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MARTIN-LUTHER-UNIVERSITY HALLE-WITTENBERG
Institute of Agricultural and Nutritional Sciences, Animal Breeding[1]
vit - Vereinigte Informationssysteme Tierhaltung w. V., Verden / Aller[2]

Use of somatic cell count from the colostral phase as an early indicator for health and stayability in the course of lactation

RENATE SCHAFBERG[1], KATHRIN F. STOCK[2] & HERMANN H. SWALVE[1]

GERMANY

Bundesministerium für Ernährung und Landwirtschaft
Bundesanstalt für Landwirtschaft und Ernährung
PT Innovationsförderung.

Motivation

Somatic cells are an indicator for immune response and easy to measure

Transition period is a critical time for well-being and survival

Mastitis and culling mostly occurs in early lactation

→ **Is the early somatic cell count a useful health-indicator ?**

→ Colostrum (transition milk) also affecting calf health

Project: BHNP
Breed for health neo partus

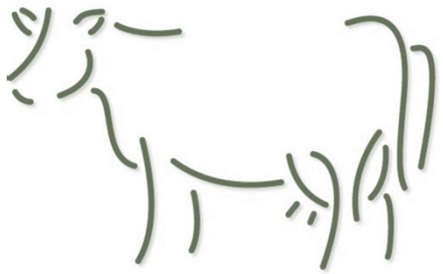
Somatic Cell Count in early lactation (N=8,447)

Period of data recording 01.01.2010 to 31.03.2013

15,273 observed calvings, well documented

→ Censored data for all lactations

- 5,588 heifer calvings and 9,685 cow calvings
- 10,529 HF animals in total
  - Some with repeated calvings
- 7 large dairy farms in eastern Germany
  - Average herd size 920 cows
  - Milk yield 9,900 kg



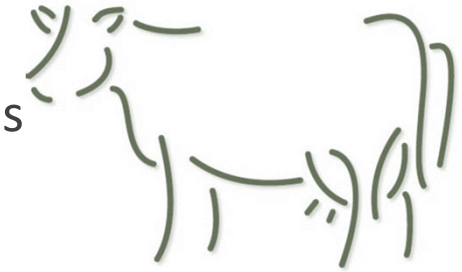
SCC in early lactation and additional data

SCC in early lactation → SCCel

- Between partus to DIM 12 (20)
- Analysis according to milk routine

Health Data

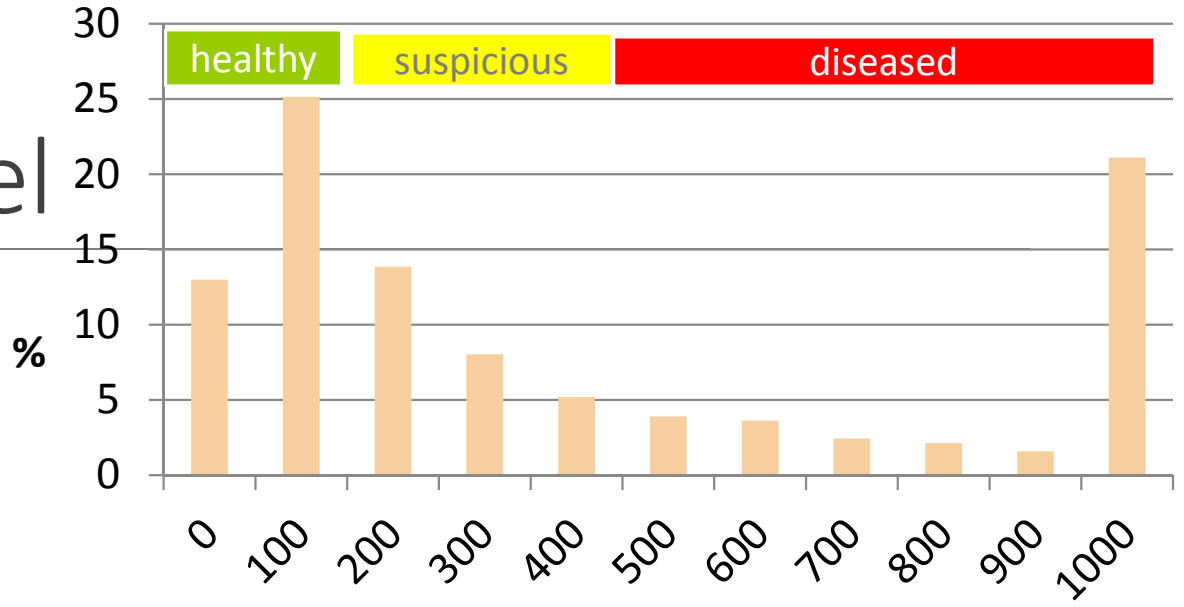
- include all veterinarian diagnoses and farmers´ observations
- documented in herd management software
- edited for mastitis diagnosis (DIM 0-350)



