Karjojensisäisen vaihtelun huomioonottaminen koelypsymallissa
Accounting for within herd variation in the test-day model

M. Lidauer and E. A. Mäntysaari
MTT Agrifood Research Finland, Animal Production Research, FIN-31600 Jokioinen, martin.lidauer@mtt.fi, esa.mantysaari@mtt.fi

Abstract

Finnish genetic evaluation of dairy cattle is based on test-day yields, applying a multiple-trait random regression TD model. The model does not account for heterogeneous variance in the data. Ignoring heterogeneous variance reduces reliability of ranking of breeding candidates. Preferred method to account for heterogeneous variances is a use of multiplicative mixed model. It accounts for genetic differences among breeds, which is important under Finnish circumstances where herds typically consist of different breeds, and the breeds are evaluated simultaneously. Further, it accounts for reduced variance in later lactations due to selection as well as the relationships within herds. A multiplicative mixed model approach was applied to the Finnish test-day evaluation and its effect on within herd variation and on breeding values was studied.

Data consisted of 26.3 million test-day records from all lactations of all Finnish cows that calved for the first time after 1987. The data were assumed to be homogeneous within strata and heterogeneous across strata. Test-day observations for the same trait, which belonged to the same calving year × calving season × parity class and to the same herd class represented a stratum; i.e., the model to describe the heterogeneity in the data consisted of a fixed calving year × calving season × parity classification and of a fixed herd classification. The multiplicative mixed model approach required to solve both, the random regression test-day model and the heterogeneity model simultaneously.

Results showed that the method removed heterogeneous variance among later lactations and among time. Within herd standard deviations of observations were more similar when adjusting for heterogeneous variance. Herds with bull dams had on average a higher within herd variation compared to all herds but about the same variation when accounting for heterogeneous variance. This had positive effect on the reliability of pedigree indices (average of parents breeding value) of young sires. Investigation of bias in pedigree indices for protein yield of young sires showed a reduction of bias by 23% to 43% when accounting for heterogeneous variance. Accounting for heterogeneous variance had little effect on EBVs of bulls, but large effect on EBVs of cows. The correlation between EBVs from the evaluation without adjustment for heterogeneous variance and EBVs from the evaluation with adjustment for heterogeneous variance were between 0.998 and 0.999 for active bulls (born within 1991 to 1993 and having at least 60 daughters with records) and between 0.988 and 0.991 for cows born in 1996, but correlations were between 0.69 and 0.71 for the best 1000 cows. When ranking animals by the EBV of later lactation milk, there were 7 new cows in the top 10 and 306 new cows in the top 1000 when adjusting for heterogeneous variance. The top 1000 cows were on average 6 month older when adjusting for heterogeneous variance. The genetic SD of EBVs from the multiplicative model were between 5% and 14% smaller for active bulls and between 10% and 18% smaller for cows born in 1996. Genetic trend over time showed between 1% and 11% smaller yearly progress for cows when applying the multiplicative mixed model.

Applying a multiplicative mixed model, to account for heterogeneous variance, is feasible for the Finnish random regression test-day model. Results from this study were consistent with findings presented in the literature. Results indicate an increase in the accuracy of bull dam selection and therefore application of this method for the Finnish random regression test-day model evaluation is recommended. However, additional work is needed to elaborate the best suitable model for describing the heterogeneity in the data.