



Alternative system of evaluation of mastitis in Slovakia

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Introduction

- Somatic cell count (SCC) is a key indicator of mastitis in dairy cows.
- Cows with SCC >200,000 cells/ml are likely to be infected in at least one quarter.
- SCC $\geq 300,000$ cells/ml suggests a high probability of infection with significant mastitis pathogens.
- In Slovakia, in raw cow milk SCC is categorized into two categories:
 - Q $\leq 300,000$ cells/ml
 - 1: $\leq 400,000$ cells/ml

Aim

- Comparison of genetic parameters and breeding values of SCC using lactation somatic cell score (LSCS) and categorical somatic cell count SCC 1 (exceeding 200,000), a SCC 2 (exceeding 400,000)

Material and Methods I.

- Calculated lactation somatic cell count LSCC using:

$$SCS = \log^2(SCC/100) + 3$$

- In total 7340 cows, with 115,225 test day records
- Records from years 2018 to 2022
- Single trait animal model
- Model equation:

$$y_{ijklm} = P_j + YS_k + HB_l + PE_m + a_i + e_{ijklm}$$

- y_{ijklm} is LSCS, P_j is the fixed effect of parity (3 levels = 1, 2, 3) YS_k is combined effect of year (5 levels = 2018, 2019, 2020, 2021, 2022) and season (4 levels = 1 (January to March), 2 (April to June), 3 (July to September), 4 (October to December)) HB_l is combined effect of the herd (6 levels = 1, 2, 3, 4, 5, 6) and breed (2 levels = Red holstein, Black holstein), PE_m is permanent environment, a_i is additive genetic effect of animal and e_{ijklm} is a residual effect.

Material and Methods II.

- Alternative system: SCC1 exceeding 200,000 and SCC2 exceeding 400,000
- In total 6440 cows with 149,993 test day records
- Records from years 2018 to 2023
- Lactation periods ranging from 5 to 500 days
- Each test-day record was binary-coded (0 or 1) for both SCC1 and SCC2
- Multitrait animal model
- Model equation:

$$y_{ijklmn} = P_j + HYS_k + MP_l + PP_m + PE_n + a_i + e_{ijklmn}$$

- y_{ijklm} is categorical SCC1 a SCC2, P_j is fixed effect of parity (3 levels = 1, 2, 3), HYS_k is combined effect of herd (6 levels = 1, 2, 3, 4, 5, 6), year (6 levels = 2016, 2019, 2020, 2021 2022, 2023) and season (4 levels = 1 (January to march), 2 (April to June), 3 (July to September), 4 (October to December), MP_l is fixed effect of milk production (kg) (4 levels = 1 ($\leq 10,061.8$ kg), 2 (10,061.8–11,736.75 kg), 3 (11,736.75–13,747.9 kg), and 4 ($> 13,747.9$ kg).), PP_m is fixed effect of protein production (%) (4 levels = 1 ($\leq 3.25\%$), 2 (3.25–3.39%), 3 (3.39–3.55%), and 4 ($> 3.55\%$), PE_m is permanent environment, a_i is additive genetic effect of animal and e_{ijklm} is a residual effect

Material and Methods II.

- Genetic parameters and breeding values estimated in BLUPF90 family programs,
- Breeding values were recalculated to relative (RBV)
- Spearman correlation calculated in SAS 9.4

Spearman correlation between LSCS and production traits

	LSCS	MILK KG	PROTEIN %
LSCS	1.0		
MILK KG	-0.071 <.0001	1.0	
PROTEIN %	0.051 <.0001	0.007 0.433	1.0

Spearman correlation between SCC1 and SCC2 and production traits

	SCC 1	SCC 2	MILK KG	PROTEIN %
SCC 1	1.0			
SCC 2	0.855 <.0001	1.0		
MILK KG	0.004 0.621	-0.008 0.3858	1.0	
PROTEIN %	0.069 <.0001	0.052 <.0001	-0.140 <.0001	1.0

