RELATIONSHIPS BETWEEN DAYS OPEN AND MILK PRODUCTION TRAITS IN CANADIAN HOLSTEINS

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SUMMARY

Genetic correlations of days open with milk, fat and protein yields, and fat and protein contents were estimated from 31641 first lactation records of daughters of 488 young and 75 proven sires from Quebec DHAS data using multivariate REML fitted to a sire model accounting for relationships among sires. The heritability of days open was 0.014 ± 0.009, and genetic correlations with milk, fat and protein yields, and fat and protein percentages were 0.544 ± 0.219, 0.512 ± 0.220, 0.630 ± 0.223, -0.006 ± 0.203 and -0.055 ± 0.205, respectively. Because of very small genetic variance of days open, its high and positive antagonistic genetic correlations with yield traits may be of limited consequence in genetic evaluation of dairy cattle. It was suggested that the milk production traits may be adjusted for days open for evaluation of sires.

INTRODUCTION

The reproductive problems lead to the disposal of a substantial number of dairy cows. Reproductive disorders make the dairying less profitable by increasing the costs on health and insemination. The rate of genetic gain is also reduced by increasing the generation interval. The days open is largely affected by the management and environmental factors. The heritability of days open has also been reported to be very low, but the genetic correlations of days open with milk production traits were large and antagonistic (Wilton et al., 1967; Kragelund et al., 1979; Hansen et al., 1983; Seykora and McDaniel, 1983; Hermas et al., 1987; Van Arendonk et al., 1989). Because of low heritability of reproductive traits, most researchers have concluded that the genetic selection for improved fertility may not be worthwhile. Van Arendonk et al. (1989) concluded that the correlated response in fertility traits will reduce the profit of selection on milk production traits upto 5%.

This study was undertaken to estimate the heritability of days open and its genetic and phenotypic correlations with milk production traits. Analyses were also conducted to ex-

amine as to how the estimates of (co) variances would behave when the days open is ignored or fitted as a covariable.

MATERIALS AND METHODS

Data consisted of first lactation records of 31641 daughters of 488 young and 75 proven sires in 7351 herd-year-seasons, collected from files of the Quebec Dairy Herd Analysis Service over a period from September, 1979 to December, 1987, as used by Chauhan and Hayes (1991). Each record had information on days open (DO), milk, fat and protein yields and fat and protein contents. Average DO was 109 days.

Multi-trait analyses with equal design matrices for all traits were carried out using a mixed model with herd-year-season as a fixed effect, young sires as random and related, age at first calving and lactation length as covariables, using the REML programs of Dr. K. Meyer. Proven sires were fitted as fixed effects. Two seasons were taken: September to February and March to August as used by the Agriculture Canada. Three analyses were carried out: 1) all six traits including days open, 2) five traits with days open as a covariable, and 3) five traits ignoring days open.

RESULTS AND DISCUSSION

The heritability of days open was only 0.014 ± 0.009. Genetic and phenotypic correlations of DO with production traits are in Table 1. Genetic correlations with milk, fat and protein yields were high and positive, but with fat and protein contents were close to zero. All phenotypic correlations with DO were low. The estimates were consistent with reports from United States (Berger et al., 1981), Europe (Van Arendonk et al., 1989), and Israel (Kragelund et al., 1983). But the genetic correlations of DO with BCA for milk and fat yields reported from the data of Ontario Dairy Herd Improvement Corporation (Raheja et al., 1989) were surprizingly low (0 to 0.06). The genetic basis of high correlations of days open with milk production traits is however unclear. It has been considered that the first heat after parturition is delayed in high yielding cows because of physiological reasons and also that some dairymen intentionally delay the breeding of high yielding cows.

Table 1. Genetic and phenotypic correlations of days open with production traits in first lactation

Trait	Genetic correlation with days open	Phenotypic correlation with days open
Milk yield	0.544 ± 0.219	0.148 ± 0.007
Fat yield	0.512 ± 0.220	0.134 ± 0.007
Protein yield	0.630 ± 0.203	0.154 ± 0.007
Fat %	–0.006 ± 0.203	–0.016 ± 0.007
Protein %	–0.055 ± 0.205	–0.016 ± 0.007

Table 2. Sire and residual (co)variances for milk production traits with and without days open as a covariable

Trait	With days open		Ignoring days open	
	Sire	Residual	Sire	Residual
Variances				
Milk	53492	587823	55049	600542
Fat	72	764	74	777
Protein	37	496	39	507
Fat %	0.022	0.104	0.022	0.104
Protein %	0.005	0.029	0.005	0.029
Covariances				
Milk, Fat	840	15786	894	16196
Milk, Protein	1122	15451	1173	15834
Milk, Fat %	–17	–81	–18	–80
Milk, Protin %	–10	–52	–10	–52
Fat, Protein	31	503	33	515
Fat, Fat%	0.692	3.303	0.690	3.282
Fat, Protein %	0.070	0.005	0.071	0.005
Protein, Fat%	–0.138	–0.696	–0.139	–0.717
Protein, Protein%	0.023	0.057	0.024	0.049
Fat %, Protein %	0.007	0.031	0.007	0.031

The sire as well as residual (co)variances for yield traits were reduced by fitting the days open as covariable (Table 2). Corresponding heritabilities and genetic correlations were also slightly smaller (Table 3).

Table 3. Heritabilities and genetic correlations amomg milk production traits from analysis with and without days open as a covariable

Trait	With days open		Ignoring days open	
	Estimate	SE	Estimate	SE
Heritabilities				
Milk	0.334	0.033	0.336	0.033
Fat	0.344	0.034	0.347	0.034
Protein	0.280	0.031	0.286	0.031
Fat %	0.689	0.049	0.688	0.049
Protein %	0.630	0.047	0.630	0.047
Genetic correlations				
Milk, Fat	0.428	0.059	0.444	0.058
Milk, Protein	0.794	0.027	0.801	0.026
Milk, Fat %	–0.514	0.052	–0.507	0.053
Milk, Protein %	–0.566	0.049	–0.556	0.050
Fat, Protein	0.607	0.046	0.620	0.045
Fat, Fat%	0.554	0.049	0.546	0.050
Fat, Protein %	0.112	0.068	0.112	0.068
Protein, Fat%	–0.154	0.069	–0.151	0.069
Protein, Protein%	0.051	0.071	0.052	0.071
Fat %, Protein %	0.629	0.037	0.629	0.037

Considering the heritability of DO, it was concluded that the variation in days open was by and large environmental, and therefore the milk production data may be adjusted for days open for evaluation of sires. Schaeffer and Henderson (1972) also recommended for the adjustment for days open.

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