



Influence of Genomics on Breeding Organisation and Dairy Farms

135th Anniversary of Estonian Herdbook
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Euroopa Maaelu Arengu
Põllumajandusfond:
Euroopa investeeringud
maapiirkondadesse



A. Influence of Genomics on Breeding Organisation

10 years ago.....

Q: Will the service of herdbook organisations change?

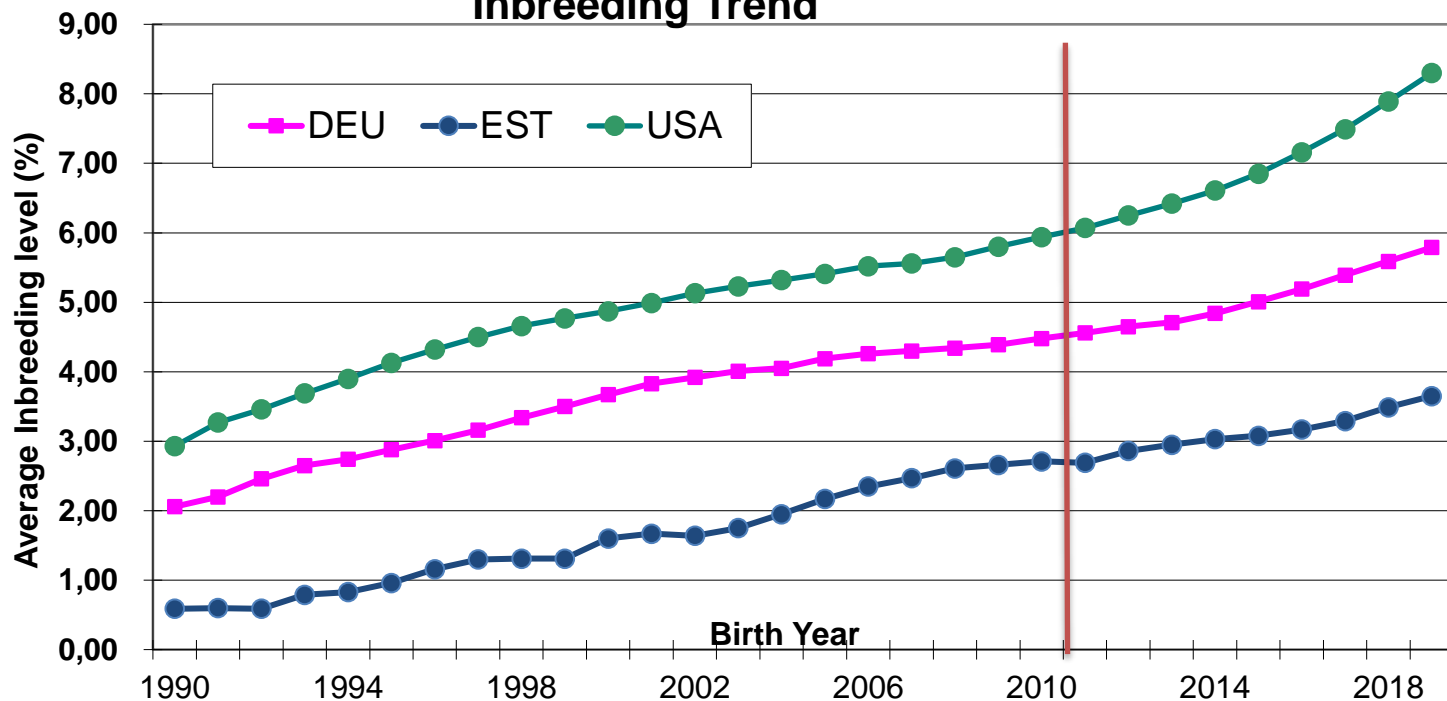
2020: The influence of genomics has changed the service of the breeding organisation