Master file data

- vit (Verden)
- edited animal data, incl. pedigree and cullings
- test day records

Distribution of SCCel



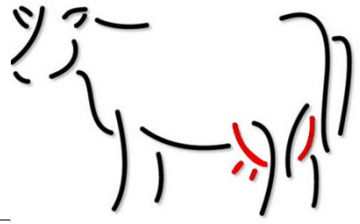
SCC	La 1,1 AFC < 25	La 1,2 AFC 25-27	La 1,3 AFC > 27	La 2	La 3	La 4+	N
< 100,000	27.17	27.45	27.42	**33.67**	26.88	21.57	2,337
100,000-400,000	35.39	30.18	29.27	38.51	39.90	34.05	2,985
> 400,000	37.44	**42.38**	**43.31**	27.81	33.21	**44.38**	3,125
N	1,119	1,246	755	2,150	1,406	1,771	**8,447**

Probability of culling

SCCel	Culling < 50 (N=7,133)	Culling < 100 (N=6,111)	Culling < 350 (N=5,160)
< 100,000	2.87 (0.109)	6.50 (0.006)	29.68 (0.014)
100,000-400,000	4.26 (0.151)	8.72 (0.007)	35.70 (0.014)
> 400,000	7.28 (0.231)	12.92 (0.008)	43.34 (0.014)

SAS 9.4: GLIMMIX (probit)
HYS, AFC-La and milk yield TD1 as covariate

Probability of mastitis diagnosis



SCCel	Mastitis < 10 (N=7,295)	Mastitis < 50 (N=7,317)	Mastitis < 100 (N=7,288)	Mastitis < 350 (N=6,262)
< 100,000	3.76 (0.120)	12.53 (0.008)	20.85 (0.010)	49.64 (0.014)
100,000-400,000	5.91 (0.173)	16.59 (0.009)	24.97 (0.010)	54.18 (0.013)
> 400,000	16.09 (0.358)	31.42 (0.011)	39.58 (0.012)	62.20 (0.012)

SAS 9.4: GLIMMIX (probit)
HYS, AFC-La and milk yield TD1 as covariate

LSMeans for SCSel

	N (Y/N)	Yes	No
Culled < 350	5,160 (2,008/3,152)	4.48	3.94
Culled < 100	7,484 (928/6,111)	4.66	3.98
Culled < 50	7,133 (577/6,556)	4.85	3.94
Mastitis < 350	6,262 (3,308/2,954)	4.45	3.88
Mastitis < 100	7,288 (2,056/5,232)	4.81	3.76
Mastitis < 50	7,317 (1,531/5,786)	5.07	3.73
Mastitis < 10	7,295 (762/6,533)	5.64	3.77

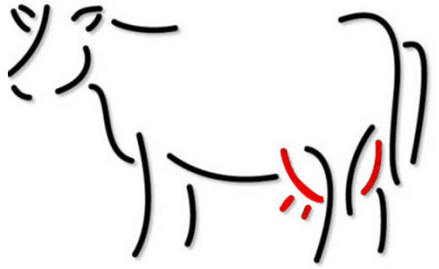
SAS 9.4: Mixed

Milk yield TD1 + HYS + TD0*AFC-La + mastitis/culling

Estimates of heritabilities

- Culling < 350 DIM 0.03 (0.016)
- Culling < 100 DIM 0.04 (0.021)
- Culling < 50 DIM 0.04 (0.027)

- Mastitis < 350 DIM 0.08 (0.018)
- Mastitis < 100 DIM 0.05 (0.016)
- Mastitis < 50 DIM 0.07 (0.018)
- Mastitis < 10 DIM 0.07 (0.021)

