19. WORLD **SIMMENTAL FLECKVIEH** CONGRESS

The robust Fleckvieh cow – breeding for fitness and health

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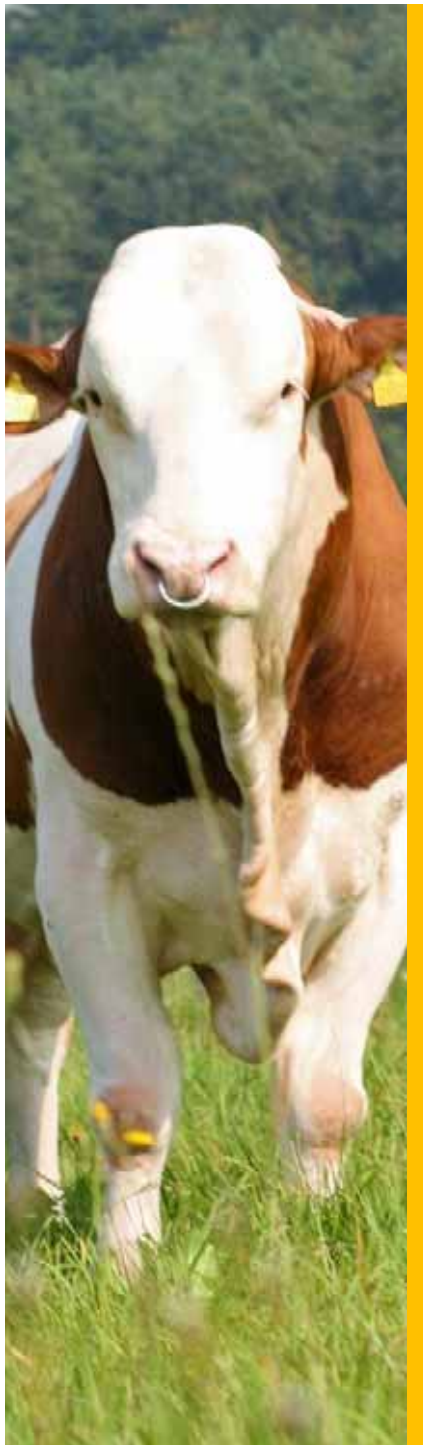
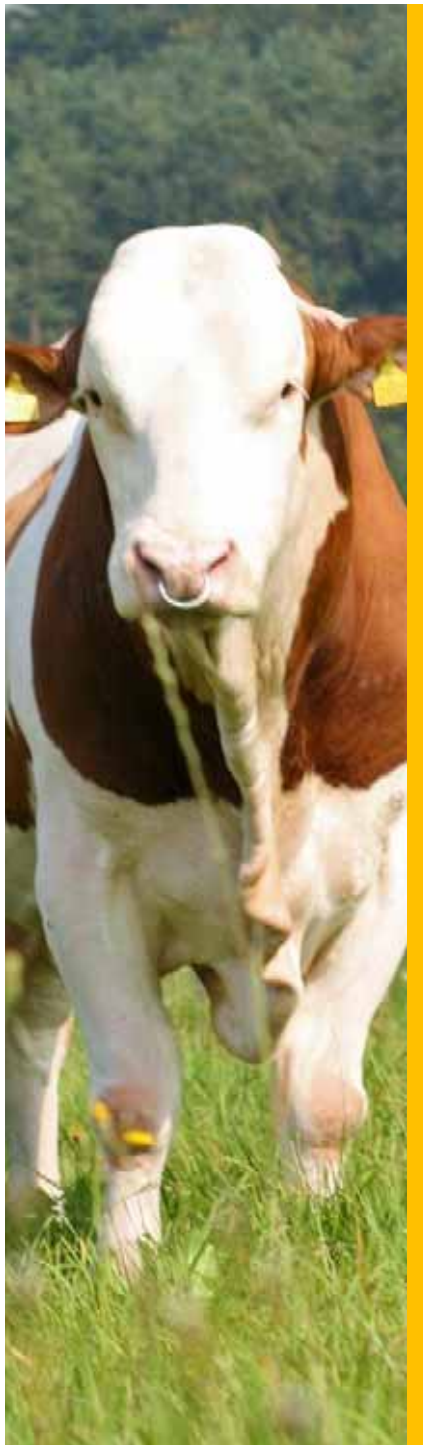
Landshut, September 22, 2012



OVERVIEW

- Background
- Present situation
- Genetic evaluation
- Breeding values for direct health traits
- Genomic selection and fitness and health
- Outlook



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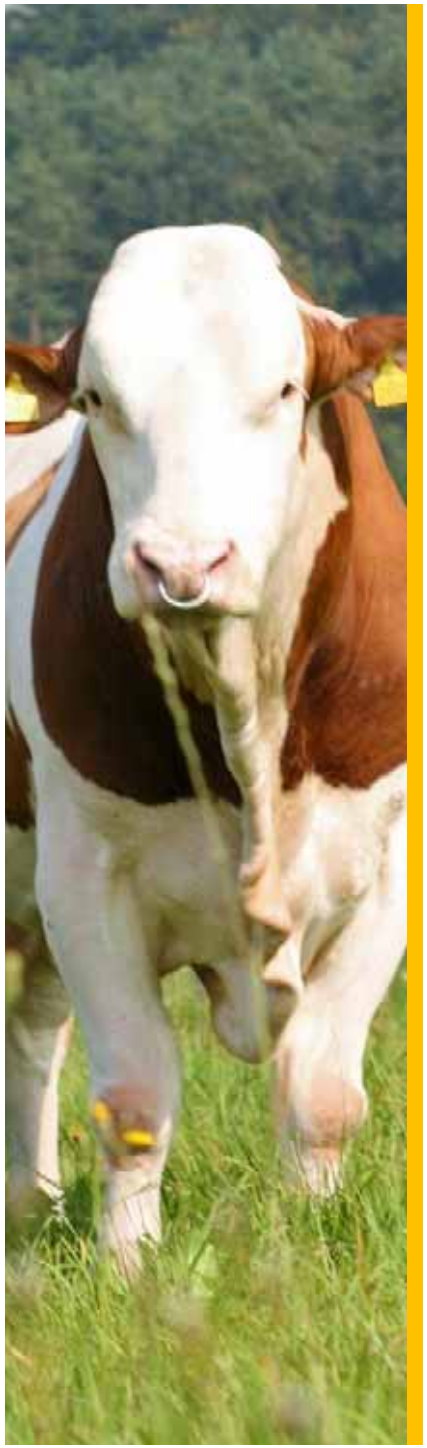
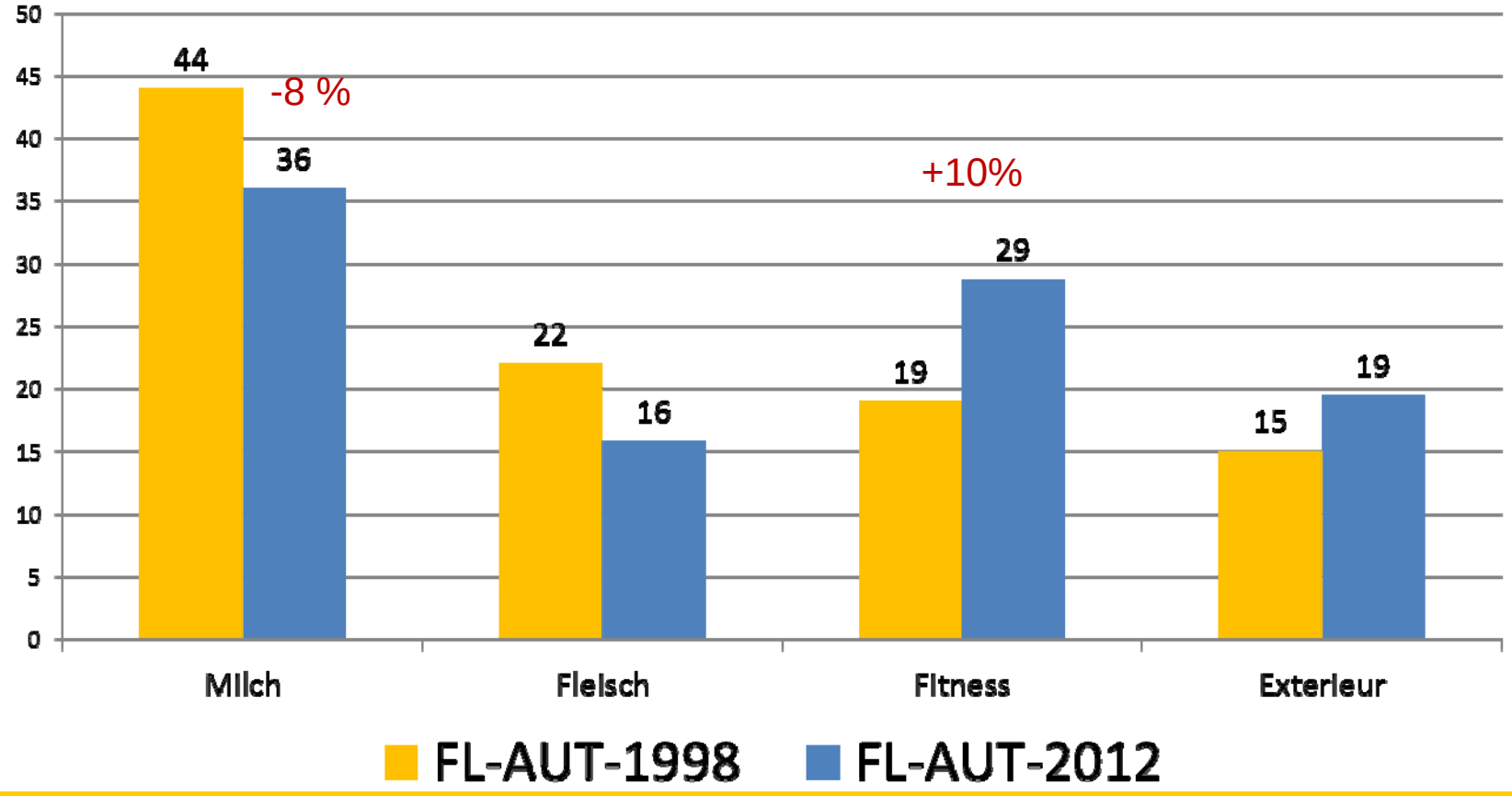


