APPROXIMATIVE GENETIC RELATION BETWEEN EVALUATED TRAITS FOR THE DAIRY CATTLE

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SUMMARY

Genetic correlations for milk, beef and fertility traits are calculated on the basis of correlations between breeding values of bulls in the Simmental and Holstein cattle. The correlations between independent breeding values for each trait are calculated as the residual from procedure GLM/SAS respecting effects of birthyear and group of tested bulls. Genetic correlation is approximately equal to the correlation of breeding values in the case, that both traits are measured on the same animal, or to the correlation of breeding values corrected by reliability in the case, that each trait is measured on another animal. Database covers all tested bulls born from 1979 till 1992. The highest genetic correlations were found within groups of traits (milk production and contents, and body weight and daily gains). Between groups of traits there are only low correlations.

Keywords: Cattle, Genetic correlation, Breeding value, Simmental, Holstein.

INTRODUCTION

Data for dairy cattle are due to large size of populations and wide range of recorded traits frequently in several independent databases. The evaluation is reflecting this situation and is provided independently for groups of traits (milk, beef, reproduction ..). The estimation of genetics parameters is rather difficult to perform for the complex of all recorded traits simultaneously. Calo et al. (1973), Blanchard et al. (1983) and Merks (1989) used for calculation of the genetic relations the correlations between the breeding values.

The breeding values for the principal traits are in the Czech Republic estimated by the means of the BLUP method. Progeny test for dairy traits was historically organised for group of young bulls in the way, that each young bull met in some herd proven bulls and each young one from his group. Test for beef traits is organised in the progeny test stations with standard nutrition.

Going out from this situation, the objective of this study is the estimation of approximative genetic correlation for all principal traits available in the national databases. Correlations are calculated from the breeding values of sires evaluated independently for each trait (milk, beef, fertility). The calculation is done for the two main dairy Czech breeds - Simmental and Holstein.

MATERIAL AND METHODS

Breeding values (BLUP) for milk, beef and fertility traits in the Simmental and Holstein bulls born from 1979 to 1992 are used for estimation of genetic correlations. In the calculations are included only breeding values with higher reliability - minimal requirement for each trait of fertility is effective number of observations 120, for milk traits 25 and for beef traits 7. The number of observations (of bulls) and variability (of breeding values for each trait and of the amount of information for the bull) are in the table 1.

Correlations between the breeding values are calculated as residual from linear model (GLM/SAS) with fixed effects of birthyear of the bulls and group which were bulls tested in.

Genetic correlations are calculated in two ways. In the case, that each trait is measured on the another animal, the covariance between breeding values of traits is only genetic and the genetic correlation is

$$r_{G_{A,B}} = \frac{r_{BV_{A,B}}}{r_A \cdot r_B}$$

where

$r_{BV_{A,B}}$, is the correlation between the breeding values for trait A and B

r_A , r_B , are the accuracies for breeding values of corresponding traits.

In the case, that the pair of traits is measured on the same animal, the covariance between the breeding values of traits includes the environmental part. The rate of the environmental part in the total covariance is decreasing with growing up of the reliability of the breeding values. We suppose, that the genetic and environmental covariances are approximately in the same proportion like variances and that "covariance" reliability is approximately the geometrical mean of reliability of breeding values. In this case the genetic correlation is equivalent to

$$r_{G_{A,B}} \approx r_{BV_{A,B}}$$

RESULTS AND DISCUSSION

Traits are relative breeding values (RBV), with means approximately 100 (Table 1). Exceptions are for body weight (B1), and daily gains (B3 and B4) which are means of bulls progeny. Own fertility of bulls is evaluated on heifers (R1) and on cows (R2). Separate evaluation is also for fertility of heifers-daughters (R3) and cow-daughters (R4). The effective number of observations for fertility varied between bulls from required minimum 120 to the 35 thousands, which is possible to see from standard deviations (S1 - S4). This corresponds with high reliability of breeding value estimation. The effective number of daughters per bull (SM) corresponds with all dairy traits and varied from 25 to the 400. The effective number of sons (SB) corresponds with all beef traits and varied from 7 to 28.

