PL5.7

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The use of herd-test-day solutions of the random regression test-day model in dairy herd management web-tool, "Maitoisa"

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Introduction

In recent years, interest in genetic evaluation using test-day (TD) records has increased among dairy breeders (Swalve, 2000; Jensen, 2001). Many countries have already implemented routine genetic evaluation with a TD model. For example, in Finland, multi-parity random regression (RR) TD model has been developed for the production traits (milk, protein and fat yield) (Lidauer et al., 2000) and somatic cell count (SCC) (Negussie et al., 2002).

There are several advantages of using test-day models compared with the traditional use of 305-day lactation model (Swalve, 2000). Instead of herd-year (hy) classification of management groups the herd-test-day (htd) classification in the TD model allows to better account for month-to-month short-term environmental variation in the traits. Environmental effects specific to each test-day can be specified, and in RR TD models the shape of the lactation curve is also allowed to differ for each animal. On the contrary, models for 305-day lactation assume that all effects (i.e. calving month, calving interval etc.) are the same during the entire lactation. By averaging test-days within lactation they ignore all the changes in the above-mentioned systematic environmental effects. Moreover, in the TD model the first and later lactation are usually considered as two different traits, which offers an opportunity to separate breeding values of bulls and cows for the first and later lactations

Herd solutions of test-day model in herd management

Apart from offering better means of genetic evaluation, TD models provide also opportunities for the development of advanced herd management tools. As test-day models account test-day effects, the herd test-day solutions of the models offer a source to extract potential additional information for management use.

When breeding values are estimated with the TD model, misinforming effects of different herd management practices are excluded. Each TD result can be presented as a sum of the effect solutions. Fixed effects considered in the Finnish RR TD models for production and SCC traits are: the age at calving, year-month of the test, herd-year, the stage of the lactation, and for the production traits also gestation stage. Furthermore, random effects are herd-test-day, daily breeding value, and daily non-genetic animal effect (Lidauer et al., 2000; Negussie et al., 2002). These effects are calculated for the first and later lactations separately. The summing of test-day model solutions for herd-year and herd-test-day effects provide a means to receive an estimate of a monthly herd production level (herd management level) that is independent from other effects in the evaluation model.

After summing up the herd-year and herd-test-day solutions, country means of herd management levels are calculated, and each herd will get management levels for milk, protein and fat yield and SCC expressed as deviations from the country mean production year-month levels. The country and regional percentiles are also calculated from these deviations. For clarity estimates for management level for protein and fat yield are converted into fat and protein concentrations of the milk. Because monthly management levels are deviations from the country mean levels, a herd that follows an average seasonal variation has monthly management level that is a straight zero line if plotted against years and months. However, if the plotted management levels fluctuate differently

from national level it is possible to recognize poorer (or better) performances in certain phases of the feeding cycle.

Herd management levels have been further modeled to assist identification of unusual test-days, repeated phenomena and for prediction of probable deviations in the subsequent year. For recognition of patterns and unusual test-days, a seasonal time trend analysis was developed to smoothen the random fluctuations and display the yearly production pattern. This time trend model consisted of two yearly repeating sine curves (12 months amplitude) that are in different phases and a third curve that has different amplitude (24 months). In the final model three sine curves and a monthly linear trend are fitted as a fixed for each herd and as a random effect within each herd-year. For utilization of the model, system that automatically update the data-base for management levels for new solutions and estimate the predicted values by time trend model were programmed with SAS. Modeled and observed monthly herd management levels and percentiles are provided in the herd management web-application "Maitoisa" (in English "Milky"). The Maitoisa service has been offered to farmers and dairy advisors since 2001 (Nousiainen 2003).

"Maitoisa" in practice

The web application offers a very powerful tool for users. It provides an access to management levels and corresponding trend analysis results. The herd management levels of milk yield (milk deviation, kg/day), protein and fat concentration (protein and fat deviation, % units) and SCC (SCC deviation) used in the "Maitoisa" help to recognize several management problems in feeding, udder health, etc. Besides deviations from the mean, modeled herd management levels assist users to identify herd-specific phenomena. Typical episodes that can be recognized are: continuous insufficient feeding; seasonal feeding difficulties, mostly occurring during summer, autumn and in May; problems in udder health revealed by the high SCC deviations; unsuccessful raising of replacement heifers leading to unexpectedly large differences between the milk and protein deviations of primi- and multiparous cows.

The herd management levels are displayed as tables or graphs plotted by calendar months and years and users can save the results to their own computer. In addition to management effects of his own herd, the farmer can request the country or region percentiles to be displayed in the graphs. With the help of percentiles, the users can compare deviations in the herd management level. Such information is useful as it first provides a picture of the performances of the herds from one month to the next and secondly under sub-optimal performance it sends a clear signal and thereby alerts farmers to take appropriate measures in the herd management.

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