BACKGROUND

- Genetic gain up to 100 kg milk per year; genomic selection will enforce genetic gain
- Good fitness and health important for economic efficiency – indirect costs!
- Undesired genetic correlations between milk yield and fitness/health.
- Low heritabilities for fitness and health traits – difficulties in recording.
- Consumers are asking for healthy food from healthy animals.

EXPECTATIONS OF BREEDERS?
RELATIVE WEIGHT OF INDIVIDUAL BREEDING GOAL

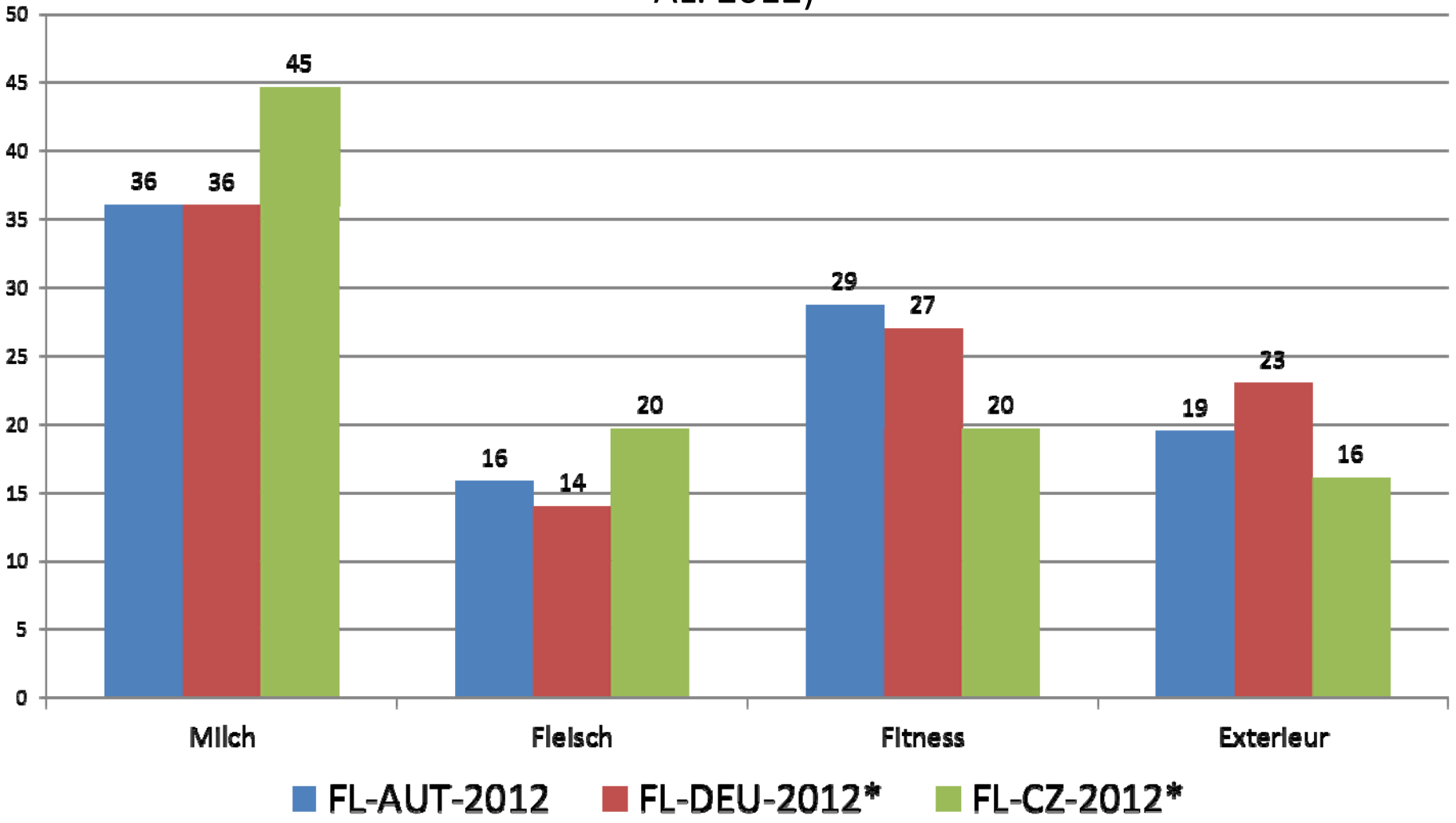
RESULTS OF A SURVEY WITHIN FLECKVIEH-BREEDERS IN 1998 AND 2012 (STEININGER ET AL. 2012)



More weight on fitness, reduced importance of dairy and beef traits.

EXPECTATIONS OF BREEDERS?
RELATIVE WEIGHT OF INDIVIDUAL BREEDING GOAL

FLECKVIEH 2012: ÖSTERREICH, DEUTSCHLAND, TSCHECHIEN (STEININGER ET AL. 2012)



* 2012 Preliminary results: Coverage AUT: 1.637 (finished); **DEU:312*; CZ: 15* in process**

STEPS WITHIN BREEDING

Breeding goal (TMI)

↓

Performance recording

↓

Genetic evaluation

↓

Selection and mating

↓

Genetic gain

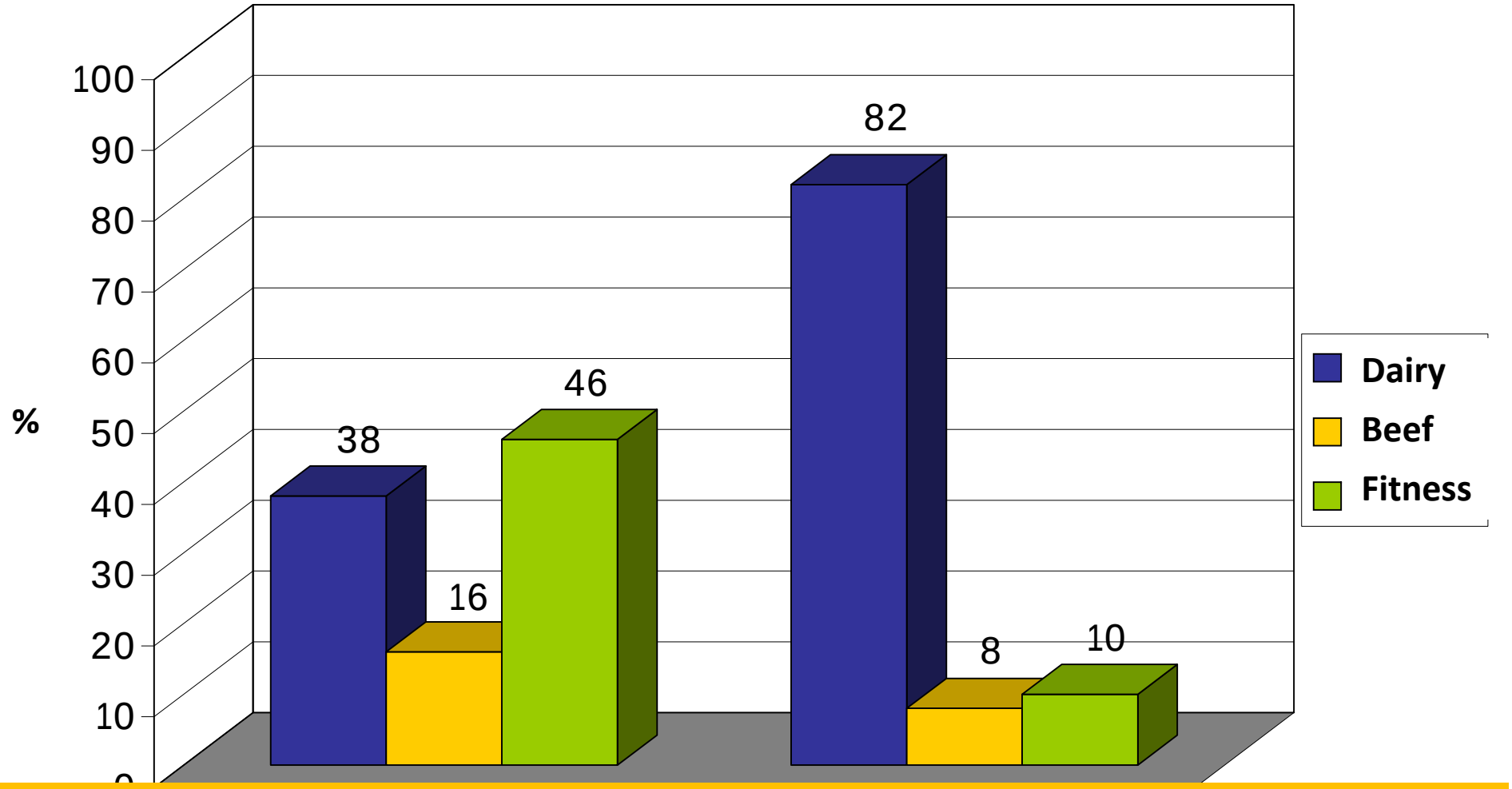
Optimization in all steps is important. Reliable data from performance recording is the precondition for genetic gain in the respective traits.