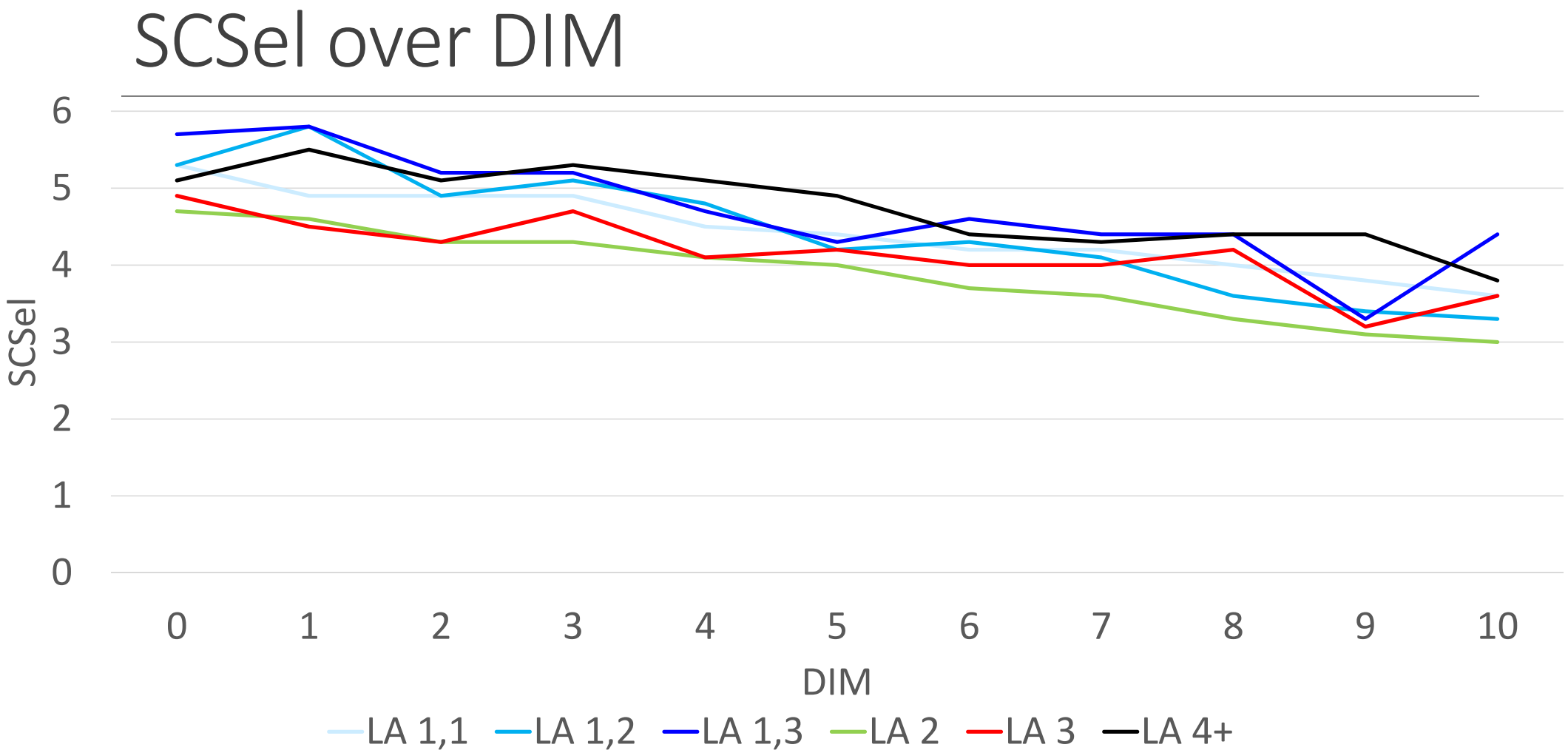


ASReml 3.0 (bin, Probit)
HJS + AFC-La

SCSel and testday milking routine

h^2	SCSel	SCS/TD 1	SCS/TD 2
SCSel	**0.11** (±0.018)	0.65 (0.080)	0.59 (0.085)
SCS/TD 1	0.32 (0.012)	**0.13** (±0.015)	1.00 (0.016)
SCS/TD 2	0.23 (0.013)	0.49 (0.008)	**0.16** (±0.016)

