ESTIMATION OF COVARIANCE COMPONENTS FOR TEST DAY PRODUCTION IN DAIRY GOAT

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SUMMARY

Heritability and genetic and phenotypic correlations for daily milk yield (MY) and fat content (FC) from third to eighth month of lactation were estimated from 7215 test day records of Saanen and Alpine breeds in Republic of Slovenia. REML estimates were obtained by Powell algorithm using an animal model to individual test day, two trimester and joint data sets. Two trait model concerned MY and FC was performed. Heritabilities through lactation declined from 0,20 to 0,13 for MY and from 0,29 to 0,16 for FC. Heritabilities for first and second trimester were 0,30 for MY and 0,20 for FC. Genetic correlations between MY and FC in each month moderate (from –0,12 to –0,39), while values of –0,26 in first and –0,31 in second trimester were esstimated. MY and FC were also negativly correlated (-0,45) in joint data set. Heritability for MY was higher in first than in second trimester, as it correspond with the most proeductive part of lactation. Other estimated values were similar in both trimesters as well as in whole preiod.

INTRODUCTION

Evaluation of genetic parameters for milk production in goats is usually based on lactation records, predicted from monthly taken controls. Hence, breeding value prediction of lactation traits is two step aproach, where the complete phenotypic trait value is predicted, and thereafter breeding value. Reproduction ability of goats in Slovenia is seasonal with kidding period in February-March. Milking season starts in May and lasts five to six months. In other words, matings occur during the last months of lactation. Therefore, breeding value for goats and bucks should be obtained before the end of lactation, in order to prepare mating plans for the current season. The alternative is to use records data from early lactation that are available before mating. The aim of the present work was to estimate genetic parameters in dairy goat using early records in lactation and investigate possibilities for their use in prediction value.

MATERIAL AND METHODS

Data were 7771 test day records for daily milk yield and fat content, taken from 1519 lactations of Saanen and Alpine goats in 35 herds in Slovenia from May 1991 through November 1993. The first, second, ninth, and tenth month of lactation were represented with less records that the main milking period, so 556 test day record were deleted. and only lactations with at least three test day records were involved in teh analyses.

The pedigree file contained 930 does and 36 bucks. Animals bought outside the system were assumed to be unrelated and buck's ancestors were unknown. The number of progeny per sire ranged from 1 to 60 with the average of 8.94 offsprings recorded. The number of progeny per

dam was much lower (1.39 goats recorded). Does as well as bucks were mainly used within one flock, thus the amount of ties among flocks was expected to be low.

Several fixed effects had to be included in the model. An animal model (model <1>) contained year-season of kidding (9 year-season levels), breed (Saanen and Alpine) litter size (0, 1, 2 and 3 and more) and parity (1, 2, 3, 4, 5 and more) as fixed effects. In addition to additive genetic effect (animal), the common flock effect was treated as random. Variance components were estimated for milk yield and fat content. In the second stage of the analysis, the data sets of individual test days were grouped, in the first and second trimester. The two trait model was upgraded with fixed effect due to test day and permanent environment effect (Model <2>).

$$y_{tijklmno} = YS_{ti} + B_{tj} + K_{tk} + P_{tl} + f_{tm} + a_{tijn} + e_{tijklmno} \qquad <1>$$
$$y_{tijklmnop} = YS_{ti} + B_{tj} + K_{tk} + P_{tl} + T_{tm} + f_{tn} + P_{tijo} + a_{tijo} + e_{tijklmnop} \qquad <2>$$

where: $y_{tijklmno}$ / $y_{tijklmnop}$ = represents individual test day record for trait t (MY and FC); YS_{ti} = the fixed effect of year season, i = 1, 2, ... 9; B_{tj} = breed effect, j = 1, 2; K_{tk} = effect of litter size, k = 1, 2, 3, 4; P_{tl} = the fixed effect of parity, l = 1, 2, 3, 4, 5; T_{tm} = the fixed effect of test day, m = 1, 2, 3 or m = 1, 2, ... 6; f_{tm} = common flock effect, m = 1, 2, 3, ... 35; a_{tijn} = additive direct genetic effect (animal); $e_{tijklmno}$ = the random residual pertaining $y_{tijklmno}$ / $y_{tijklmnop}$.

The covariance components were estimated using a REML (Petterson and Thompson, 1971) by Derivative Free approach, as implemented in the computer program PERUN (Kovac, 1992).

RESULTS AND DISCUSSION

The results of test day analyses and trimesters data sets are presented in Table 1 and 2.

