IT-Solutions for
Animal Production

IB annual online meeting 2021, joint session with ICAR:
8. Supporting Circular Economy: How Does it Affect the Breeding Goals?

RZ€ - The new German total merit index expressing breeding impact in Euro

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RZ€ - expressing breeding impact in Euro

- All breeding values (EBV) on German scale are relative EBV
  - Average 100, genetic spreading 12 points
- Advantage: one scale, EBV including indices comparable across traits
- Disadvantage: phenotypic differences unclear
- ➔ economic impact of relative EBV often under- or overestimated

- New **RZ€ =** Euro differences in profit compared to average cow
- During lifetime of cow
  - 3.01 years, 2.75 lactations
  - Margin calculated for 1 point resp. 1 Sg difference EBV for all traits
- Sum of individual EBV * margin = RZ€
- For Holsteins

RZ€

Phenotypic difference ⇔ EBV difference (I)

- **Derived from sire-EBV-differences ⇔ daughter-phenotype-differences**

Relative EBV	daughter trait	daughter phenotype (∅ all lact.)	12 points EBV ≈ +/-
RZS	cell count (tsd/ml)	218*	**83***
RZN	longevity (days)	1115	**259**
RKFit	survival rate (%) until 15 mo.	93.0*	**4.4***
1st-to-last heifer	1st-to-last heifer (days)	31.3	**6.2**
NR heifer	NR heifer (%)	72.0	**5.0**
calv.-1st	calv.-1st (days)	84.2	**9.0**
1st-to-last cows	1st-to-last cows (days)	51.5	**10.1**
NR cows	NR cows (%)	55.7	**6.3**
CE direct	difficult calvings (%)	3,5*	**2.0***
SB direct	still born calves (%)	5.8*	**2.4***
CE daughter	difficult calvings (%)	3.2*	**1.7***
SB daughter	still born calves (%)	5.8*	**3.1***
dairy type	dairy type (scores)	81.9	**0.9**
body	body (scores)	82.1	**1.1**
feet & legs	feet & legs (scores)	80.6	**1.0**
udder	udder (scores)	81.2	**1.0**
stature	stature (cm)	148.4	**2.1**
RZD	milking speed (kg/min.)	2.42	**0.40**
RZcalffit	Young stock survival %	93.0	**4.4***

- 24 points sire-EBV-diff. equals 1 Sg=12 points in daughters

**) spreading on phenotypic scale is skewed*

Phenotypic difference ⇔ EBV difference (II)

- Published health EBV are indices of several single traits (except RZudderfit)
- ➔ **+/- 12 points index EBV causes differences in several traits at the same time**

Relative EBV	daughter trait	daughter phenotype (∅ all lact.)	12 points EBV ≈ +/-
RZudderfit	mastitis %	25.6*	**12.0***
RZhoof	mortellaro %	24.1*	**12.0***
	sole ulcer %	15.1*	**13.2***
	digital phlegmon %	8.4*	**10.8***
	white line defect %	7.6*	**6.4***
	laminitis %	6.8*	**3.5***
	tylom %	5.1*	**4.4***
RZrepro	ovarian cycle disorders %	19.7*	**11.5***
	metritis %	13.1*	**7.4***
	retained placenta %	7.5*	**4.9***
RZmetabol	displaced abomasum %	1.4*	**3.1***
	milk fever %	1.9*	**1.7***
	ketosis %	3.1*	**2.4***

Diff. in 6 traits at the same time for 12 points RZhoof index

Diff. in 3 traits at the same time for 12 points RZrepro index

Diff. in 3 traits at the same time for 12 points RZmetabol index

**) spreading on phenotypic scale is skewed*

The margins per trait

- Margins are calculated under ceteris paribus condition
- Returns minus costs to produce 1 unit extra with an existing cow

RZ€	*margin/unit* €	12 points EBV equal	€/Sg+life	€/EBV unit+life
Fat *(kg)*	*2.56*	25.1	197.72	7.88
Protein *(kg)*	*4.09*	19.8	248.76	12.56
F/P free milk *(kg)*	*-0.02*	690	-51.13	-0.07
RZN *(replacement, days)*	*1099*	259	258.69	21.56
FtL heifers *(day)*	*1.67*	6.2	10.35	0.86
CtF cows (day)	*0.33*	9.0	6.05	0.50
FtL cows *(day)*	*1.99*	10.1	52.06	4.34
SB direct	*138*	2.4	9.87	0.82
SB maternal	*138*	3.1	12.81	1.07
CE direct *(heavy calv., %)*	*49*	1.9	5.03	0.42
CE maternal *(heavy calv., %)*	*49*	1.8	4.03	0.34
RZudderfit *(Mastitis, %)*	*186*	12	61.39	5.12
RZhoof *(case, %)*	*32-74*	4-13	30.13	2.51
RZrepro *(case, %)*	*28-100*	5-12	17.10	1.43
RZmetabol *(case, %)*	*131-289*	*2-3*	39.86	3.32
RZcalffit *(loss, %)*	*450*	4.4	54.61	4.55