FLECKVIEH TOTAL MERIT INDEX (TMI)

		w per unit	Relative (%)	
Dairy	**Fat kg**	0,45	4,4	**37,8**
	Protein kg	4,50	33,4	
Beef	**Net daily gain**	1,34	7,3	**16,5**
	Dressing %	0,85	4,6	
	Trading score	0,85	4,6	
Fitness	**Longevity**	2,47	13,4	**43,7**
	Persistency	0,36	2,0	
	Fertility female	1,25	6,8	
	Calving ease	0,68	3,7	
	Stillbirth	1,49	8,1	
	Somatic Cell Count	1,78	9,7	
	Milkability	0,36	2,0	**2,0**

Presently no direct health traits are included within the Total Merit Index in Austria and Germany (DEA).

TMI-WEIGHTS AND GENETIC GAIN



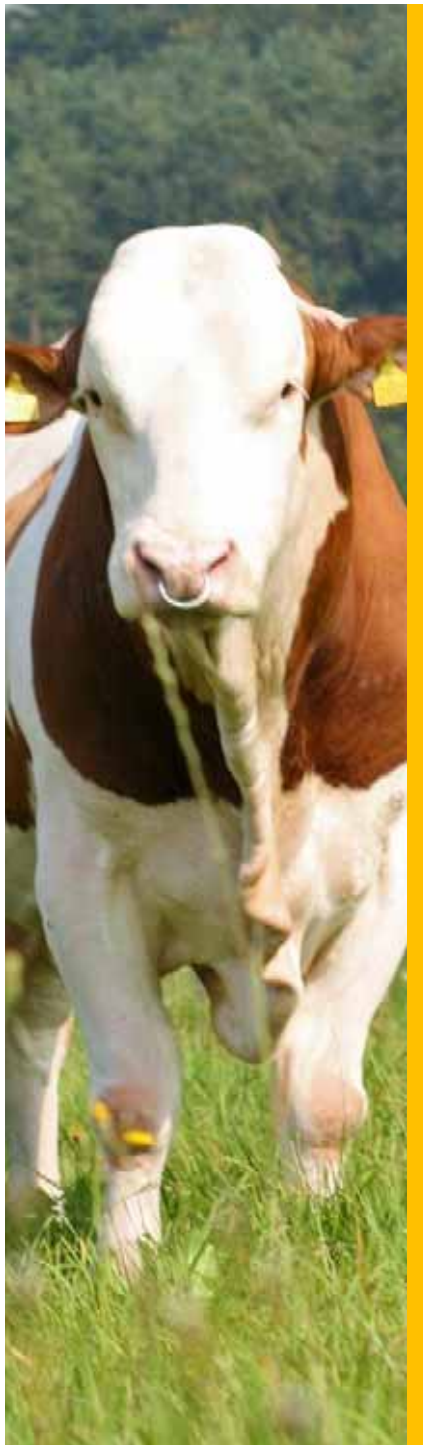
Survey among breeders within the project „OptiGene“ (2012):
about 30% genetic gain for fitness expected (presently about 10% realized)

GENETIC TRENDS (GENETIC GAIN PER YEAR)

Ø OF THE LAST 10 YEARS (ZUCHTDATA, 2012)

	Fleckvieh
Total Merit Index	2,5
Dairy Index	2,4
Milk kg	99
Fat %	-0,015
Protein %	-0,002
Beef Index	0,1
Fitness Index	0,7
Longevity	0,8
Fertility female	-0,3
Somatic cell count	0,2

Good fitness status of Fleckvieh: e.g AUT 2011 (longevity: 3.75 years, avg. SCC: 185 t, avg. intervall between calving: 391 days)



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JOINT GENETIC EVALUATION

VIT Informations-Systeme Tierhaltung

Holstein
All traits

LfL Tierzucht

Dairy

Conformation

Milkability

Somatic Cell Count

Persistency

Baden-Württemberg

Beef

ZuchtData EDV-DIENSTLEISTUNGEN GMBH

Fertility

Calving ease

Stillbirth

Longevity

New: direct health traits

Total Merit Index

EBV FERTILITY

- **Female fertility:**
  - Non-Return-Rate 56 (NR56) (heifer; cow) +

  Interval from first to last insemination (heifer; cow)
  - Presently no EBVs for direct health traits (e.g. early fertility disorders, cystic ovaries,..) considered within the index
- **Male fertility:**

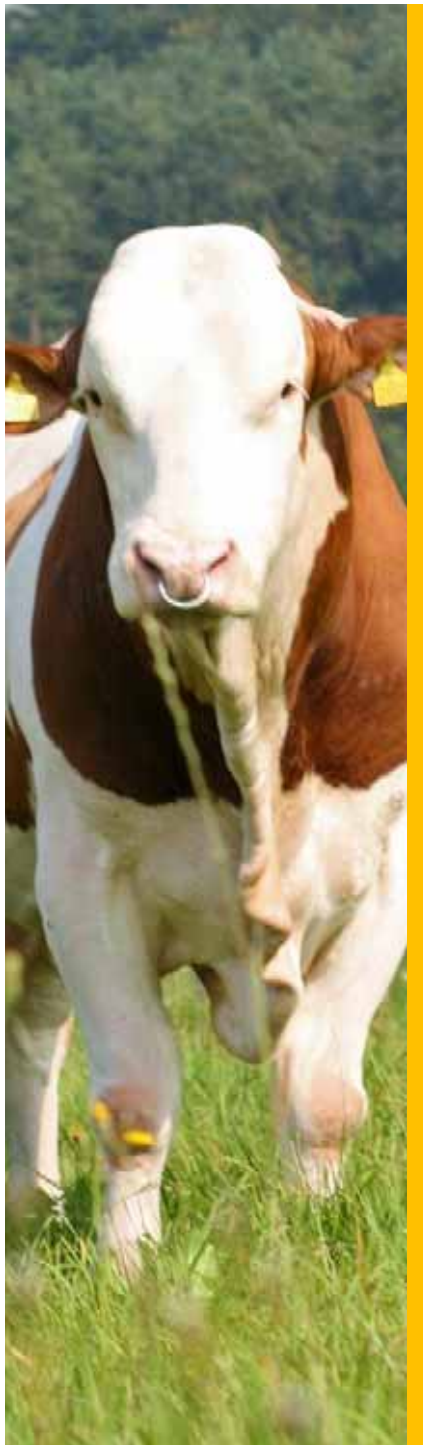
  corrected NR56 in % (no EBV)

EBV CALVING EASE / STILLBIRTH

Multivariate genetic evaluation for calving ease and stillbirth (maternal and direct). Traits for heifers and cows.

EBV UDDER HEALTH

Presently only somatic cell count (SCC) included in TMI. EBVs for mastitis provided. Udder health-index with SCC, mastitis and conformation traits is being developed.



MASTITIS:
CORRELATIONS TO OTHER TRAITS

SCC: EBV-corr 0.46 (genet. corr 0.6-0.7)

- high SCC mainly in chronical and subclinical cases
- acute clinical cases often not discovered within performance recording
- often no diagnoses for subclinical cases

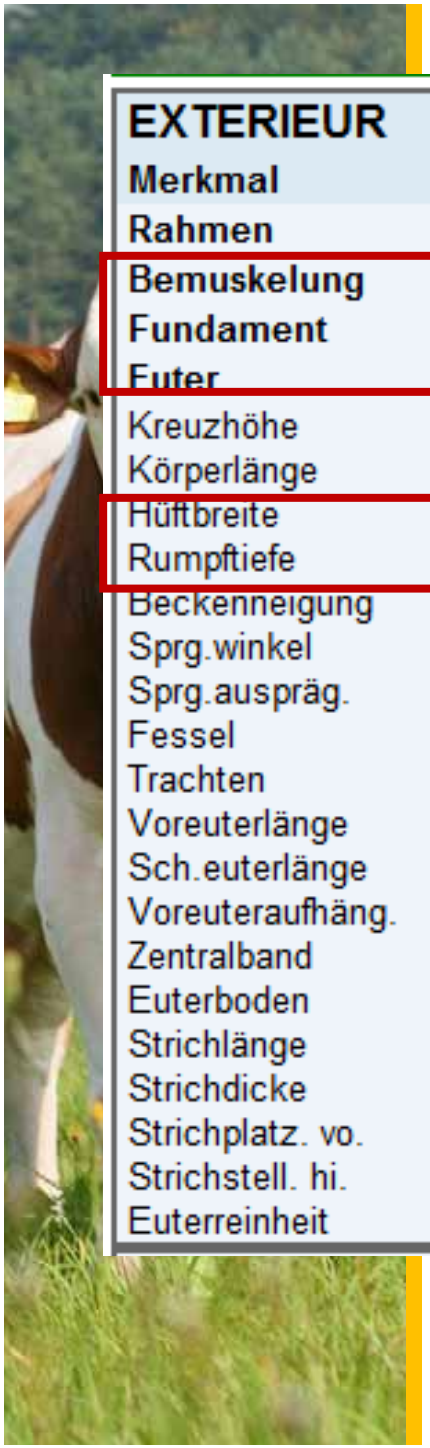
Combination of both traits best

- Mas – Dairy Index: EBV-corr -0.13
- SCC – Dairy Index: EBV-corr +0.03
- Mas - Fitness Index: EBV corr 0.32

Higher udders, better fore udder attachment, teat placement inwards: **fewer cases of mastitis**.