ASReml 3.0 multivariate
Fixed effects: HYS + AFC-La
N=15,273


SCSel over DIM
SCSel
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
DIM
LA 1,1
LA 1,2
LA 1,3
LA 2
LA 3
LA 4+

SCSel and testday records by DIM

	N	h^2	se
DIM 0 to 4	4006	**0.10**	0.028
DIM 5 to 10	5131	**0.07**	0.021
DIM 11 to 20	3741	**0.05**	0.026

ASReml 3.0 univariat
Fixed effects: HYS + AFC-La

Multivariate Analysis of SCSel by DIM

h^2	DIM 0 to 4	DIM 5 to 10	DIM 11 to 22
DIM 0 to 4	**0.12 (±0.03)**	0.91 (0.13)	0.93 (0.15)
DIM 5 to 10	0.32 (0.04)	0.08 (±0.02)	0.94 (0.14)
DIM 11 to 20	0.31 (0.03)	0.48 (0.02)	0.08 (±0.02)

ASReml 3.0 multivariat
Fixed effects: HYS + AFC-La

LSMeans for SCS04

		SCS04		SCSel	
	N (Y/N)	Yes	No	Yes	No
Culling < 350	2420 (902/1518)	5.39	5.06	4.48	3.94
Culling < 100	3297 (437/2860)	5.43	5.00	4.66	3.98
Culling < 50	3332 (266/3066)	5.55	5.00	4.85	3.94
Mastitis < 350	2907 (1443/1464)	5.43	4.92	4.45	3.88
Mastitis < 100	3407 (868/2539)	5.74	4.82	4.81	3.76
Mastitis < 50	3407 (624/2783)	6.01	4.82	5.07	3.73
Mastitis < 10	3395 (310/3085)	6.70	4.84	5.64	3.77

SAS 9.4: Mixed

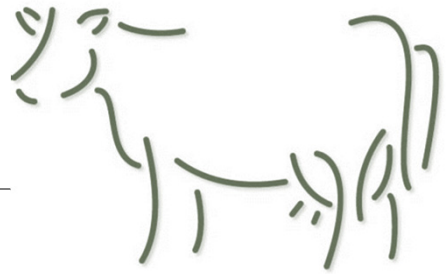
Milk yieldTD1 + HYS + TD0*AFC-La + mastitis/culling

Multivariate Analysis of binary traits and SCS04

	Binary trait h^2	SCS04 h^2	gen. correlation	phen. correlation
Culling < 350	0.03 (0.016)	0.11 (0.029)	0.81 (0.314)	0.09 (0.020)
Culling < 100	0.05 (0.022)	0.12 (0.031)	0.60 (0.255)	0.09 (0.019)
Culling < 50	0.05 (0.028)	0.12 (0.031)	0.63 (0.301)	0.08 (0.021)
Mastitis < 350	0.08 (0.018)	0.12 (0.029)	0.55 (0.184)	0.11 (0.019)
Mastitis < 100	0.07 (0.015)	0.11 (0.027)	1.00 (0.100)	0.19 (0.017)
Mastitis < 50	0.08 (0.017)	0.12 (0.029)	1.00 (0.118)	0.21 (0.017)
Mastitis < 10	0.09 (0.022)	0.12 (0.030)	1.00 (0.128)	0.25 (0.018)

ASReml 3.0 multivariat
Fixed effects: HYS + AFC-La

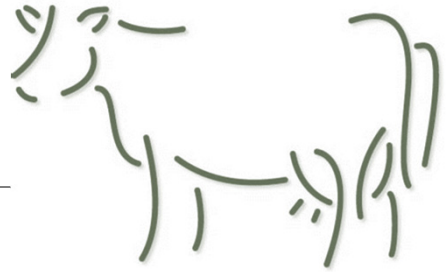
Conclusion



- Measuring of early SCC is recommended
  - Thresholds depend on time period
- The heritability of SCSel/SCS04 is 0.1
- High SCSel can be considered as a risk factor (early mastitis and culling)
  - The genetic correlations to mastitis or culling are remarkably high
- SCSel could be an indicator for innate immune response
  - but more studies are needed

Transition milk: Sampling is easy, the analysis is routine & cheap, and suitable as an indicator for health

Thanks for your attention



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Innovationsförderung. PT

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