Milk yield. Phenotypic variance decreased through the end of lactation. The heritability estimates for test day MY (from 0.13 to 0.20) were close to the Swedish and Australian results obtained on cow data (Danell, 1982, Meyer et al., 1989). The phenotypic variance for the first trimester was higher than that for the second trimester, while the joint data set had intermediate value. Heritability estimates were 0.30, 0.21 and 0.30 for the first, second and both trimesters, respectively. Estimates were higher than those obtained by Agyemang et al. (1985).

Fat content. The increasing tendency of phenotypic variance at the end of lactation was evident. The heritability estimates were with the highest value of 0.29 in the fifth month of lactation and lowest one in the third month of lactation (0.16). The results were similar to those found by Danell (1982). The common flock effect explained between 13 % in the fifth and 27 % of the phenotypic variance in the seventh month of lactation. The phenotypic variance in joint analysis was closer to the second trimester. Heritability was about 0.18, while repeatability was low (0.21) except in the first trimester when it was 0.32. Around 15 % of phenotypic variances were explained by a common flock effect in all three analyses.

Table 1. Variances as proportion of phenotypic variance for MY and FC in different test days

	Third		Forth		Fifth		Sixth		Seventh		Eighth	
	MY	FC	MY	FC	MY	FC	MY	FC	MY	FC	MY	FC
Correlations and variances as proportion of phenotypic variance												
Residual covariances												
MY	0.52	-0.09	0.52	-0.02	0.46	-0.12	0.54	-0.28	0.51	-0.31	0.52	-0.11
FC		0.62		0.61		0.58		0.65		0.49		0.59
Additive direct genetic effect												
MY	0.18	-0.12	0.19	-0.35	0.20	-0.23	0.15	-0.16	0.13	-0.21	0.16	-0.39
FC		0.16		0.23		0.29		0.17		0.24		0.22
Common flock effect												
MY	0.30	-0.48	0.29	-0.40	0.34	-0.40	0.31	-0.57	0.36	-0.43	0.32	-0.37
FC		0.22		0.16		0.13		0.18		0.27		0.19
Phenotypic correlations												
MY		-0.19		-0.18		-0.20		-0.33		-0.33		-0.23

Table 2. Variances as proportion of phenotypic variance and partitioning covariances for milk yield and fat content in the first and second trimester and joint data set

	Proportion of phenotypic variance						Partitioning of covariances					
	First		Second		Joint		First		Second		Joint	
	MY	FC	MY	FC	MY	FC	MY	FC	MY	FC	MY	FC
Correlations and variances as proportion of phenotypic variance												
Residual covariances												
MY	0.35	-0.01	0.38	-0.27	0.44	-0.15	0.2354	-0.0011	0.2015	-0.0832	0.2726	-0.0501
FC		0.55		0.62		0.65		0.2041		0.4753		0.3939
Additive direct genetic effect												
MY	0.30	-0.26	0.21	-0.31	0.30	-0.45	0.2016	-0.0285	0.1103	-0.0381	0.1882	-0.0678
FC		0.16		0.18		0.20		0.0597		0.1395		0.1217
Permanent environment effect												
MY	0.04	-0.05	0.07	-0.41	0.01	0.09	0.0272	-0.0019	0.0379	-0.0129	0.0077	0.0007
FC		0.16		0.03		0.01		0.0597		0.0259		0.0080
Common flock effect												
MY	0.30	-0.43	0.34	-0.54	0.25	-0.49	0.1994	-0.0425	0.1827	-0.0807	0.1555	-0.0552
FC		0.13		0.16		0.14		0.0497		0.1217		0.0821
Phenotypic correlations												
MY		-0.15		-0.34		-0.27	0.6636	-0.0739	0.5324	-0.2149	0.6240	-0.1662
FC								0.3732		0.7624		0.6057

Correlations. Genetic correlations varied without trend from -0.12 to -0.39. Steine reported higher genetic correlations between the daily milk yield and fat content, from -0.31 to -0.47 (cit. by Ricordeau, 1981). Phenotypic correlation between MY and FC in the first trimester was -0.15, higher in the second one (-0.34) and an intermediate value of -0.27 in joint data set. Genetic correlations were higher -0.26, -0.31 and -0.45 for the first, second and joint data set, respectively. Common flock effect was on the average of -0.49 and with similar trend as phenotypic correlations. Correlations estimated between the MY and FC in test days and trimester sets were intermediate compared with the results of Kala and Prakash (1990) obtained on Indian and other results of exotic dairy goats (Kennedy et al., 1982, Boichard et al., 1989).

The trimester estimations of heritability for milk yield were higher than reported. Such results can be explained by the highest milk yield, especially in the first trimester that correspond to the most productive month of lactation. Nevertheless, these analyses of covariance components suggested that there was a very strong relationship for test day production between mid and whole lactation.

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