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Institute of Agricultural and Nutritional Sciences, Group Animal Breeding

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Genetic evaluations for birth weight: comparison of continuous and discrete definitions of birth weight under varying accuracies of recording

Waurich[1)], B., Wensch-Dorendorf[1)], M., Cole, J.B.[2)] and Swalve, H.H.[1)]

[1]Group Animal Breeding, University of Halle, Theodor-Lieser-Str.11, D-016120 Halle/Saale Germany,
[2]Animal Improvement Programs Laboratory, Agricultural Research Service, USDA, Beltsville, MD, USA.

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Introduction

many countries have calving problems

birth weight is highly heritable and strongly connected with dystocia

documentation of birth weight takes economic efforts

➔ weighing or scoring?

Introduction

Data from Mecklenburg-Western Pomerania cooperator test herd scheme with precise documentation (22 herds from 2005)

Documentation for all calvings of a herd (also stillborn)

Weighing of all calves

heifers (41±4,5kg) and cows (45±5,2kg)

All calvings	heifers	cows
81,419	30,589	50,830

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The Idea

For birth weight parameter estimation:

weighing necessary or subjective scoring precise enough ?

frame

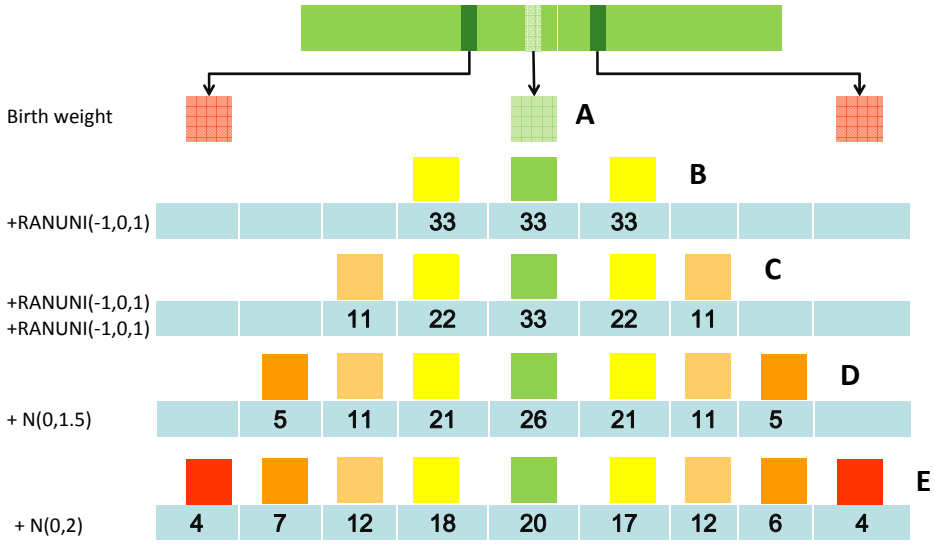
muscle mass ⇒ birth weight

Weighing data: For research purposes

➔ manipulation of data

➔ grouping weights into in classes

Manipulation of weight data - varying accuracies



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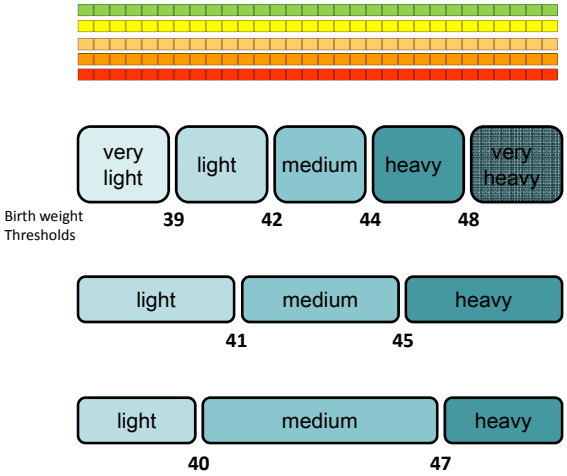
Calf size - The discrete definitions