- Type classification >50% 2020: → *decreased numbers of bulls tested;*
- Milk recording 2020: → *more and different frequency of service*
- Genotyping service, parentage verification 2020: → *is partly offered*
- Can we keep the farmers influence due to Competition of private companies? 2020: → *it is possible so far*

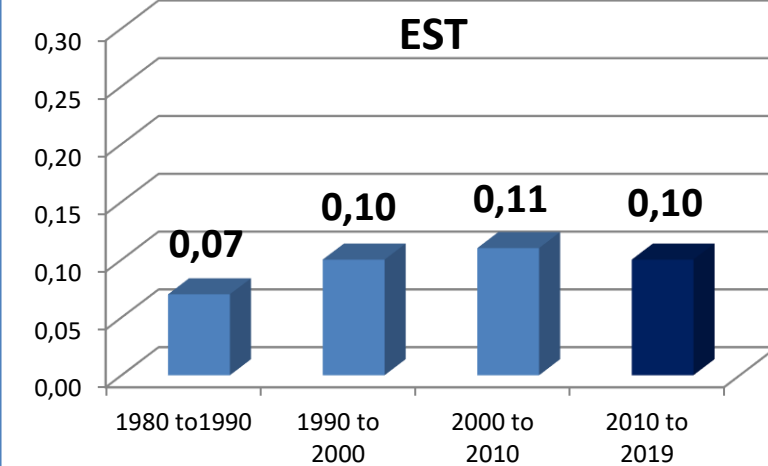
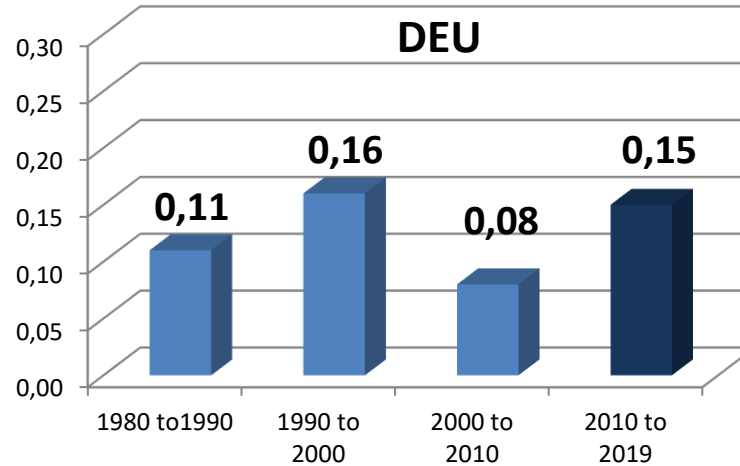
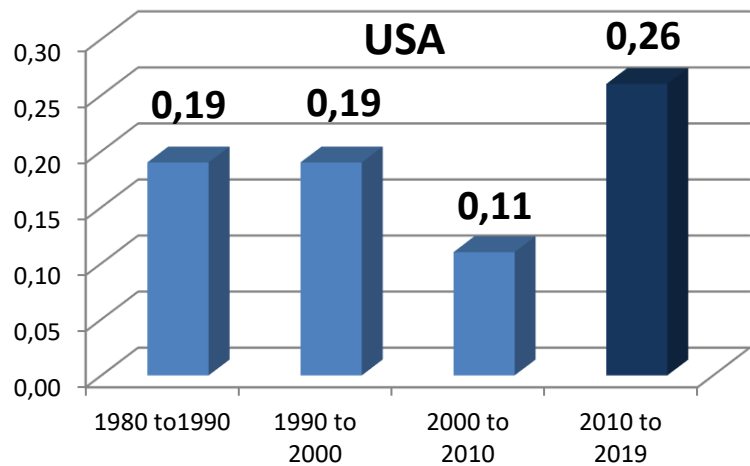
Q: What will be the change of breed development goals

- Reduced generation interval
- Faster progress in fertility and health traits
- Increase of inbreeding is possible

Inbreeding Trend



- In times of **Genomics** inbreeding has increase in the female populations
- The inbreeding in the AI-bulls is higher (USA: 14,3%)



10 years ago.....