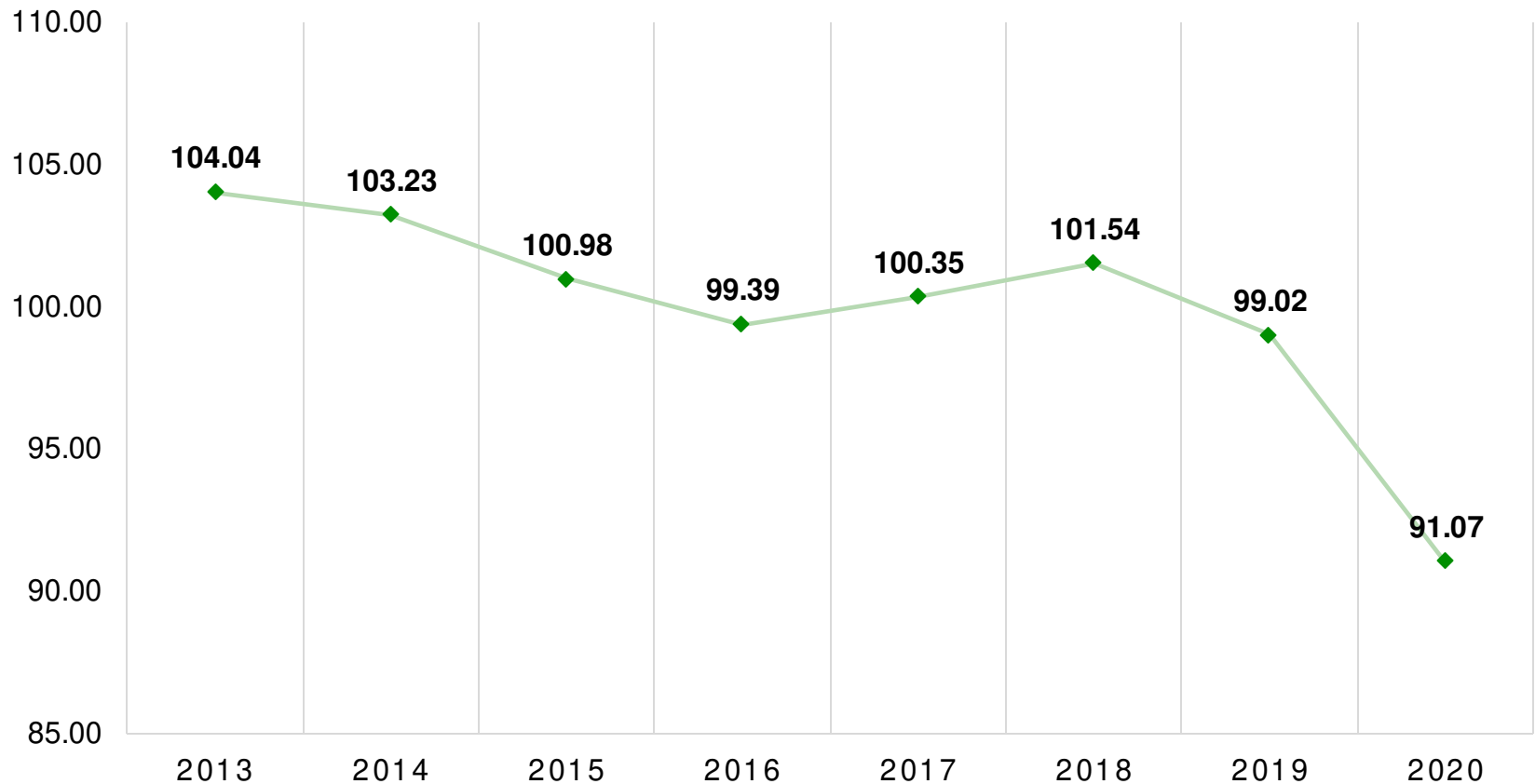
Genetic parameters and heritability

	σ^2_g	s.e	h^2	s.e
LSCS	0.529	0.072	0.155	0.020
SCC 1	1.352	0.198	0.120	0.019
SCC 2	0.638	0.119	0.111	0.019

