DIFFERENCES IN MULTIPLE TRAIT PREDICTION OF TRANSMITTING ABILITIES FOR HERDLIFE DUE TO DATA SOURCE

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SUMMARY

Data were production and herdlife information from herds participating in the Holstein Association of America classification program. Cows were divided into two data sets based on registry status. Production and herdlife information from all cows freshening for the first time in the same herd-year in classified herds indicated that the registered cows that were classified were not a random sample of their herds.

Genetic and phenotypic (co)variances among linear type traits, final score, first lactation milk and fat yields and productive life to 84 month were estimated with a multiple trait sire model for both registered and grade populations. Maximum accuracy of prediction of herdlife from the linear type traits was much higher in the registered analysis (59%) than in the grade analysis (25%). Addition of milk production to prediction raised the maximum accuracy in the grade analysis to 71%, while the maximum accuracy in the registered analysis was raised to 68%. Similar results were observed in using correlations from a previous study.

These results suggest that accuracy of evaluation of herdlife from the linear type traits is dependent on registry status, previous selection of the data for yield or a combination of these effects.

INTRODUCTION

Multiple trait BLUP analyses are useful for improving the accuracy and timeliness of evaluations for traits such as herdlife. However, the gains in accuracy with multiple trait evaluations are dependent on the accuracy of the estimates of genetic and environmental correlations used in the analysis (Schaeffer 1984).

Research by Boldman et al. (1992) used multiple trait PTA's for linear type traits to predict sire transmitting abilities for herdlife in a population of grade Holsteins. Research by Short and Lawlor (1992) indicates that estimates of genetic correlations between some type traits and herdlife are different for registered and grade populations.

The objective of this research was to evaluate differences in prediction equations for herdlife developed from multiple trait estimates of variances and covariances among productive life, the type traits, and milk and fat yield in populations of grade and registered Holsteins.

MATERIALS AND METHODS

Production and type data files were merged to obtain cows with both classification scores and 84 month opportunity length. Productive life was measured as total months in milk to 84 months. Edits required daughters to have matching sire identification from the two data sources and for herd-years to have at least 15 cows freshening for the first time. Additional edits removed sires born prior to 1960 and those sires with less than 7 daughters in 5 herds. Data were 153,341 registered daughters of 1117 sires and 45,610 grade daughters of 1082 sires.

Multiple trait REML genetic and residual variances and covariances among the traits were estimated with a sire model as described by VanRaden et al. (1990). The maximum accuracy of predicting transmitting ability for herdlife from the type traits was evaluated as:

$$v_g * G * v_g'$$

which is the quadratic form of the vector of genetic correlations of the traits to herdlife (v_g) and the matrix of correlations among the traits (G).

RESULTS AND DISCUSSION

Differences in mean first lactation mature equivalent milk and fat yields and productive life totals between the classified cows and their unclassified herdmates are in Table 1 for both the registered and grade groups. A herdmate was defined as any cow freshening for the first time in the same herd-year. Comparison of these means may give an indication of whether cows that are classified are a random sample of the population or a selected group. The differences in these groups indicate that the registered cows that were classified had higher first lactation production and longer herdlife than their unclassified herdmates. Classified grade cows appear to be unselected for production, but have longer average herdlife.

The sire model REML estimates of the heritabilities of all traits and the genetic correlations to productive life are in Table 2. Estimates were similar to those reported by Short and Lawlor (1992) with heritabilities tending to be lower in the population of grade cows. Relationships of the type traits to herdlife also differed between groups, with the genetic correlations tending to be closer to zero in the grade population. These results agree with previous work by de Haan et al. (1992) and Cassell et al. (1990).

Maximum accuracies of predicting productive life from the linear type traits and from the linear type traits with first lactation production are in Table 3 for both the registered and grade analysis. Also in Table 3 are the maximum accuracies from predicting months of herdlife to 84 months using the correlations from the study of Short and Lawlor (1992).

Prediction of herdlife from the type traits was nearly twice as accurate using the correlations estimated from registered cows as those from grade cows in both studies. Addition of first lactation milk production to the analysis greatly improved the accuracy of prediction from the grade analysis, but only slightly in the registered population. Results from the combined registered and grade analysis from Short and Lawlor (1992) was intermediate to the two populations. Results from the registered analysis may reflect increased importance of type after selection for production as shown in previous research by Keller and Allaire (1987).

Table 1. Difference in mature equivalent (ME) production and herdlife between classified grade and registered Holsteins and their unclassified herdmates freshening for the first time in the same year.

Variable	Registered cows[1]	Grade cows
1st lactation ME milk (kg)	+528	-47
1st lactation ME fat (kg)	+17	-2
Productive life (months)	+7.7	+3.6

[1] The registered analysis contained 271,622 cows, 56% of which were classified, while the grade analysis contained 196,449 cows, 23% of which were classified.

Table 2. Heritabilities of first lactation mature equivalent (ME) milk, age adjusted linear type and final scores, and genetic correlation (r_g) to 84 month productive life (PL) estimated with registered and grade Holstein cows with a multi-trait REML sire model.

	Registered cows[1]		Grade cows	
Variable	h^2	r_g	h^2	r_g
Productive life (PL)	.07	--	.04	--
1st lactation ME milk	.42	.35	.26	.16
1st lactation ME fat	.38	.32	.26	.14
Stature	.36	.07	.27	-.09
Strength	.26	-.07	.19	-.24
Body depth	.29	-.08	.24	-.22
Dairy form	.26	.31	.20	.09
Rump angle	.31	.08	.23	-.05
Thurl width	.24	.11	.16	-.06
Rear legs side view	.16	-.08	.10	-.07
Foot angle	.11	.17	.06	-.01
Fore udder attachment	.23	.35	.18	.26
Rear udder height	.20	.40	.16	.14
Rear udder width	.17	.38	.14	.14
Udder cleft	.16	.21	.14	.09
Udder depth	.28	.29	.21	.31
Teat placement	.24	.16	.19	.09
Final score	.28	.41	.17	.14

[1] The registered analysis used 153,341 daughters of 1117 sires while the grade analysis used 45,610 daughters of 1082 sires.

Table 3. Differences in the maximum reliability achieved in different data sources for indirect prediction of 84 month herdlife from the linear type traits and production.

	Traits used in prediction		
Data source	Type	Type + Milk	Type + Milk + Fat
This study			
Registered cows	.59	.64	.68
Grade cows	.25	.50	.71
Short and Lawlor (1992)			
Registered cows	.73	.74	
Grade cows	.38	.45	
Combined analysis	.54	.58	

CONCLUSIONS

Cows surviving to be classified may not be a random sample of the population. Selection for production before classification appears to be more stringent in the registered population than in the grade population. Increased importance of first lactation production in predicting herdlife in the grade population may reflect selection for production in the registered population or differences in management practices in the populations. These results would suggest that caution be exercised in interpreting research with registered, classified cows. Indirect prediction of herdlife from the type traits using correlations estimated from a mixture of registered and grade cows may be inappropriate for either population.

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