Influence of Genomics on breeding organisation?

Q: Where will breeder's send their samples?

2020: *Yes, Breeder's send their samples to national or international partners*

Q: Do countries exchange genomic information on cows?

2020 : *Countries exchange genomic information on cows and bulls (international cooperations)*

Q: Herd-books need access to all genomic information

2020 : Most of them have or use the service of international partners

Q: Can HB-associations protect the interests of members?

2020 : Yes, if they offer competitive and reliable service

Q: Will all genomic information be published?

2020 : Yes, gEBVs; but not any genomics formulars

Consequences for the herdbooks

- Individual herd-books have different structures.
 - Traditional Herdbook Associations.
 - Herdbook Associations with Milk Recording (*DHI*).
 - Breeding Associations with Evaluation Centre.
 - Breeding Organisation (*including Herdbook and AI*).
 - Fully Integrated Breeding Company.

Traditional Herdbook Associations

(AUT, DNK, SWE, FRA, TUR)

▪ **Characteristics**

- Focus primarily on registration, classification and showing
- Source for pedigrees
- Not involved in any milk recording or AI business

▪ **Expected development**

- Reduced demand (*type classification, registration*)
- Parentage verification with more accuracy through genomics
- Will future generations be convinced of the relevance of the traditional service?



Loss of income

They will disappear in medium term

Herdbook Associations with Milk Recording (DHI)

(ESP, UKE)

▪ **Characteristics**

- Traditional herdbook tasks (*classification, registration, pedigree*)
- Collection of performance data
- Government mandated ear tag registration
- Association staff with multi tasks in farm data collection (*great advancement!*)

▪ **Expected development**

- Associations to enlarge their service to genomics
- Closer co-operation with AI industry

Breeding Associations with Genomics Service and Evaluation Centre

(ITA, POL)

▪ **Characteristics**

- Traditional herdbook activities
- parentage information may be obtained by genomics
- High advantage due to the data access, but
- Limitation on personal contacts to members

▪ **Expected development**

- To enlarge the service for farms
- Need to integrate with on-farm services
- Will further increase cooperation with other service partners

Breeding Organisation (including Herdbook, AI, Genomic Service and Sales)

(DEU, (EST))

▪ **Characteristics**

- To offer full service to farmers
- Controlling the data flow
- Genotyping service is established


▪ **Expected development**

- Further enlarge the customer service (*new traits*)
- Built up the partnership with the customers (farm contracts)

Fully integrated Breeding Company

(DEU, NLD)

▪ **Characteristics**

- optimum solution to deliver a comprehensive range of services
- Has integrated Milk and Performance Recording
- integration of further services are easily possible
- Genomics is of great benefit to this structure, it maximise the use of information in all parts of the business
 - identification of the best bloodlines, sire selection, progeny testing through to semen sales, herdbook tasks and data collection
 - using information collected in other sectors of the business.
-  **These integrated structures are in a strong position to develop and expand (*all services under one roof*).**

B. Herd Genotyping

A platform for the implementation of direct breeding values for animal health and a tool for genomic herd management

KuhVision + Herd genotyping



Aims of the projects

- creating a female reference population
- implementing new breeding values (e.g. health traits)
- genomic herd management system for farmers