EBV LONGEVITY

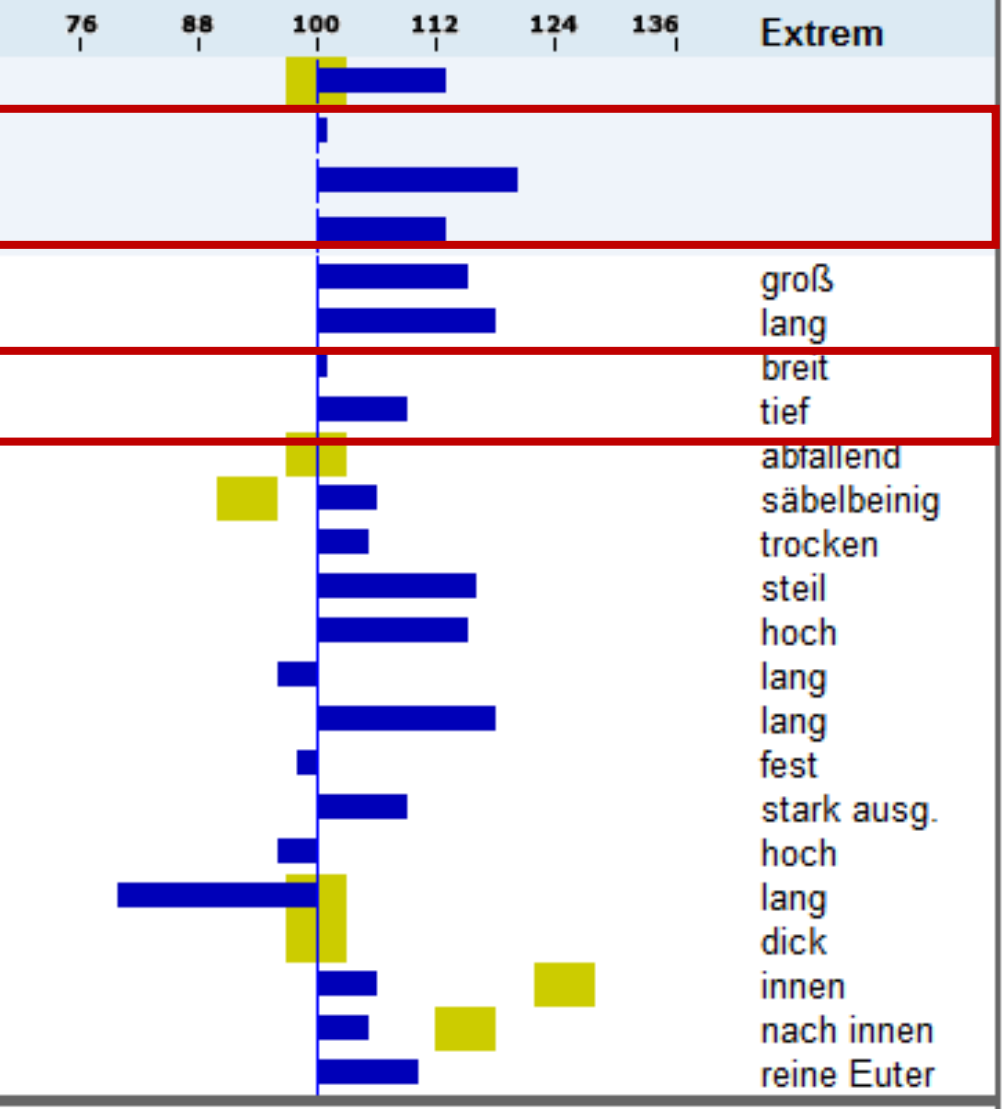
Trait: functional or production independend longevity
Auxiliary traits fitness and conformation are included for better prediction.



EXTERIEUR

75 Töchter: **113 - 101 - 120 - 113 (87)**

Merkmal	ZW	Extrem	Extrem
Rahmen	**113**		
Bemuskelung	**101**		
Fundament	**120**		
Euter	**113**		
Kreuzhöhe	115	klein	groß
Körperlänge	118	kurz	lang
Hüftbreite	101	schmal	breit
Rumpftiefe	109	seicht	tief
Beckenneigung	100	eben	abfallend
Sprg.winkel	106	steil	säbelbeinig
Sprg.auspräg.	105	voll	trocken
Fessel	116	durchtrittig	steil
Trachten	115	niedrig	hoch
Voreuterlänge	96	kurz	lang
Sch.euterlänge	118	kurz	lang
Voreuteraufhäng.	98	locker	fest
Zentralband	109	nicht ausg.	stark ausg.
Euterboden	96	tief	hoch
Strichlänge	80	kurz	lang
Strichdicke	100	dünn	dick
Strichplatz. vo.	106	außen	innen
Strichstell. hi.	105	nach außen	nach innen
Euterreinheit	110	Nebenstr.	reine Euter