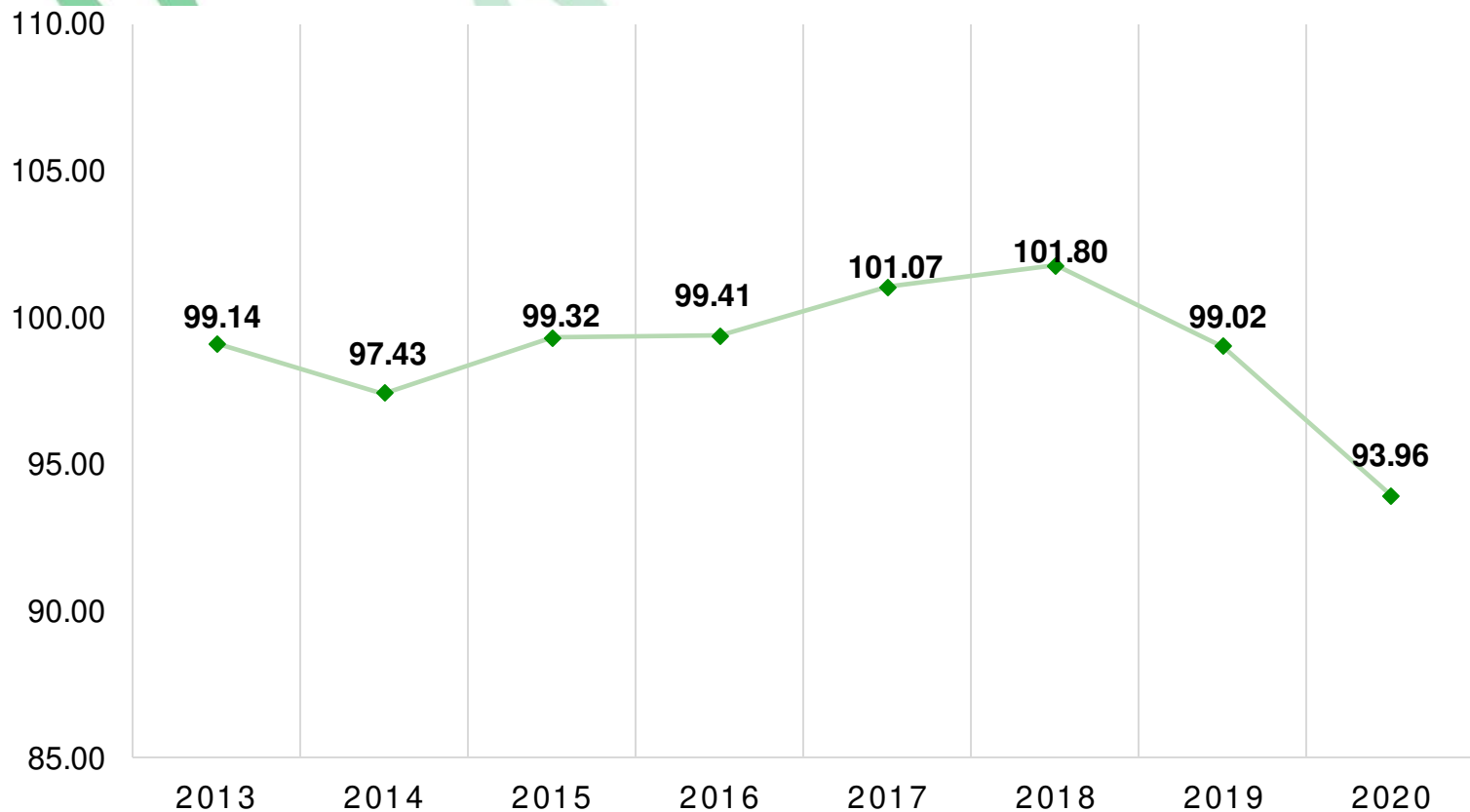
RBV of best bulls

Bull no.	RBV SCS	REL SCS	RBV SCC 1	REL SCC 1	RBV SCC 2	REL SCC 2
1	140.38	0.73	145.00	0.75	142.26	0.72
2	137.62	0.69	135.13	0.66	135.03	0.64
3	128.13	0.58	125.36	0.37	124.46	0.51
4	128.07	0.68	124.82	0.48	124.39	0.36
5	126.27	0.31	122.36	0.53	122.65	0.46
6	122.15	0.67	122.26	0.53	121.45	0.52
7	121.63	0.46	121.88	0.29	121.10	0.28
8	120.63	0.26	119.80	0.64	120.54	0.40
9	120.59	0.41	118.83	0.26	117.99	0.63
10	119.26	0.33	118.83	0.56	117.83	0.42

