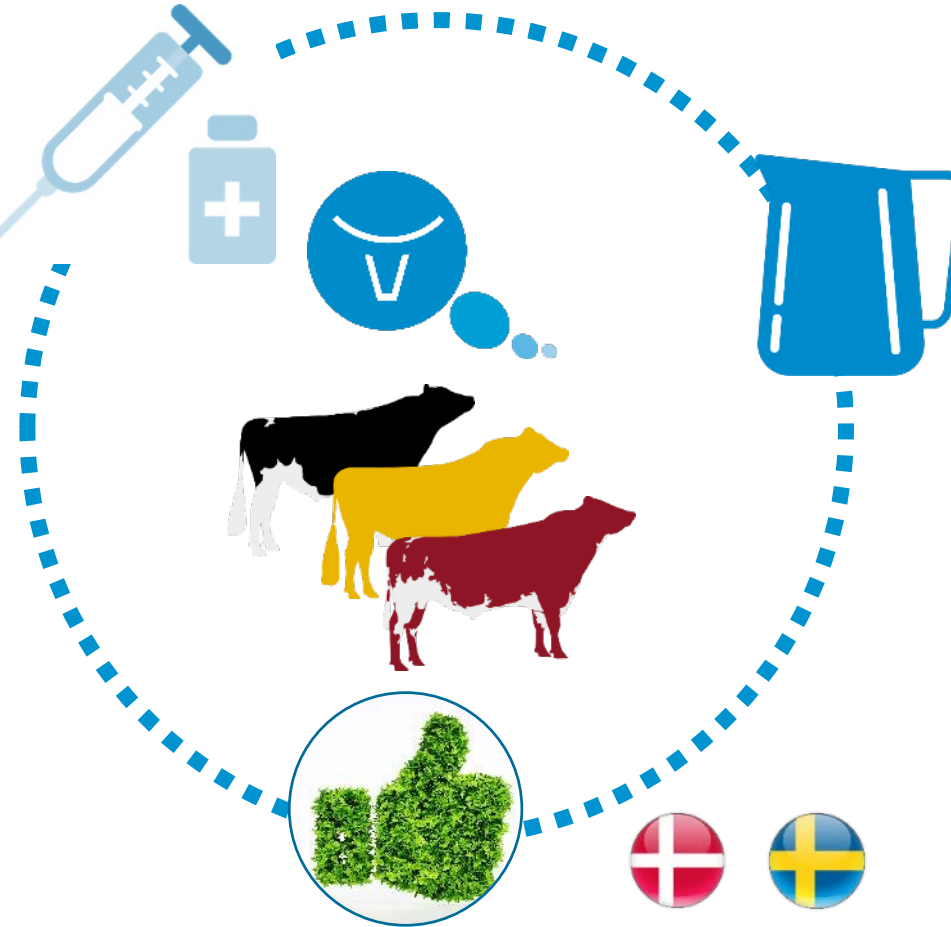
3.
Beef semen in bottom 60%

4.
Cross breeding

Our demands from customer and market

7.1 mg/PCU

38.4 mg/PCU

"License to produce"

Use of gene editing, reprotechnologies?

7,156 kg

9,196 kg

High production

low environmental footprint

Future Phenotypes - New Registrations

Selective breeding can be utilized to ensure progress for resource efficiency. **Technology development** is moving fast and needs to be **utilized for new and existing traits**