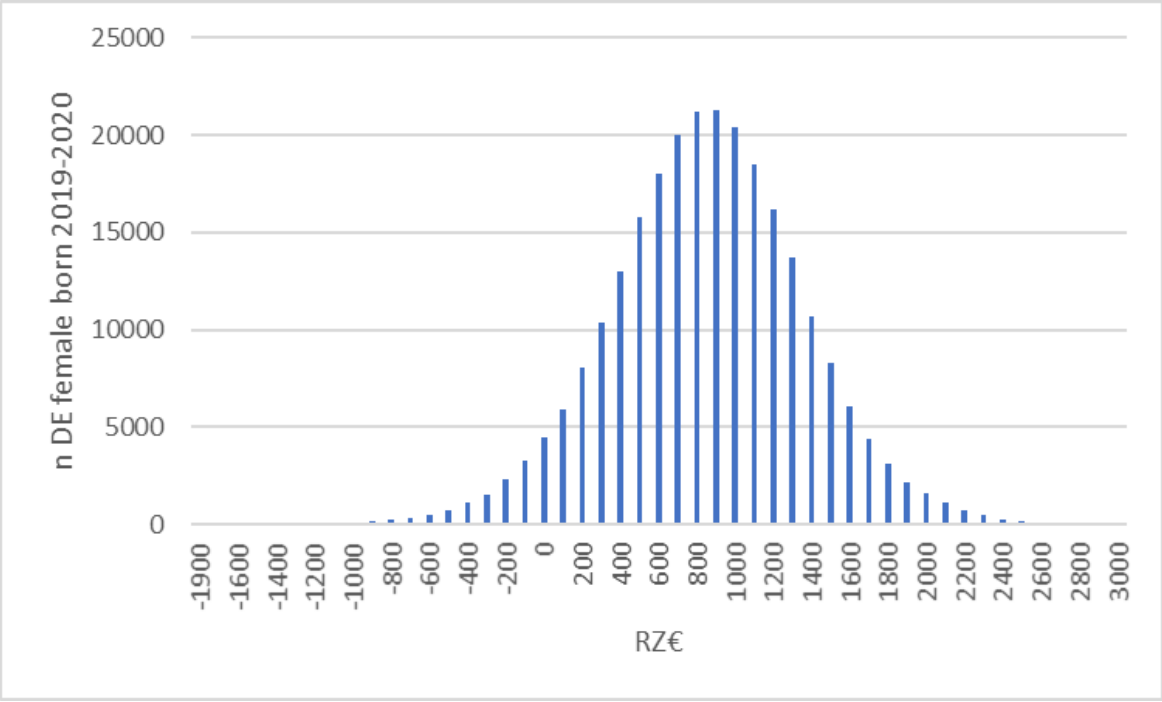
Relative economic impact of traits / complexes

- Ratio of margins per Sg and lifetime

RZ€	€/Sg+life	Resulting relativ weights (%)		
Fat *(kg)*	197.72	20.7	**41**	**milk production traits**
Protein *(kg)*	248.76	26,0		
F/P free milk *(kg)*	-51.13	-5.3		
RZN *(replacement, days)*	258.69	27.0	**27**	**productive life**
FtL heifers *(day)*	10.35	1.1	**7**	**daughter fertility**
CtF cows (day)	6.05	0.6		
FtL cows *(day)*	52.06	5.4		
SB direct	9.87	1.0	**3**	**calving traits**
SB maternal	12.81	1.3		
CE direct *(heavy calv., %)*	5.03	0.5		
CE maternal *(heavy calv., %)*	4.03	0.4		
RZudderfit *(Mastitis, %)*	61.39	6.4	**16**	**health traits**
RZhoof *(case, %)*	30.13	3.1		
RZrepro *(case, %)*	17.10	1.8		
RZmetabol *(case, %)*	39.86	4.2		
RZcalffit *(loss, %)*	54.61	5.7	**6**	**young stock survival**
Sum		100.0	100	