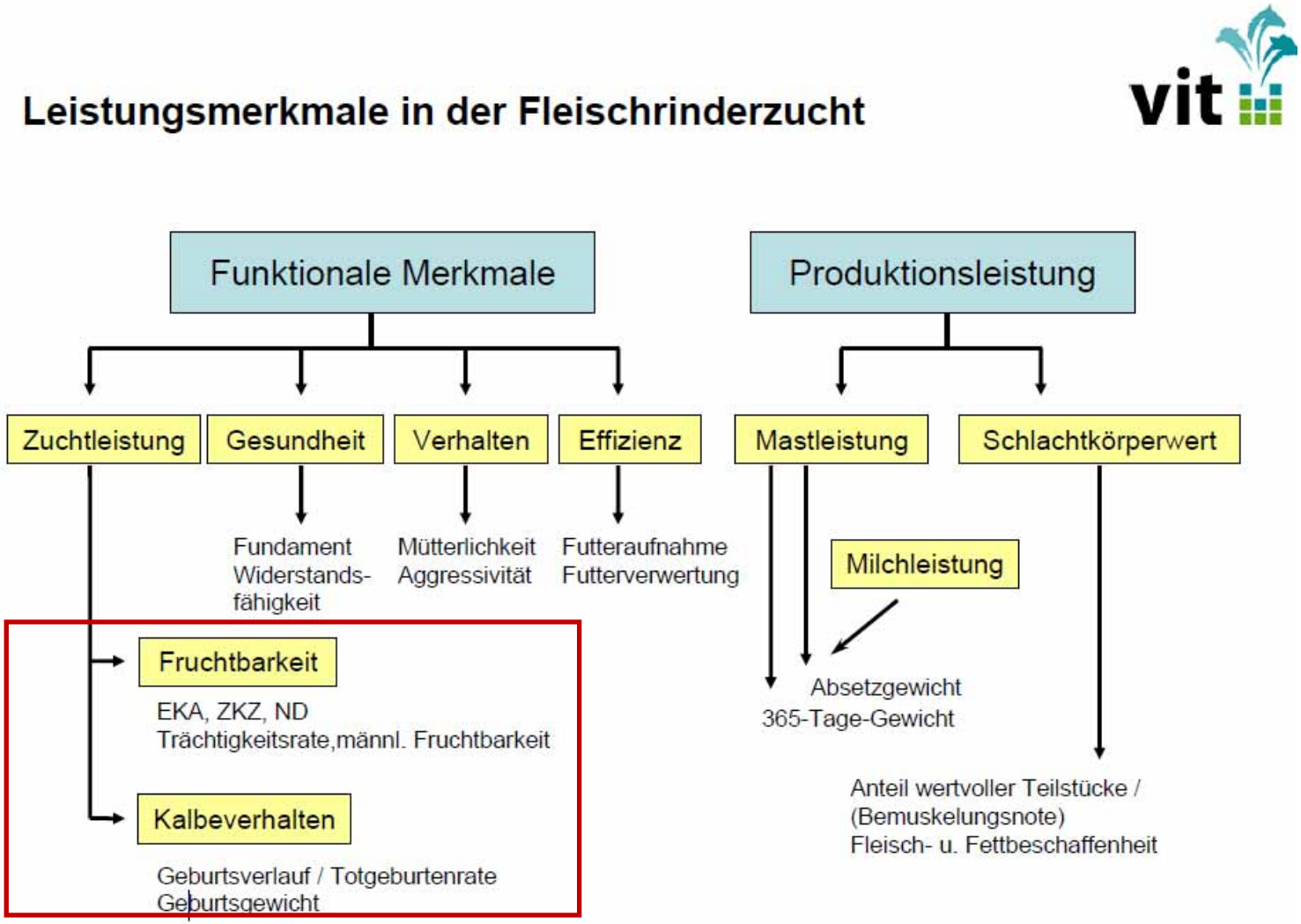


Conformation not within TMI

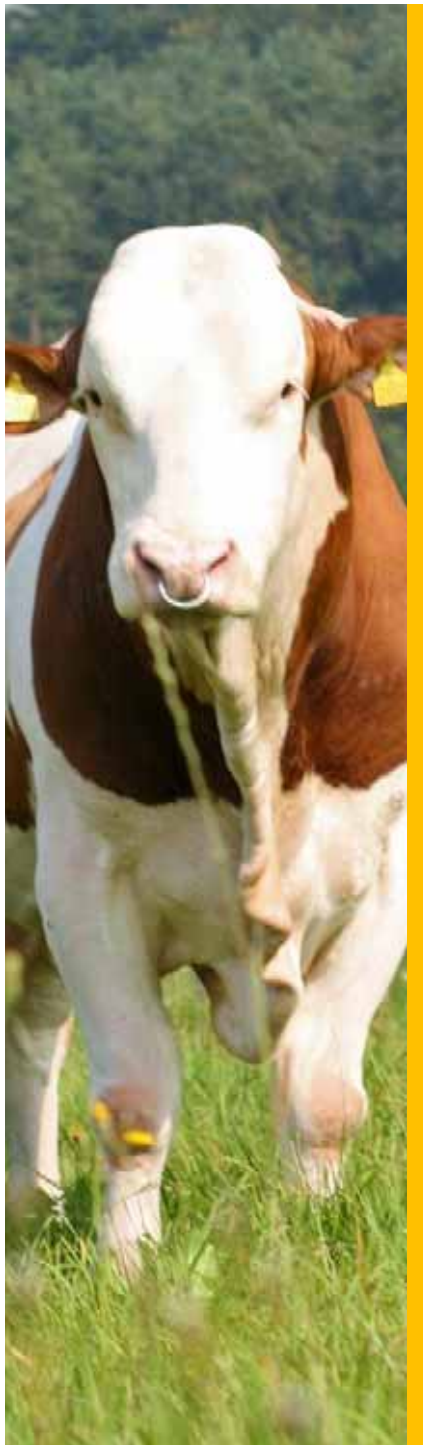
Auxiliary traits for longevity

FLECKVIEH FLEISCH

FLECKVIEH – FLEISCH (DEU)
GENETIC EVALUATION



Quelle: Ruten, 2011



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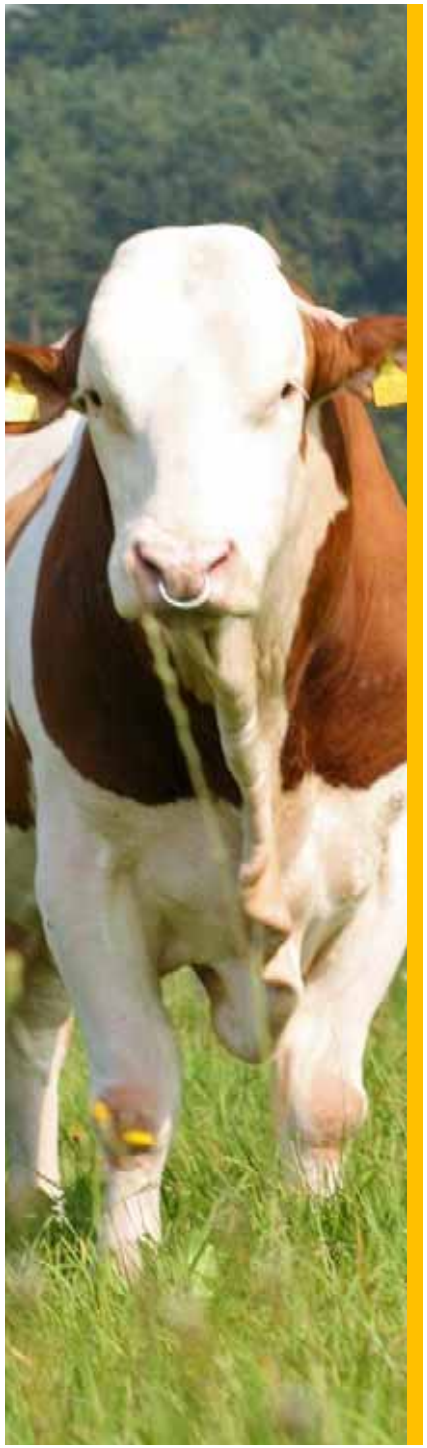
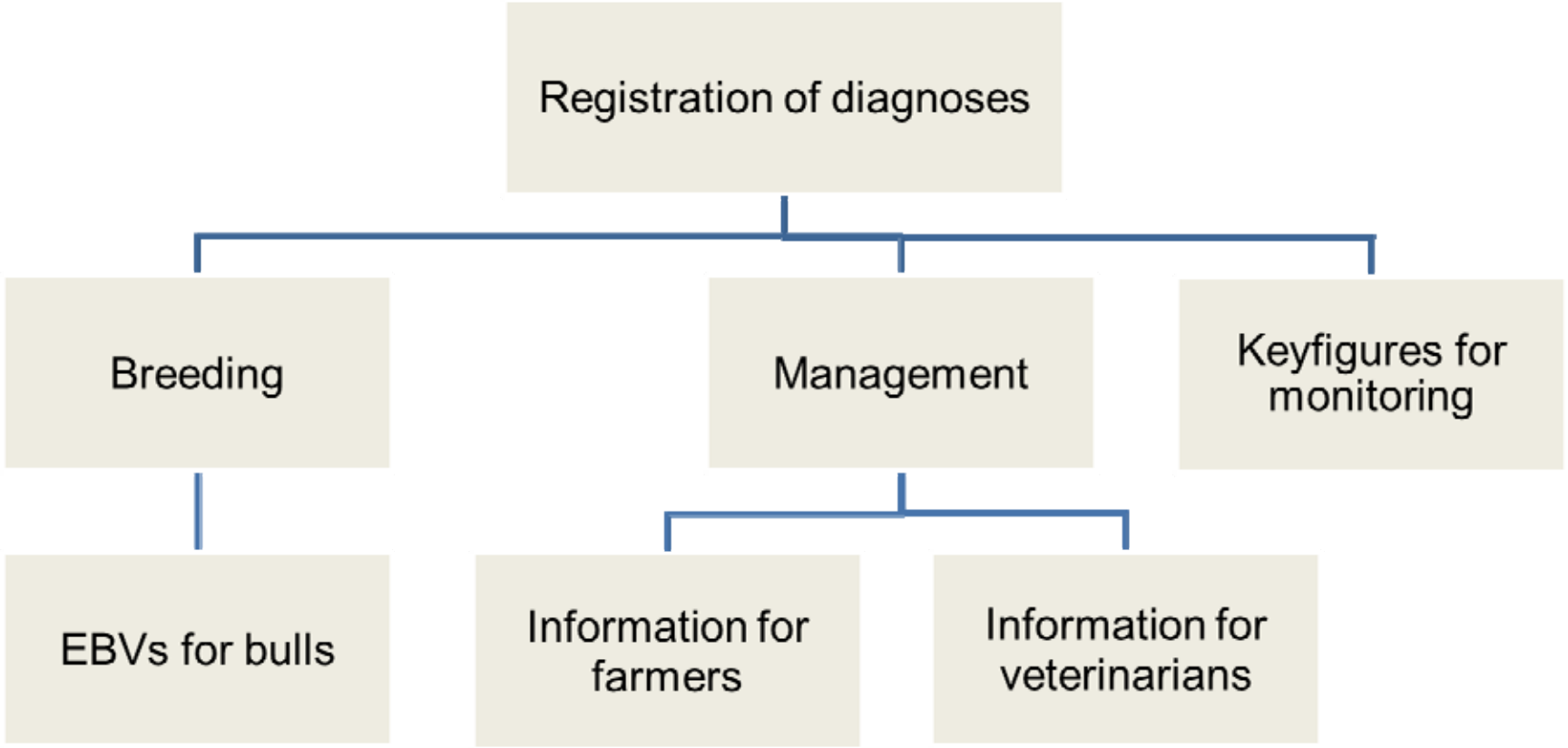


WHY BREEDING FOR DIRECT HEALTH TRAITS?

- Direct health traits (diagnoses,..) only recorded and used in the routine in the Nordic countries till recently
- Other countries: mainly auxiliary traits e.g. SCC
  Worldwide research activities on health in cattle (ICAR-survey, 2012)

  New: France and Canada – mastitis included in udder health-index starting 2012/2013
- **Results from research: more efficient to breed for direct health traits** (zB Heringstad et al. 2007)
- **Challenge is** recording of direct health data (diagnoses) – veterinarians are important partners!