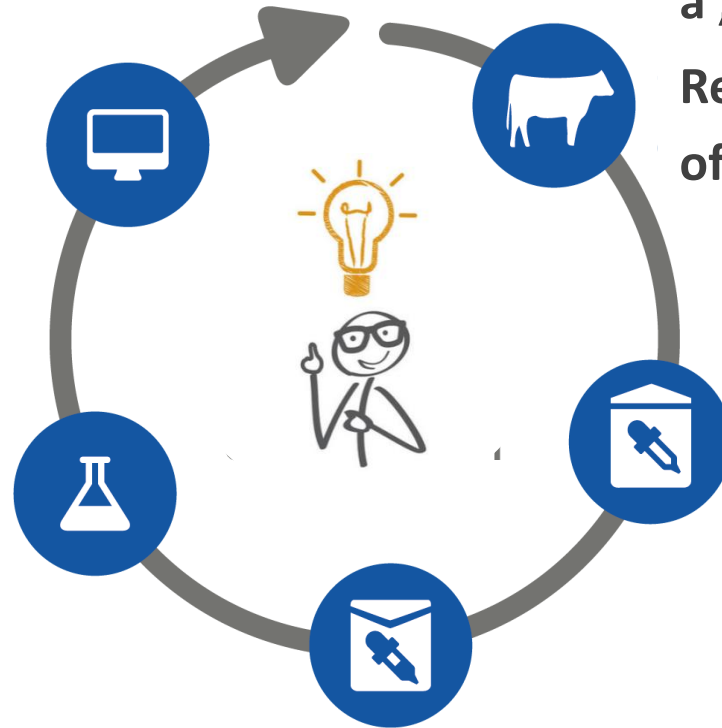
Current status

- 1.810 farms take part → increase of 20 farms per month
- 552,000 genotyped female animals
- > 17 % of registered Holstein cows are genotyped
- > 185,000 cows calved already and have phenotypes

How does it work?

Farmer receives GEBV
via Internet portal
„NETRINDgenom“
(web based)

Automatic analysis in
the lab and breeding
value estimation by
data center vit



Female calf is born on
a „KuhVision-farm“.
Report of birth to the
official German database

Automatic mailing of
the Tissue-Sampling-Tag
to the farmer

Easy sampling and
shipping the sample
to the lab



Advantage for the farmer

- Full information about the genetic level of the herd
- Possibility to select animals in an early stage
 - Which calf to raise?
 - Which cattle to sell?
 - Which cattle to inseminate with sexed semen?
 - Which cows to breed with a beef breed?
- Higher breeding progress
- Increasing the herd health



➡ The herd at a glance for the genomic management!

Benefits for farmers

- 6 different health breeding values for genotyped animals
- Economic breeding value
- Another 42 breeding values within performance, functionality and conformation
- Information about genetic peculiarities (horn status, red factor ...) and genetic defects (Brachyspina, BLAD, CDH, Haplotypes HH1-HH6)
- β - und κ - casein type
- regular health reports about the own herd



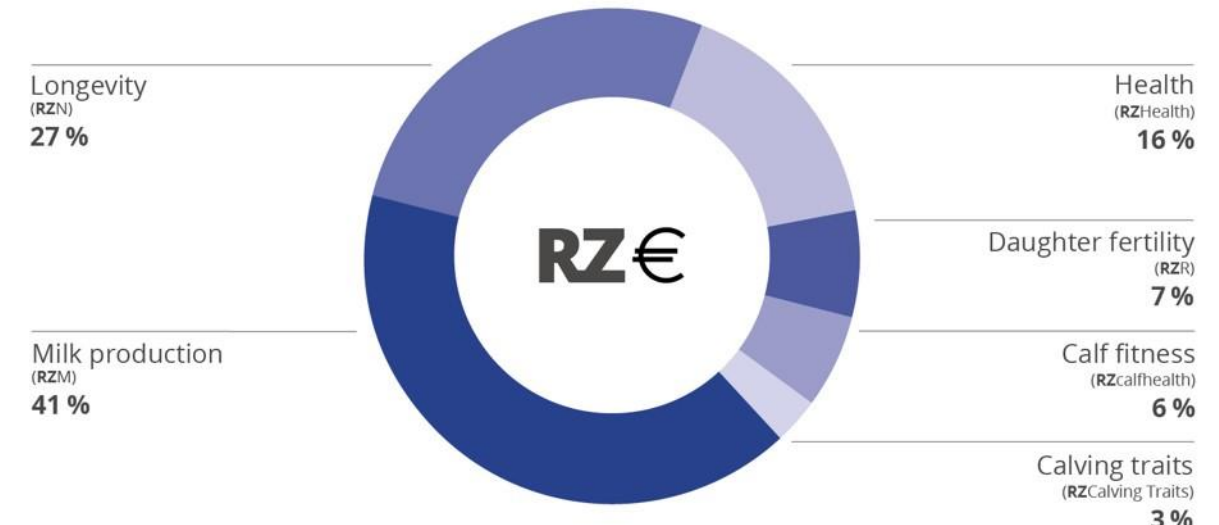
New breeding values resulting from KuhVision and other projects