The effects of birthyear and of the group of tested bulls are for majority of traits not significant, or only on low level of significance.

Summary of the genetic correlation are in the table 2. Between groups of traits (fertility, milk, beef) exist only very low positive and negative correlations in both breeds. Higher correlations exist within each group of traits. The maternal and direct effect of fertility are correlated only on low level.

REFERENCES

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Table 1. Number of the bulls, variability of the relative breeding values and number of observations per bull

Trait		Simmental bulls			Holstein bulls		
		Number	Mean	St. dev.	Number	Mean	St.dev.
Fertility of bulls on heifers	R1	2026	100.32	8.73	572	101.20	9.02
Effective number of observations	S1	-	549.86	1067.12	-	908.85	1992.41
Fertility of bulls on cows	R2	2150	100.55	8.72	587	101.32	8.71
Effective number of observations	S2	-	869.52	1904.05	-	1612.70	3891.56
Fertility of bull's daughters - heifers	R3	2393	99.98	9.88	602	100.44	10.16
Effective number of observations	S3	-	491.34	936.33	-	806.94	1961.49
Fertility of bull's daughters - cows	R4	2596	99.64	9.70	643	99.92	10.01
Effective number of observations	S4	-	508.34	892.66	-	795.72	2052.75
Milk kg	M1	2072	100.18	9.83	562	99.85	9.53
Fat kg	M2	2072	100.12	9.76	564	100.41	9.71
Fat %	M3	2074	100.09	4.72	560	100.41	4.68
Protein kg	M4	1260	100.24	9.71	337	99.22	9.47
Protein %	M5	1263	99.87	4.75	341	99.95	4.91
Effective number of observations	SM	-	76.05	39.55	-	88.02	43.92
Body weight in 500 days kg	B1	1356	533.76	34.06	310	523.12	30.82
Corrected netto gain g	B2	1299	99.81	4.92	293	100.03	4.67
Daily gain from 150 to 500 days g	B3	932	1034.30	71.04	310	1005.98	76.89
Daily gain from the birth to 500 days g	B4	1356	980.93	64.54	310	960.15	63.91
Dressing percentage	B5	1292	99.98	4.71	298	100.01	4.76
Effective number of observations	SB	-	11.01	2.08	-	11.11	2.08

Table 2. Genetic correlations between traits for Simmental (below diagonal) and Holstein (above diagonal) cattle

	R1	R2	R3	R4	M1	M2	M3	M4	M5	B1	B2	B3	B4	B5
R1		.32	.03	-.04	-.06	-.02	.05	.0	.07	-.20	.03	-.29	-.22	.12
R2	.25		.0	-.06	.08	.12	.07	.04	.09	.32	.29	.30	.32	-.14
R3	.08	.03		.10	.02	.03	.04	-.02	-.03	-.09	-.05	-.10	-.19	-.14
R4	.02	.02	.10		.05	.07	.07	.02	.09	-.09	-.05	-.06	-.06	-.22
M1	.03	.01	.05	-.03		.83	-.38	.90	-.54	-.09	-.14	.0	-.08	-.40
M2	.06	.0	.04	.0	.89		.09	.81	-.21	-.09	-.18	-.05	-.11	-.56
M3	-.03	-.03	.0	.08	-.31	.07		-.25	.61	-.15	.14	-.13	-.15	.16
M4	.02	.0	.07	-.03	.90	.87	-.14		-.28	.0	.0	-.06	-.07	-.24
M5	-.08	.0	-.06	.03	-.48	-.26	.51	-.19		-.07	.13	-.09	-.03	.33
B1	.08	.0	-.08	-.10	-.08	-.03	.03	-.10	-.02		.40	.86	.98	-
B2	-.03	-.02	-.09	-.11	-.13	-.11	-.02	-.08	.05	.69		.46	.37	.37
B3	.04	-.07	-.14	-.18	.0	.0	-.08	-.06	-.03	.88	.79		.90	-
B4	.08	-.03	-.11	-.12	-.09	-.04	.03	-.10	.0	.99	.70	.91		.03
B5	-.05	-.05	-.04	.0	-.08	-.10	.04	.02	.08	.03	.38	0	.02	