REGISTRATION OF DIAGNOSES IN AUSTRIA AND GERMANY (GMON; PROGESUND)



Austria: Health monitoring cattle 2006-2010; routine since 2011
Germany (Bavaria/Baden-Württemberg): start 2010

EBVS FOR HEALTH TRAITS UNDER WWW.ZAR.AT

GS RAU AT 653.713.345

geb: 23.01.2002 16.3% Red Holstein HB: 10/605345
Züchter: Ratzberger Johann, 3352 St.Peter Au
Station: GENOSTAR, NÖ+Stmk: eingeschränkt, SNr. 1997
CRV: eingeschränkt

ABSTAMMUNG	Söhne	Stammbaum
RUMBA AT 623.710.746 ZW: 110 / 107 / -132 +0.09 +0.21	RALBO DE 09 11825633	RADI
	STUTZI AT 477.737.946	HARKO
IRINA AT 353.632.433 ZW: 112 / 110 / +457 -0.01 -0.07 5/4 - 9552-4.34-3.29-729 HL: 4. - 11541-4.37-3.24-879	GS MALF AT 040.568.233	MORELLO
	IRISA AT 288.300.433 6/5 - 9734-4.11-3.22-713	HAU RED

ZUCHTWERTE (ZWS AT/DE, 14.08.2012) *GZW +1, MW +1, FW +1, FIT +2* **gGZW 133 (99)**

MILCH +754 -0.20 +16 -0.01 +25 **MW 118 (99)**

100-Tg.:	8950	2590 - 3,95 - 3,20 - 185	Stall: 7663	Tö int.: 10447	PM	Anp.(MW):	
1.Lakt.:	5593	6774 - 4,09 - 3,45 - 511	7697	10447	7	97,0	
2.Lakt.:	1070	7498 - 4,09 - 3,52 - 571	7737	4307	5		
3.Lakt.:	58	7624 - 4,11 - 3,47 - 578	7498	565	3		

FLEISCH **FW 104 (99)**

Nettozunahme:	111 (99)	Ausschlachtung:	91 (99)	Handelsklasse:	101 (99)

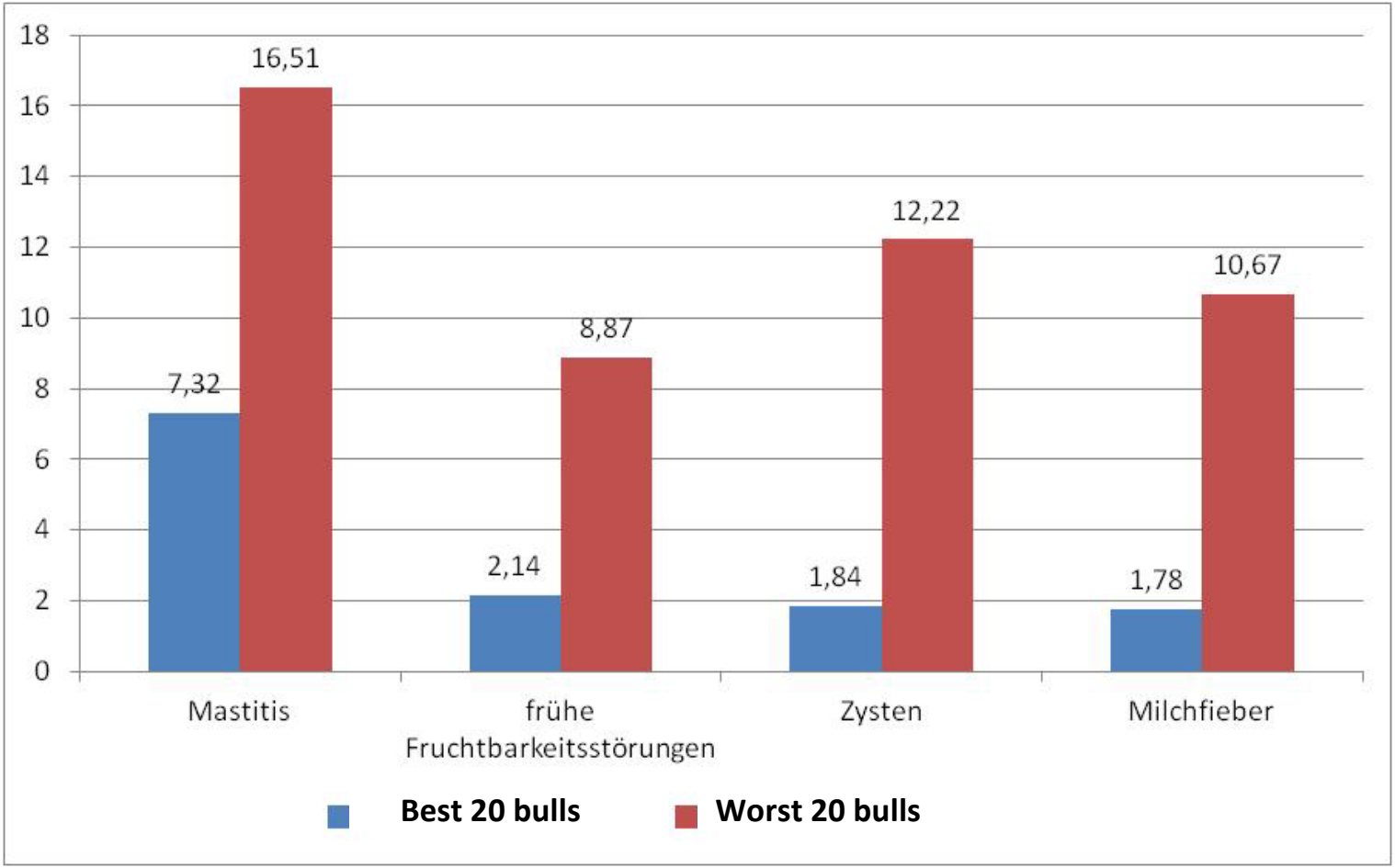
FITNESS **FIT 129 (99)**

Nutzungsdauer:	125 (98)	Kalbeverlauf (p/m):	95 (99)	120 (99)		
Persistenz:	83 (99)	Totgeburten (p/m):	102 (99)	107 (99)		
Zellzahl:	119 (99)	Bef./Fruchtb. mat.:	+1%	111 (98)	Melkbarkeit:	102 (99)
Mastitis:	115 (94)	frühe Fru.stör./Zysten:	104 (95)	95 (97)	Milchfieber:	97 (97)

Official EBVs for direct health traits in DEA (Austria and Germany) since 12/2010!

EBVS FOR DIRECT HEALTH TRAITS

PERCENTAGES OF DAUGHTERS WITH AT LEAST ONE DIAGNOSES



Genetic differences between bulls are existing.

Herd management

Examples of information provided to farmers and veterinarians

1 2

Datum	LTag	T
05.01.2012	93	Eierstockzysten
22.12.2011	79	Eierstockzysten
16.11.2011	43	Eierstockzysten
05.10.2011	1	Erkrankungen der Nachgeburts
04.08.2011	400	Vorbeugendes Trockenstellen
22.11.2010	145	Pansenübersäuerung, Acidose
21.11.2010	144	Pansenübersäuerung, Acidose
04.08.2010	35	Eierstockzysten
04.05.2010	438	Vorbeugendes Trockenstellen
24.09.2009	216	chronische Euterentzündung
05.08.2009	166	Eierstockzysten
08.01.2009	483	Allgemeininfektionen
06.12.2008		
20.02.2008		
22.11.2007		

Eutergesundheit

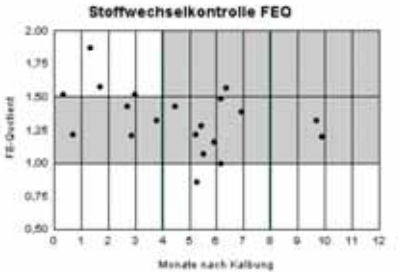
Kühe mit Zellzahl über 200.000 oder mit Euterdiagnosen

Nr.	Name	Lebensnummer	L.	Tg.	17.09.07 Zellzahl	01.08.07 Zellzahl	18.06.07 Zellzahl
	MICA	AT 999.117.842	5	103	625	165	103
	UNIVERSUM	AT 999.942.245	4	168	392 (D)	43	39
	SILVI	AT 999.382.747	4	76	344	25	T
	SUPER	AT 999.510.734	7	26	231	T	472
	UNIKA	AT 999.370.907	1	41	49 (D)		
	UNO	AT 999.268.707	1	113	23	67 (D)	S