Traits in this breeding value



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Characteristics in Breeding Value



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Genomic Herd Management

- breeding values for direct health traits
→ evidence of genetic susceptibility to economically significant disease complexes
- compensation of genetic weaknesses in animal health
e.g. support for the Mortellaro recovery
- precise replacement with the best animals in the herd
→ using sexed semen, rearing fewer calves
- reducing genetic defects
- Inter- farm comparison possible
- control of inbreeding
- computer-based programmes can help to keep an overview of the animals




Example

- data sheet for breeding values
→ information for farmers
- breeding values are displayed in the relative breeding value system
 - 100 represents the population mean
 - values above 100 are usually desired (apart from conformation)
 - standard deviation = 12



Ergebnisse Zuchtwertschätzung

DE [REDACTED]



HB-Nr.:
Orig.Name
Besitzer: Andreas [REDACTED]

Rasse: Holstein-Sbt

Geschlecht: weiblich
Geb.-Dat.: 14.01.2019

Druckdatum: 20.10.2020
Schätzdatum: 11.08.2020

Abstammung

DE [REDACTED]	V	[REDACTED] Fuel	VV	US 3125201993 Duke
	M	[REDACTED]	MV	DE 03 569 63109 Forrest

VVV US 71703339
Montross

MVV DE 03 548 12817
Fanatic

MMV CA 107381512
Embracing

Teil- und Gesamtindizes

	ZW ¹	dGW ²	gZW ³
RZG	125 21%	133 70%	134 72%
RZ€		1341 81%	1319 82%
RZM	122 21%	138 71%	139 73%
RZE	112 15%	108 58%	108 61%
RZS	103 20%	112 74%	111 76%
RZN	106 15%	101 64%	102 66%
RZR	104 15%	107 49%	107 53%
RZKm	101 16%	105 57%	104 61%

Funktionale Merkmale

	ZW ¹	dGW ²	gZW ³
KON	105	109	110
KVd	98	100	99
TGd	99	102	101
RZKd	98	101	100
RZD	100	98	99
MVH	97	95	94
BCS	101	80	82
RZKälberfit	94	94	94

Milchmerkmale

	ZW ¹	dGW ²	gZW ³
Milchmenge	793	868	898
Fettmenge	41	82	82
Eiweißmenge	25	39	39
Fettgehalt	0.09	0.45	0.44
Eiweißgehalt	-0.02	0.09	0.08