Continuous Birth weight

Five Classes, each about 20 Percent of weighings

Three Classes equal, each about 33 Percent of weighings

Three Classes wide, thresholds 25, 75 Percent of weighings

Outcome of class allocations

	5 classes			3 classes equal		3 classes wide	
	same	±1 class	±2 classes	same	±1 class	same	±1 class
A	100			100		100	
B	82.4	17.6		90.7	9.3	91.9	8.1
C	77.0	23.0		87.3	12.7	89.3	10.7
D	70.0	29.7	0.4	83.7	16.3	86.2	13.8
E	62.4	35.6	2.1	78.6	21.4	81.5	18.5

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Model

$$y_{ijklmno} = \mu + H_i + YS_j + PAR_k + SEX_l + sire_m + mgs_n + e_o$$

fixed effects		random effects	
H_i	Herd (i=1 to 20)	$sire_m$	sire of calf
YS_j	combined Year-Season (j=1 to 15)	mgs_n	maternal grandsire of calf
PAR_k	Parity (k=1 to 3)	E_o	residual
SEX_l	Sex of calf (l=1,2)		

Calculation of genetic parameters

$$\begin{bmatrix} \sigma^2_D \\ \sigma_{DM} \\ \sigma^2_M \end{bmatrix} = \begin{bmatrix} 4 & 0 & 0 \\ -2 & 4 & 0 \\ 1 & -4 & 4 \end{bmatrix} \begin{bmatrix} \sigma^2_S \\ \sigma_{S,MGS} \\ \sigma^2_{MGS} \end{bmatrix}$$

Calculation of maternal breeding value

$$mat_i = mgs_i - \frac{1}{2} sire_i$$

Heritabilities and genetic correlations

		Continuous BW		5 classes		3 classes equal		3 classes wide	
		Value	se	Value	se	Value	se	Value	se
direct	A	0.30	0.02	0.26	0.02	0.22	0.02	0.24	0.02
	B	0.29	0.02	0.25	0.02	0.21	0.01	0.23	0.02
	C	0.28	0.02	0.24	0.02	0.21	0.01	0.22	0.02
	D	0.27	0.02	0.24	0.02	0.20	0.01	0.21	0.01
	E	0.25	0.02	0.22	0.02	0.20	0.01	0.20	0.01
maternal	A	0.08	0.01	0.08	0.01	0.07	0.01	0.07	0.01
	B	0.08	0.01	0.08	0.01	0.07	0.01	0.07	0.01
	C	0.08	0.01	0.08	0.01	0.07	0.01	0.07	0.01
	D	0.08	0.01	0.07	0.01	0.07	0.01	0.06	0.01
	E	0.06	0.01	0.06	0.01	0.06	0.01	0.05	0.01

Genetic correlations range between -0.02 and 0.15

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Rank correlations of EBVs with undistorted original birth weight

		Original BW	5 classes	3 classes equal	3 classes wide
		Value	Value	Value	Value
Direct N=830	A	1	0.97	0.94	0.96
	B	1.00	0.96	0.94	0.95
	C	0.99	0.96	0.94	0.95
	D	0.98	0.96	0.94	0.94
	E	0.98	0.95	0.93	0.93
Maternal N=2,195	A	1	0.96	0.92	0.94
	B	0.99	0.95	0.91	0.92
	C	0.98	0.94	0.90	0.92
	D	0.97	0.94	0.89	0.91
	E	0.96	0.92	0.88	0.89

Conclusions

- birth weight heritability is situated mainly on calf side

- manipulation of documentation accuracy leads to reduced heritabilities
- subsumming into discrete variables leads to decreased heritabilities

➔ decrease is far not as strong as expected
➔ estimated breeding values stay robust

This study may not be a perfect imitation of the outcome of a subjective scoring system (where farmers may describe weights inaccurately), but some assessment of such a system is given

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End