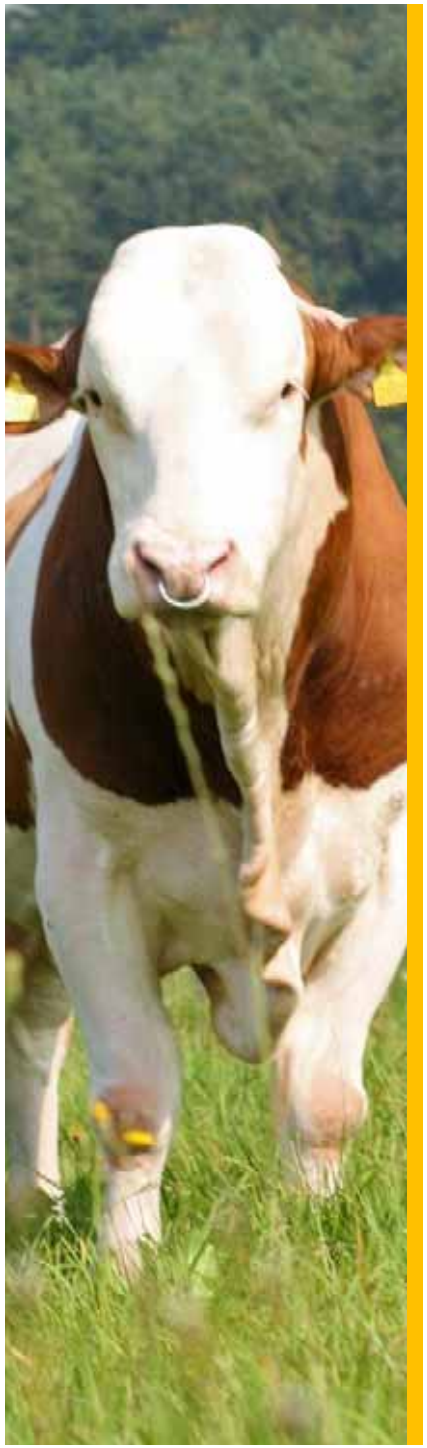
Kühe weitere Laktationen

	Einheit	Anzahl	Betrieb aktuell	Betrieb Vorjahr	Bezirk	Land
Zellzahldurchschnitt	in 1000	145	249	206	257	219
Anteil Zellzahl über 200.000	%	47	32,4	25,4	31,9	27,1
Anteil Kühe mit mind. 3 Überschreitungen	%	6	37,2	26,6	42,9	35,8
Anteil mit mind. 2 aufeinanderfolg. Überschr.	%	7	43,4	33,2	48,6	42,2
Anteil Kühe mit Diagnose Euter	%	3	18,6	0,0		
Summe Diagnosen Euter	Anzahl		5	0		
0. - 100. Laktationstag	Anzahl		3	0		
101. - 200. Laktationstag	Anzahl		0	0		
> 200. Laktationstag	Anzahl		2	0		
Trockenperiode	Anzahl		0	0	0	0
akute Euterentzündung	Anzahl		5	0		

Klasse	Anz	%
9	0	0,0
8	5	25,0
7	0	0,0
6	0	0,0
5	11	55,0
4	0	0,0
3	0	0,0
2	3	15,0
1	1	5,0



Klasse	Anz	%
Ketosegefahr	4	20,0
normal	15	75,0
Acidosegefahr	1	5,0



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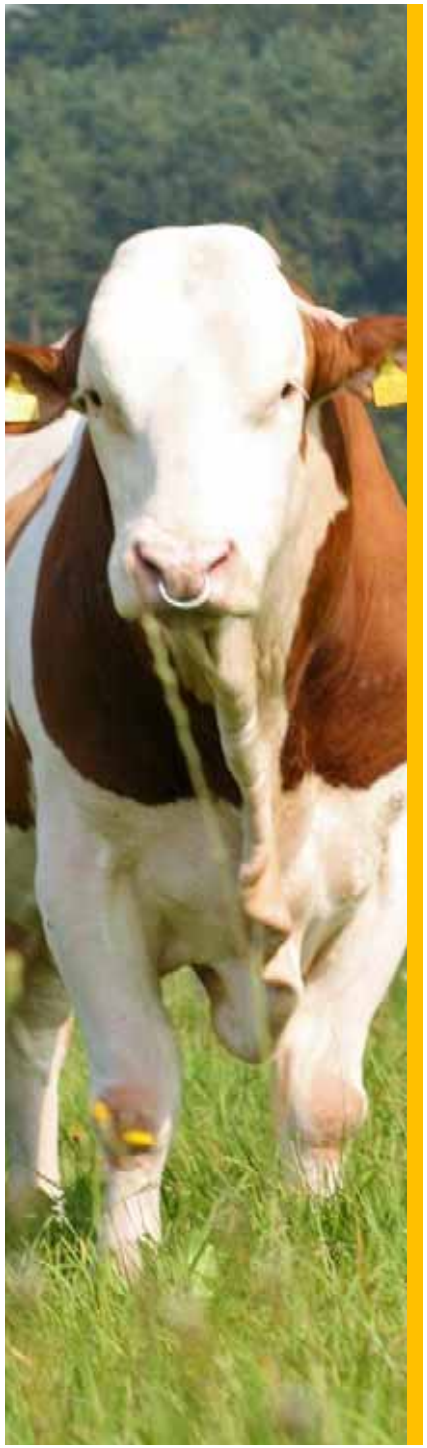
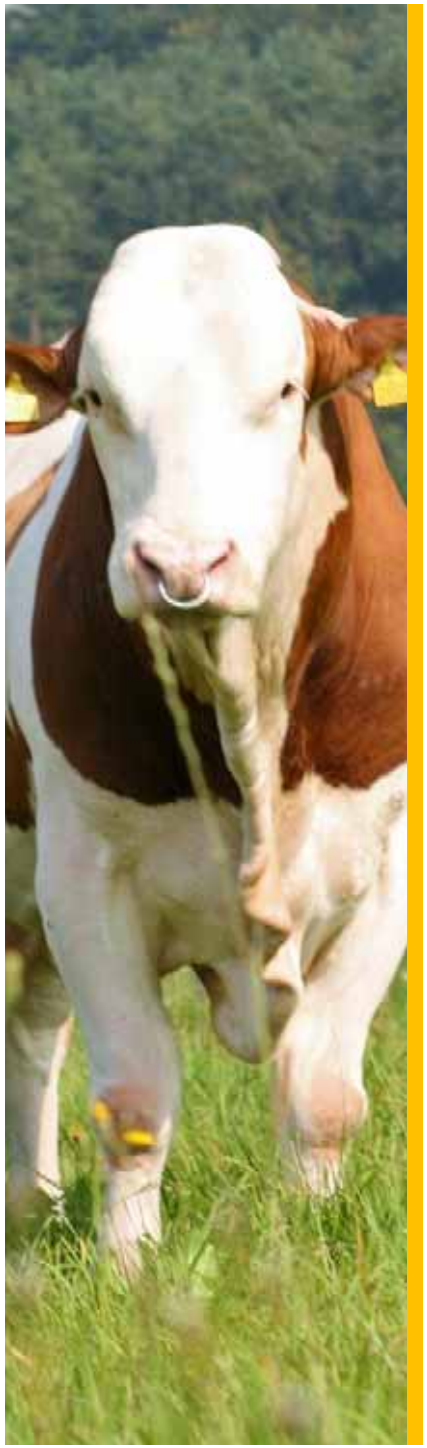


GENOMIC SELECTION BREEDING PROGRAM

- Due to the possibilities of genomic selection a big increase in genetic gain is possible
- Strong preselection of young bulls is an important measure
- Reduction of the generation interval due to the intensive use of young bulls for cows and elite matings – huge impact
- Breed planning calculations on the example of Fleckvieh AUSTRIA show a potential of a 40% increase in genetic gain per year compared to the former progeny testing program.



GENOMIC SELECTION AND FITNESS AND HEALTH

- A slight strengthening of the fitness block is observed due to genomic selection
- Advantage of larger progeny groups per young bull in terms of higher reliabilities for EBVs of fitness and health traits (precondition performance recording)
- Genomic selection **enforces genetic gain**. The **direction has to be defined by the breeding goal**. To achieve the desired genetic gain, appropriate weights in the breeding goal (TMI) are needed. (Egger-Danner et al. 2012)
- The consideration of direct health traits within the Total Merit Index is important!

RESULTS

FERTILITY INDEX AND SCC/UDDER HEALTH INDEX

Effect on annual genetic gain of fertility index and SCC/udder health index (points EBV)

CPT: Conventional progeny testing program
GS50: Genomic program with 50% inseminations with young GS-bulls
GS100: Genomic programm with 100% insemination with young GS-bulls

	TMI		TMI-DHT		TMI-DHT50	
	Fertility Index	SCC	Fertility Index	Udder H I	Fertility Index	Udder H I
CPT	-0.15	-0.08	0.22	0.07	0.61	0.50
GS50	-0.11	-0.09	0.37	0.10	0.85	0.61
GS100	-0.15	-0.19	0.42	0.08	0.99	0.68

*DHT= Direct health traits

Summary: positive trend is enforced by GS, if trend for fitness and health is negative, GS does not change a negative trend towards a positive direction

GENOMIC BREEDING VALUES (EBVS) FOR NEW TRAITS (E.G. HEALTH)