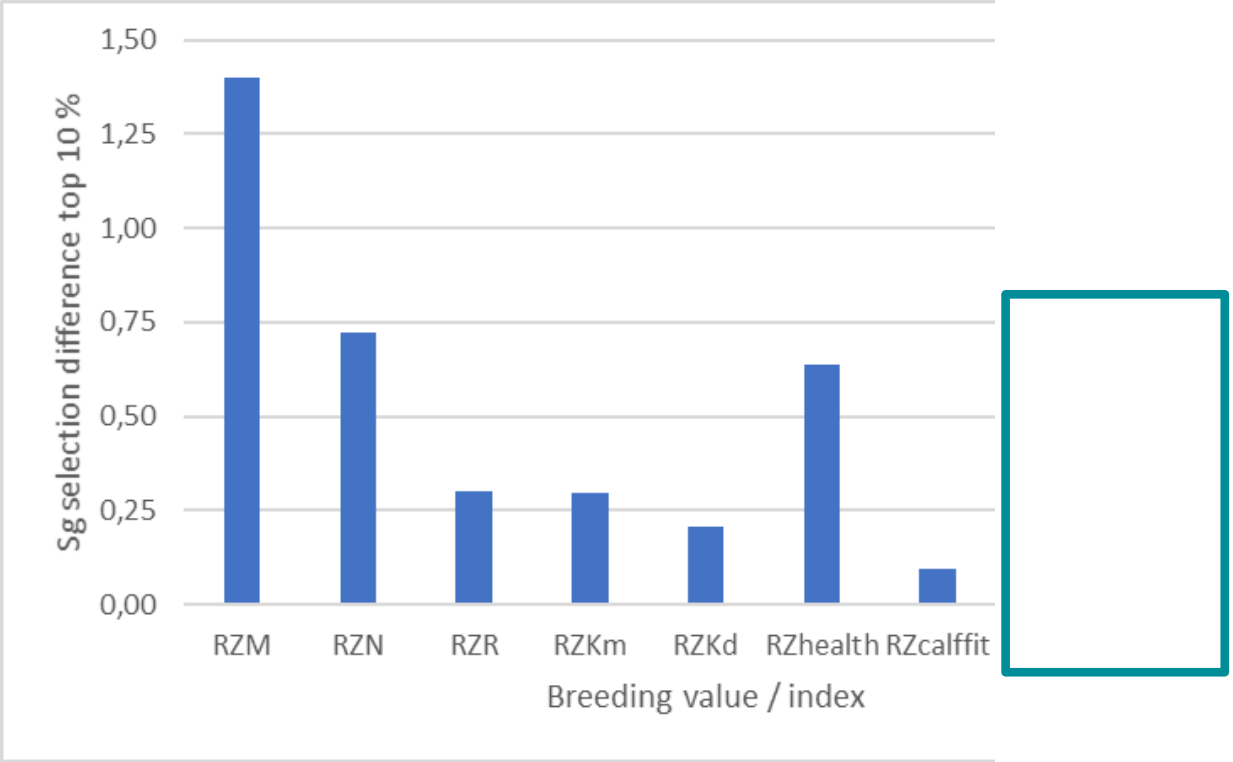
Spreading / scale RZ€

- The range of RZ€ is about -3,000 to +3,000 €
  - Base (= +/- 0 €) are 4-6 years old cows (=base cows for all EBV)
  - Genetic spreading is about 535 €
- Distribution of RZ€ for young females from herd genotyping (EBV 04-2021)
  - 256,352 HOL young females born 2019/2020 (∅ RZG 121, ∅ RZ€ +851)



Selection response with RZ€

- Superiority of 10% best for RZ€
  - All: 256,352 HOL young females born 2019/2020 (gEBV 04-2021)



RZ€

- With maximization of economic progress significant phenotypic progress in all health and functional traits is achieved, too

Summary

- Calculation of RZ€ strictly follows genetic economic impact of traits
- Direct health traits and young stock survival have substantial economic impact
- SCC and conformation traits not included because no significant economic impact
- **The scale '€ margin difference' compared to average cow makes economic impact of selection alternatives directly visible**
- **➔ Selection by RZ€ maximizes progress in profitability for most farms**
- The economic based RZ€ matches with the expectation of the society, too
  - The sum of health traits is weighted higher compared to milk production traits (59 : 41)

For more details e.g. on economic calculations visit www.vit.de – news - 9.7.2020 ‚The new total merit index RZ€'