Gesundheitsmerkmale

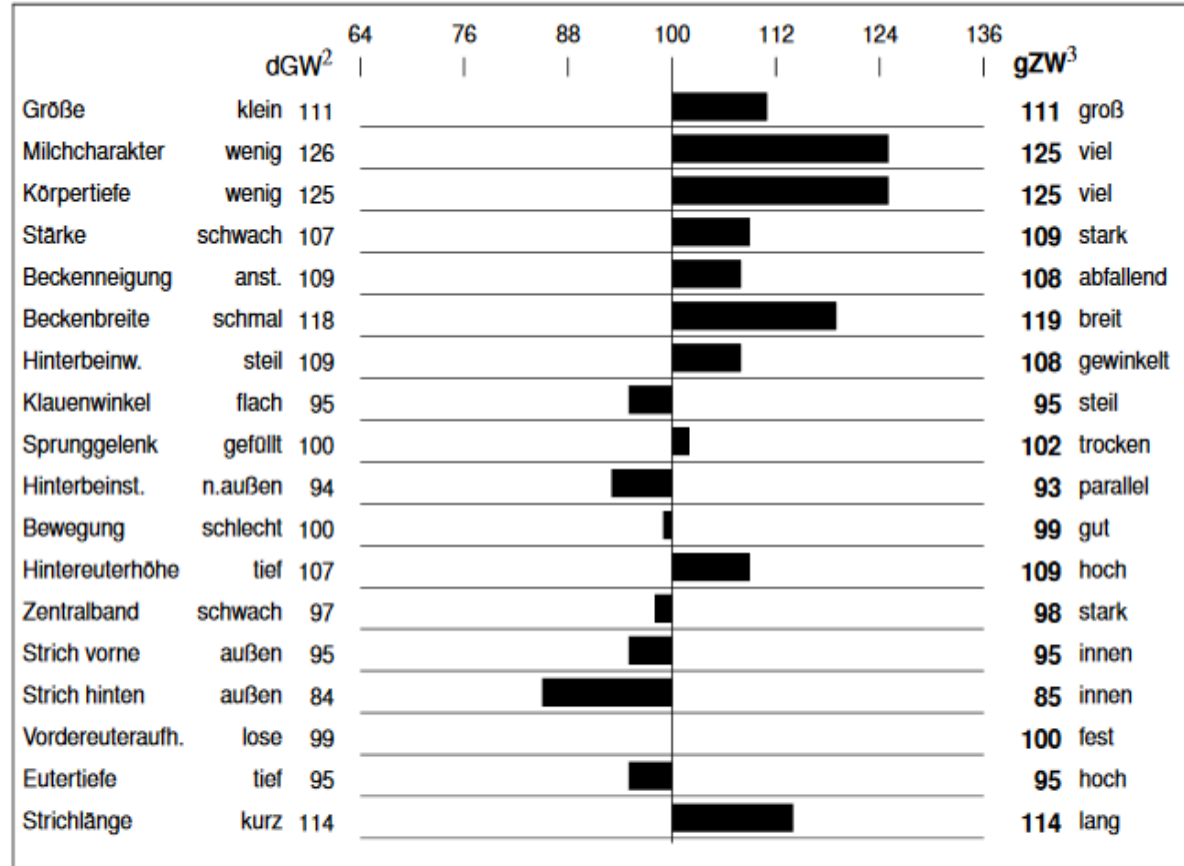
	ZW ¹	dGW ²	gZW ³
RZEuterfit	98	96	95
RZKlaue	105	104	104
DD control	106	101	102
RZRepro	105	102	103
RZMetabol	101	99	98
RZGesund	102	99	98

Example

conformation traits are displayed

as well as genetic peculiarities and defects

Exterieur



	dGW ²	gZW ³
RZE	108	108
Milchtyp	123	121
Körper	118	117
Fundament	98	97
Euter	100	101

- ¹ konventioneller ZW
- ² direkt genomischer Wert
- ³ **genomisch kombinierter ZW = offizieller Zuchtwert**