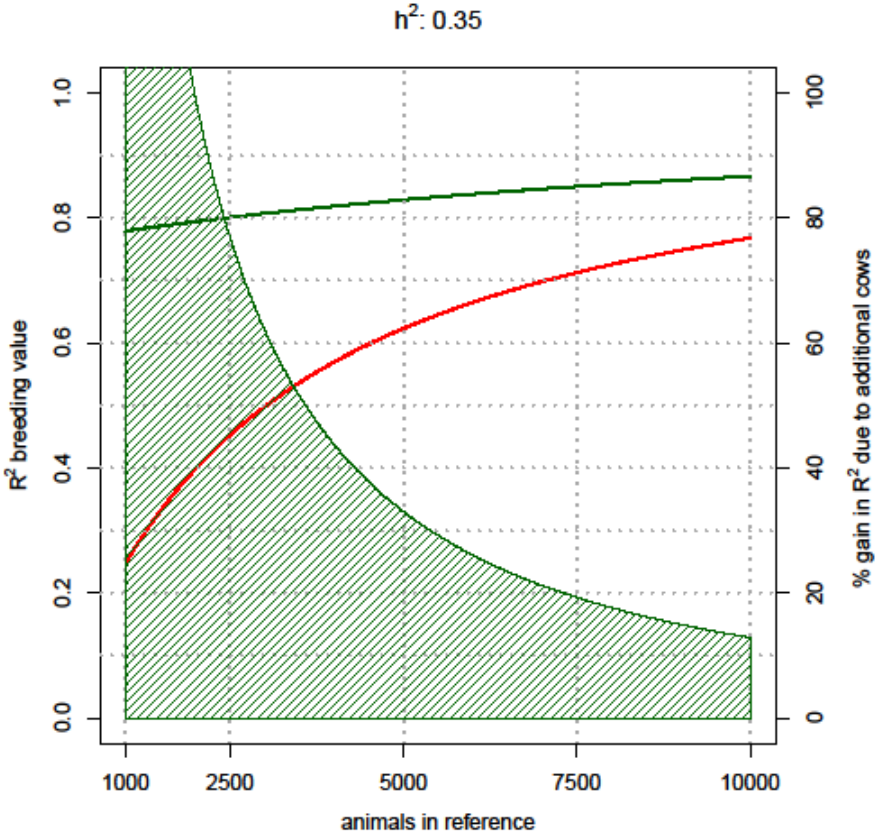
- **Presently no genomic EBVs for direct health traits for Fleckvieh available –** only up to 1,000 bulls with EBVs for direct health traits (Dairy traits: > 6,000 bulls)
- **Challenge**:

  Sufficient animals (bulls / cows) with reliable EBVs for direct health traits / health data in the reference population

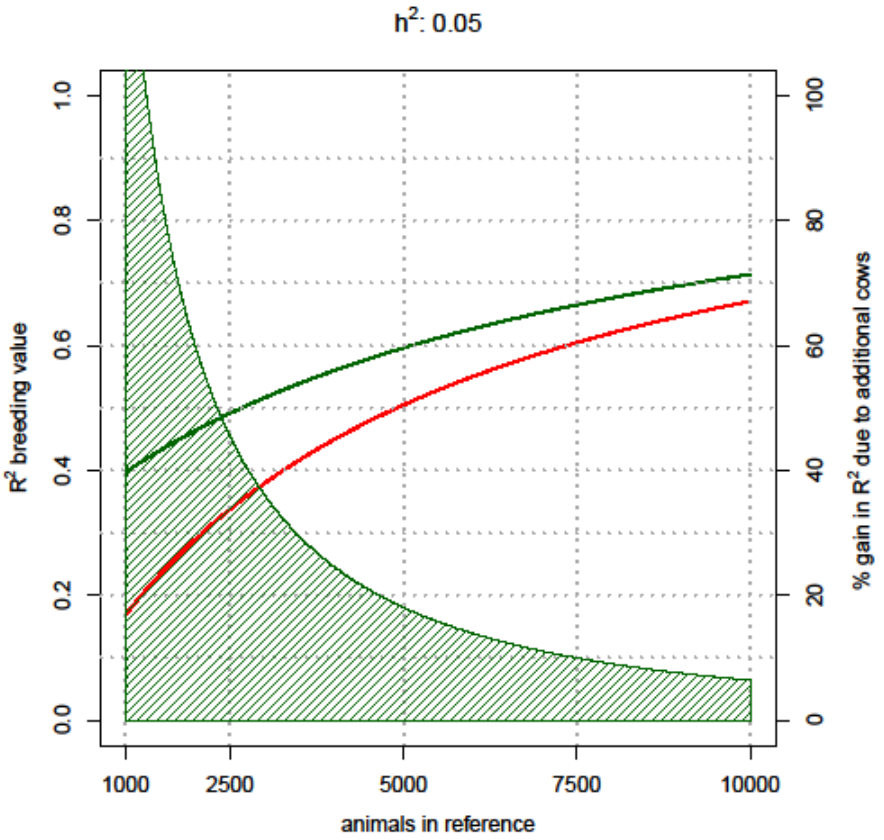
  - **Measures:**
  - Recording of direct health traits and other new traits within the routine performance recording
  - To speed up this process genotying of cows with reliable phenotypes for health traits could be a possibility – many cows are needed!

IMPACT OF GENOTYPING 25,000 COWS ADDITIONALLY TO BULLS ON RELIABILITY (R^2) FOR DIFFERENT TRAITS (h^2=0.35; h^2=0.05)

Dairy traits



Health traits



red line – only bulls / **green line** - cows addtional to bulls

(Daetwyler et al. 2010; Schwarzenbacher, 2012)

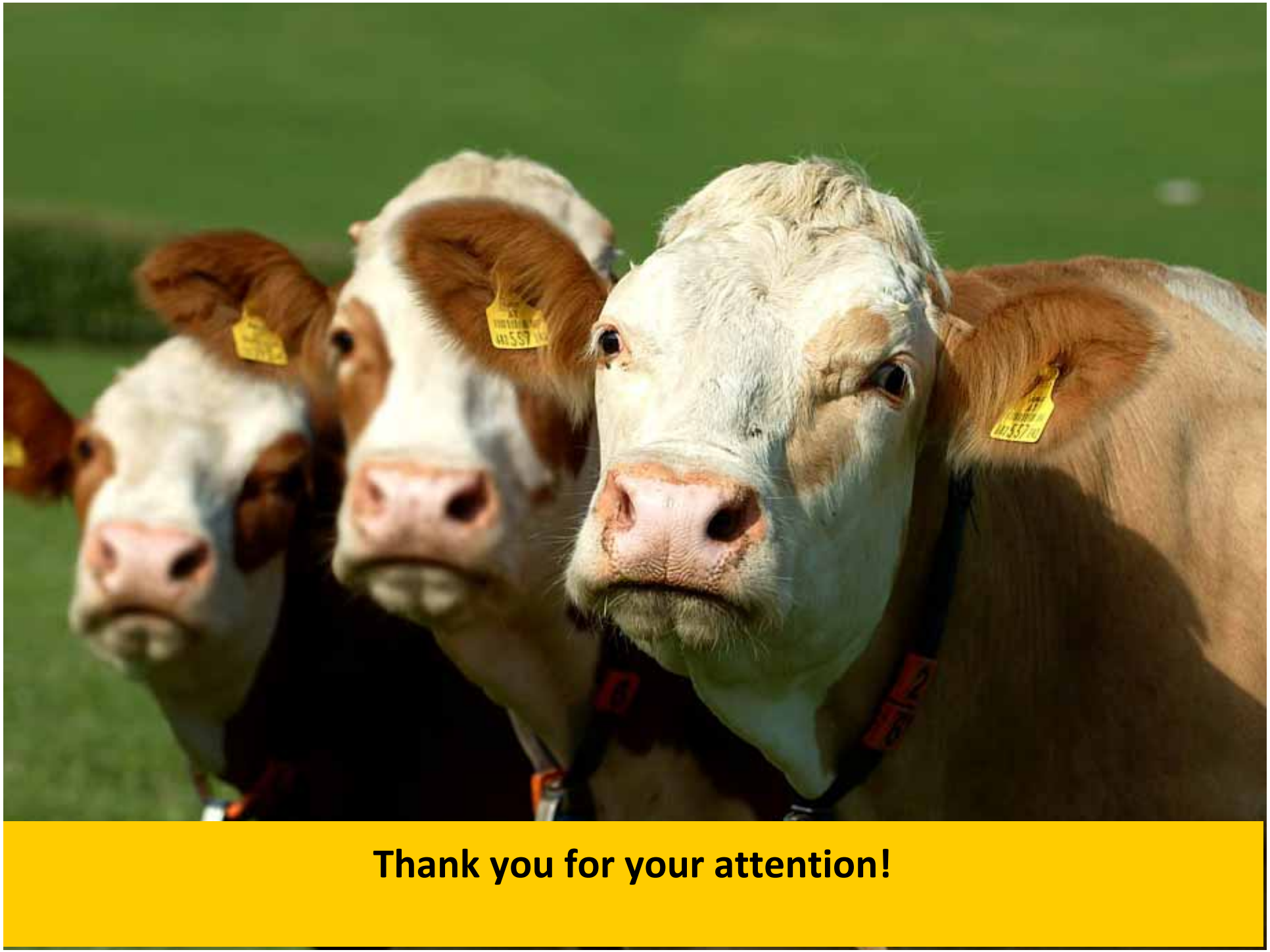
CHALLENGES FOR CATTLE BREEDING

- Genomic selection is a very strong tool to enforce genetic gain
- Important is the right direction (breeding goal)!
- Precondition to improve genetic gain for fitness and health is an appropriate weight within the TMI.
- Efficiency:
  - In times of limited resources the price of means of production will increase
  - Focus on cattle in the discussion about emissions
- Consideration of consumer needs (animal welfare, antimicrobials,...).
- Animals with high and efficient production ability, good health, robustness and uncomplicated handling are desired.

LIMITATIONS IN BREEDING FOR FITNESS AND HEALTH ARE NOT THE GENOTYPES, BUT THE THE AVAILABILITY OF PHENOTYPES.

„THE PHENOTYP IS THE KING“

M. Coffey (2011)



Thank you for your attention!