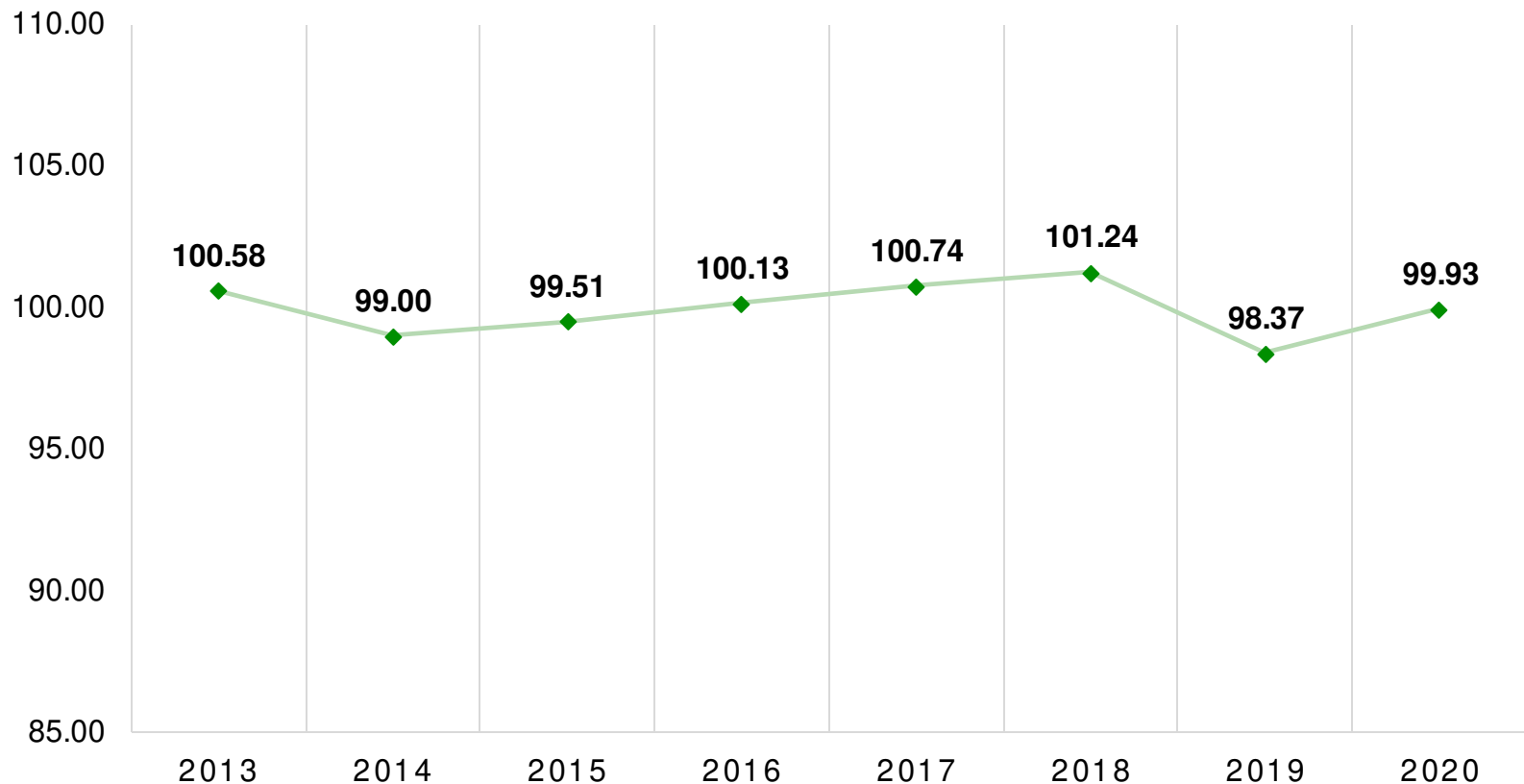
Trend of RBV for LSCC in cows



Trend of RBV for SCC1 in cows



Trend of RBV for SCC2 in cows



Conclusion

- Alternative SCC1 and SCC2 traits can be effectively used to estimate genetic parameters and breeding values.
- Significant correlation between LSCS and milk (kg) and protein (%)
- SCC1 and SCC2 significant correlation only with protein (%)
- Heritability was highest for LSCS (0.155), compared to SCC1 (0.120) and SCC2 (0.111),
- The genetic trend of relative breeding values (RBV) for cows is declining for LSCC, SCC 1 and SCC 2
- Literature shows for SCC strong correlation with clinical mastitis incidence

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Thank you for your attention!

Any questions