20. Oktober 2020, genomische Zuchtwerte

Genetische Merkmale

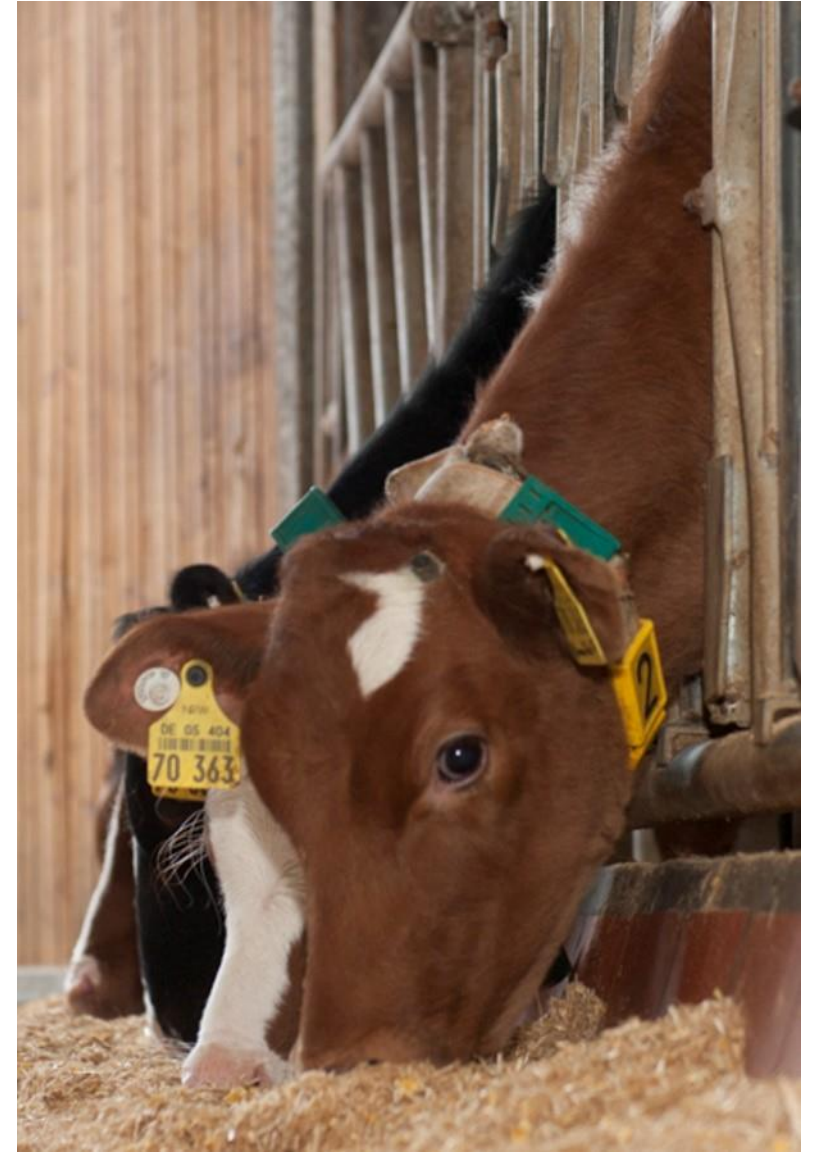
BraSp	BLAD	RotF	VRC	HornSt	KK	HH1	HH2	HH3	HH4	HH5	HH6	CDH	BK
BYN	BLF	RDF	VRF	pp	AA	H1F	H2N	H3F	H4F	H5N	H6F	CDF	A22

Bull mating programme (BAP)

- Designed by vit (*in co-operation with German breeding organisations*)
- Consideration of: inbreeding, performance data, health traits, linear type traits and genetic characteristics (genetic defects, horn status)
- Genomic breeding values of female animals are included in the programme
- BAP enables the development of a farm strategy for farms taking part in KuhVision and herd genotyping
 - e.g. defining "knock-out criteria", which are taken into account for mating decisions
 - defining own breeding goal
 - marking animals for beef cattle semen or selling if an animal is below a threshold in a "knock-out criteria,, (regardless of it's RZG)

Conclusion

- Genotyping programmes have gained enormous popularity in a short time
 - Increasing importance of genomic breeding values in herd management
 - Improved opportunities in herd management
- Valuable tool for herd management
 - A long-term approach for the improvement of animal health
 - A high demand for advice from livestock farmers



Thank you for your attention

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