- **Phenotypes**

- Efficiency, Methane, Conformation, Weight, behavior, health, male and female fertility, Embryo production, milk quality
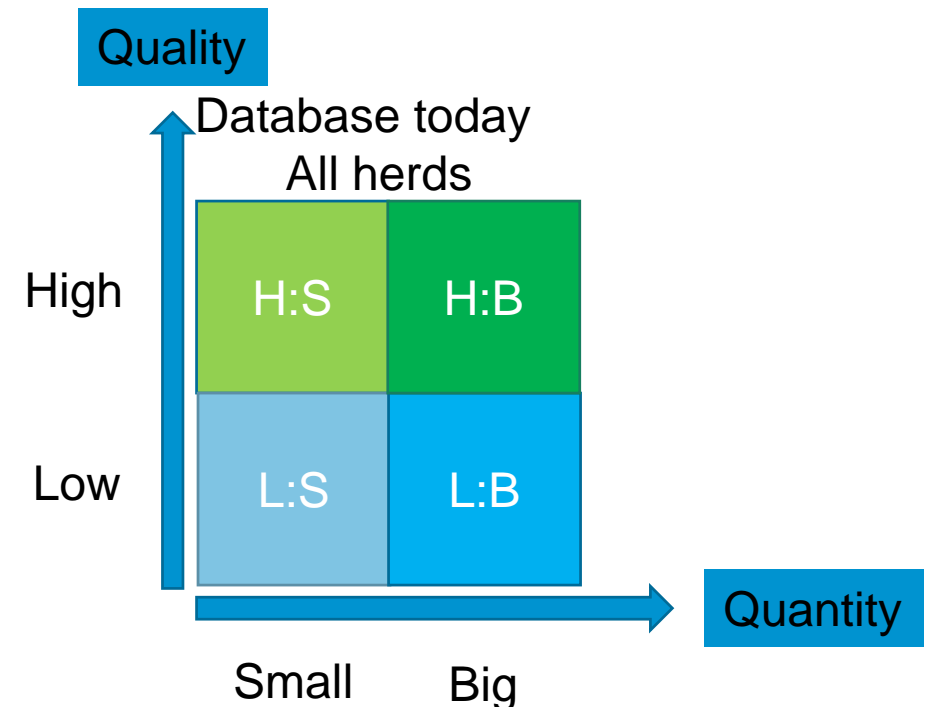
- **Registrations/Technologies**

- CFIT/3D Camera

- Sensors, Bolus, PH, Temperature, Activity, Spectra, Omics

- **Strategy**

- Genotyping, LD project, Contract herds, company partnerships

Quality

Database today
All herds

	Small	Big
High	H:S	H:B
Low	L:S	L:B

Quantity

"The Global Cow"

Understanding relation between economic traits in different environments and production systems to support and increase export globally

Analysis to perform

Gene by Environment interaction

Gene by Gene interaction

… within and across breed combinations

Criteria for success

Data collaboration is a must

Genetic links

Crosses – Dairy*Dairy & Dairy*Beef

The use of crosses is increasing both between dairy breeds and between dairy and beef breeds

- How does it affect pure breeding schemes with a large proportion of crossbred production animals?

- Across breed optimization rather than within breed focus

- Crossbred animals as an active part of the breeding population

- Ensure genetic diversity

Prepared for the future?

19

Effect of female test

	Average sub index (Reliability)				
	Before GS	**After GS**	**Diff.**	**Increase**	**Decrease**
NTM	8	8	0	15	-15
Production index	106 (29)	106 (67)	0	15	-22
Fertility	104 (17)	103 (42)	-1	11	-12
Udder Health	102 (23)	103 (56)	1	15	-10
Udder	102 (25)	102 (60)	0	14	-19

Updated: April 2018

www.vikinggenetics.com

Breeding Program 2018

Screening of high indexed females. All given mating sire proposal

Screening of all pregnancies. Agreement on testing most interesting calves (both bulls and heifers)

Bulls & heifer calves selected for Genomic testing, based on PA and pedigree

Female population

Best Daughter Proven Sires available for export. Only 1% use on domestic market

Heifers selected for donor program based on GEBVs and pedigree

Bull calves bought based on GEBVs and pedigree

Genomic bulls with export profile kept until daughter proven

Best bulls used as Active sires for 3-9 months on domestic market

All Genomic bulls are used as sires of sons. First semen goes to ET/OPU on potential Bull dams

Bulls approved for semen production

www.vikinggenetics.com

Change of generation interval, Holstein